Ministério da Agricultura e do Abastecimento



XXI INTERNATIONAL CONGRESS OF ENTOMOLOGY

XVIII Brazilian Congress of Entomology

Foz do Iguassu - Brazil 2000 - August 20th to 26th

ABSTRACTS

BOOK II

The XXI International Congress of Entomology is a joint promotion of:

Sociedade Entomológica do Brasil - 1812 -

Embrapa Soja



BRAZILIAN FEDERAL REPUBLIC

President
FERNANDO HENRIQUE CARDOSO

Agriculture and Supply Minister
MARCUS VINICIUS PRATINI DE MORAES

Embrapa

Brazilian Agricultural Research Corporation

President
ALBERTO DUQUE PORTUGAL

Directors
ELZA ANGELA BATTAGGIA BRITO DA CUNHA
JOSÉ ROBERTO RODRIGUES PERES
DANTE DANIEL GIACOMELLI SCOLARI

National Soybean Research Center

General Head
CAIO VIDOR

Head, Research and Development
JOSÉ RENATO BOUÇAS FARIAS

Head, Administration
VÂNIA BEATRIZ RODRIGUES CASTIGLIONI

Head, Communication
PAULO ROBERTO GALERANI

To request this publication, please contact:

ANT Embrapa Soja
Caixa Postal 231 - Distrito de Warta
86001-970 - Londrina, PR - Brasil
Telefone: (43) 371-6000 Fax: (43) 371-6100

Printing: 4500 issues

EDITOR

Décio Luiz Gazzoni

All rights reserved.

International Congress of Entomology (21. : 2000 : Foz do Iguassu)
Abstracts of International Congress of Entomology / -- Londrina : Embrapa Soja, 2000. Vol. II p.698.
2 v. -- (Documentos / Embrapa Soja, ISSN 1516-781X ; n.143).

1. Entomology-Congress. 2. Agriculture-Congress. I. Título. II. Série.

632.7 - CDD 21

© Embrapa 2000
According to Federal Law 9610 - 19.02.98

XXI INTERNATIONAL CONGRESS OF ENTOMOLOGY

Iguassu Falls, Brazil, August 21-26, 2000

CONGRESS PRESIDENT

Décio Luiz Gazzoni

SCIENTIFIC COMMITTEE

Flavio Moscardi, Chairman

MEMBERS

Aldo Malavasi
Alfredo Carvalho
Amador Villacorta
Amarildo Pasini
Ana Maria Meneguim
Antonio Ricardo Panizzi
Ayres de Oliveira Menezes
Beatriz S. Correa Ferreira
Clara Beatriz Campo
Daniel R. Sosa Gomez
José Lopez
Lauro Morales
Lenita J. Oliveira
Maurício Ursi Ventura
Pedro Neves
Roberto Antonio Zucchi
Rodolfo Bianco
Suely Souza Martinez

CONVENORS / COUNTERPARTS

Convenor: Gary R. Mullen
Co-convenor: Gilberto de Moraes

Convenor: Michael E. Irwin, USA
Convenor: Myron P. Zalucki, Australia
Convenor: Alberto Fereres, Spain
Counterpart: Dirceu N. Gassen,, Brazil

Convenor: Ebbe Nielsen, Australia
Counterpart: Thomas Lewinsohn, Brazil

Convenor: Walter Leal, USA
Co-Convenor: William S. Bowers, USA
Counterpart: José R. Trigo, Brazil

Convenor: Ronald E. Stinner, USA
Counterpart: Luceli de Souza, Brazil

Convenor: L. T. Wilson
Counterpart: Kleber del Claro, Brazil

Convenor: Alan McCaffery, UK
Convenor: Ian Denholm, UK
Counterpart: Celso Omoto, Brazil

Convenor: Manes Wysoki, Israel
Counterpart: José R. P. Parra, Brazil

Convenor: Y. S. Chow, Taiwan
Counterpart: Evaldo F. Vilela, Brazil

Convenor: Éric Bauce, Canada
Counterpart : José Cola Zanuncio, Brazil

Convenor: Lawrence Lacey, USA
Counterpart: Bonifácio P. Magalhães, Brazil

Convenor: David Haymer, USA
Counterpart: Louis B. Klaczko, Brazil

Convenor: Jules A. Hoffmann, France
Counterpart: Marcelo Jacobs-Lorena, USA

Convenor: Marcos Kogan, USA
Co-convenor: Heikki Hokkanen, Finland
Counterpart: Ivan Cruz, Brazil

Convenor: Thomas W. Scott, USA
Counterpart: Paulo de Tarso R. Vilarinhos, Brazil
Counterpart: João Luiz Horácio Faccini, Brazil

Convenor: Guenther Pass, Austria
Co-Convenor: Ayodhya P. Gupta, USA
Counterpart: Elisa Gregorio, Brazil

Convenor: Lowell Nault, USA
Counterpart: Tatsuya Nagata, Brazil

Convenor: Frantisek Sehnal, Czech Republic
Counterpart: Gilberto Albuquerque, Brazil

Convenor: Mauro Pinzauti, Italy
Counterpart: Lionel Gonçalves, Brazil

Convenor: Francis G. Howarth, USA
Counterpart: Pedro Gnaspini Neto, Brazil

Convenor: Carl W. Schaefer, USA
Counterpart: Jocelia Grazia, Brazil

Convenor: Merle Shepard, USA
Co-convenor: Manfred Kern, Germany
Counterpart: Sebastião Barbosa, Chile

Convenor: Christoph Reichmuth, Germany
Counterpart: Jamilton P. dos Santos, Brazil

PRESIDENT OF THE SUPPORTING COMMITEE
Plácido José de Oliveira

TREASURER
João Armelin

SECRETARY
Suzette Prado

FINANCIAL BOARD
José Maia de Andrade
Marçal Zuppi da Conceição
Maçao Tadano

PROGRAM AND ABSTRACTS
Deivis Ceslei Maggi
Emerson Durski Machado de Oliveira
Maria Clarice Nunes
Mônica Frediani
Patrícia Beatriz Naves Rodriguez
Paula Cavalcanti Francovig

BOOK DESIGN
Carlos Roberto de Oliveira
Celso Cessetti
José Roberto Kfouri
Patrícia Andréa Martins
Patrick de Carlo Maggi

INSECT EXPO
Zuleide Alves Ramiro

INSECT PHOTO CONTEST
Norman Neumaier

EDITORIAL NOTES

This book contains the complete texts of the Plenary Lectures and the abstracts of the oral and poster communications presented at the XXI International Congress of Entomology. Although all abstracts were revised by the Scientific Committee, in order to fulfill the abstracts rules, their contents are printed as received and are exclusive responsibility of the authors.

SESSION SUMMARY

SESSIONS TITLE	PAGE
SESSIONS 01 - 12 and PLENARY - ABSTRACT BOOK I	
SESSION 13 - INSECT PHYSIOLOGY, NEUROSCIENCES, IMMUNITY AND CELL BIOLOGY...	0591
SESSION 14 - INTEGRATED PEST MANAGEMENT	0642
SESSION 15 - MEDICAL AND VETERINARY ENTOMOLOGY	0724
SESSION 16 - MORPHOLOGY AND ULTRASTRUCTURE	0765
SESSION 17 - PLANT DISEASE VECTORS	0809
SESSION 18 - DEVELOPMENT AND REPRODUCTION	0821
SESSION 19 - SOCIAL INSECTS AND SERICICULTURE	0855
SESSION 20 - SPECIAL ENVIRONMENT ENTOMOLOGY	0901
SESSION 21 - SYSTEMATICS AND PHYLOGENY	0912
SESSION 22 - TRENDS AND RESEARCH TARGETS OF APPLIED PEST CONTROL FOR SUSTAINABLE CROP PRODUCTION	0977
SESSION 23 - URBAN AND STORED PRODUCTS ENTOMOLOGY	1011
SESSION 24 - SPECIAL ISSUES	1040
ERRATUM	1048
GENERAL APPENDIX	1056

[2338] CHECK-POINTS AND TRIGGERS IN THE PEPTIDE CASCADE THAT ORCHESTRATES ECDYSIS BEHAVIOR IN INSECTS

J. W. Truman & M. Fuse, Dept. of Zoology, Univ. of Washington, Box 351800, Seattle, WA 98195-1800, USA, E-mail jwt@u.washington.edu.

Since the classic studies by Fabre, it is clear that some insect behaviors are organized into behavioral sequences that are comprised of discrete behavioral phases. The phases occur in a specific order and certain sign stimuli may be required for the progression from one phase to the next. Recent work, particularly with the stomatogastric ganglion of crabs and lobsters, has shown that peptide and amine modulators are key regulators of the functional state of neural circuits. Consequently, different behavioral phases are likely due to the action of different modulators within the CNS. Therefore, understanding the relationship between the neurons that release these modulators would then be essential for understanding how insects progress from one behavioral phase to the next. Ecdysis behavior is such a complex behavioral sequence in which the animal progresses through three to four behavioral phases, each characterized by a unique set of motor patterns. The modulator(s) required for the first two phases, pre-ecdysis and ecdysis, are known -- ecdysis triggering hormone (ETH) and crustacean cardioactive peptide (CCAP) respectively. Eclosion hormone (EH), however, plays a key role in the transition from one phase to the other. Depending on species and stage, EH release is either directly caused by ETH (*Manduca*) or presumably potentiated by ETH but triggered by appropriate sensory stimuli (Grasshopper). EH, in turn, activates a complex set of modulatory neurons, the functions of which are only partially known. Among the cells activated are the neurons that are responsible for the CCAP release that causes ecdysis. Indirect evidence, though, indicates that EH also excites subesophageal neurons that suppress this CCAP release. Hence, although "primed" by EH action, the CCAP neurons do not immediately release their modulator because of this descending inhibition. The relative time-course of loss of EH-indiced excitation from these two sets of cells then determines if CCAP release (and hence ecdysis) will occur spontaneously, and, if so, after what delay? During this delay, though, appropriate stimuli that can act to trigger premature ecdysis, presumably by suppressing the descending inhibition.

Index terms: *Manduca sexta*, eclosion hormone, ecdysis triggering hormone, CCAP

[2339] PEPTIDERGIC OUTPUT OF THE CIRCADIAN CLOCK IN *DROSOPHILA*

P. H. Taghert[1], S.C.P. Renn[1], J.A. Park[2], M. Rosbash[2], & J.C. Hall[2], Anatomy & Neurobiol. Washington Univ. Med. Sch., St. Louis MO, 63110, USA, email: taghertp@pcg.wustl.edu, and Biol., Brandeis Univ., Waltham, MA 02454.

Circadian clocks provide timing signals to organize many developmental and behavioral functions. We have studied the circadian control of daily locomotor rhythms. At 25°C, adult *Drosophila* exhibit a rhythmic pattern of locomotion that is maintained under constant conditions. Several gene mutations have been identified which alter or greatly diminish such rhythms, without reducing the amount of locomotion. Many represent genes involved in the basic clock mechanism, including the genes *period, timeless, Clock* and *cycle*. There are ~16 identified brain neurons that house the clock mechanism and that provide timing signals for locomotory behavior. We have used genetics to identify the principal neurotransmitter used by these clock neurons as PDF (pigment-dispersing factor, which is encoded by the *pdf* neuropeptide precursor gene. Under cycling conditions, *pdf* mutant animals exhibit normal rhythmic behavior; under constant conditions, most become arrhythmic within a few cycles. A minority of *pdf* mutant animals remain weakly rhythmic. PDF neurons remain differentiated in the absence of their transmitter. The wild type *pdf* gene largely rescues the mutant behavioral phenotype. Following specific ablation of PDF neurons, we see the same behavioral phenotypes. Therefore, *pdf* is required for normal organization of circadian locomotory behavior and it encodes the principal transmitter that is released by pacemaker neurons to do so. These results also support the hypothesis that while the PDF neurons are the principal pacemaker neurons for locomotor control, other (non-PDF) pacemaker neurons also contribute. We will present evidence to define the site of chronobiological activity within the preproPDF precursor, and to ask whether the circadian clock is still cycling normally in the *pdf* mutant background.

circadian clock, neuropeptide, behavior, genetics, PDF

[2340] REVERSED PHARMACOLOGY IN INSECTS: FINDING NOVEL ORPHAN G PROTEIN-COUPLED RECEPTORS AND THEIR LIGANDS

C. J. P. Grimmelikhuijzen[1], F. Hauser[1], K. Eriksen[1], M. Schiøtt[2], L. Søndergaard[2], F. Staubli[1] & P. Svane[1], [1]Dept. of Cell Biology, Zoological Institute, and [2]Dept. of Genetics, Institute of Molecular Biology, University of Copenhagen, Universitetsparken 15, DK-2100 Copenhagen, Denmark, E-mail: cgrimmelikhuijzen@zi.ku.dk

In mammals, reproduction is controlled by the hypothalamic neuropeptide GnRH (gonadotropin-releasing hormone), the pituitary glycoprotein hormones LH (luteinizing hormone) and FSH (follicle-stimulating hormone), and a variety of sex steroid hormones. In insects, the molecular mechanisms behind reproduction are, so far, only poorly understood. Using several approaches, we have now found that *Drosophila melanogaster* produces at least two receptors that are structurally and evolutionarily related to the LH and FSH receptors from mammals: DLGR-1 (*Drosophila* Leu-rich repeats containing G protein-coupled receptor-1) and DLGR-2. As with the mammalian glycoprotein hormone receptors, DLGR-1 and -2 contain a large extracellular N terminus with Leu-rich repeats that probably form a horseshoe-like structure to which the ligands bind. DLGR-1 has nine of these repeats (the same number af the LH and FSH receptors), whereas DLGR-2 has 18-19, which is an unusual large number. DLGR-1 is expressed in *Drosophila* embryos, all three larval stages, pupae and adult flies, and could be involved in reproduction. DLGR-2 is only expressed in embryos and pupae, which points to a role in development. This role is confirmed by the isolation of a DLGR-2 knock-out (P-element insertion) mutant of *Drosophila*, which dies in the late phases of embryogenesis (just around hatching). A receptor similar to DLGR-1 has also been cloned from *Bombyx mori*. Furthermore, we have also cloned a receptor from *Drosophila* that is structurally and evolutionarily related to the mammalian GnRH receptor. We have permanently transfected mammalian CHO cells with the DNA coding for this receptor together with DNA coding for the G protein G-16, and transiently with DNA coding for aequorin. When a homogenate of *Drosophila* larvae was added to these transfected CHO cells, we could measure a very strong rise in intracellular Ca^{2+} concentration (luminescence), indicating ligand binding to the *Drosophila* GnRH receptor. Using this system as a bioassay, we have now purified the ligand (with HPLC) and we are presently elucidating its structure.

Index terms: *Drosophila melanogaster, Bombyx mori,* neurohormone, reproduction, development.

[2341] STRATEGIES FOR FINDING NOVEL INSECT NEUROHORMONE RECEPTORS AND THEIR LIGANDS, USING THE POTENTIALS OF THE BERKELEY "*DROSOPHILA* GENOME PROJECT"

C. Lenz, T. Secher & C. J. P. Grimmelikhuijzen, Dept. of Cell Biology, Zoological Institute, University of Copenhagen, Universitetsparken 15, DK-2100 Copenhagen, Denmark, E-mail: cgrimmelikhuijzen@zi.ku.dk

We developed a method for creating "electronic probes" to screen the Berkeley "*Drosophila* Genome Project" database for G protein-coupled (presumably neurohormone) receptors. Using these "electronic probes", we could localize DNA sequences in the *Drosophila* database that coded for two different *Drosophila* G protein-coupled receptors that were clearly related to the mammalian galanin receptors. Using PCR, with *Drosophila* cDNA as a template, and oligonucleotide probes coding for the exons of the presumed *Drosophila* receptor genes, we were able to clone the cDNA's for these receptors: *Drosophila* galanin receptor-1 (DGR-1) has 37% amino acid sequence identity with the rat galanin receptor type-1. The DGR-1 gene contains ten introns and eleven exons and is located at the distal end of the X chromosome. During the preparation of our manuscript on this work [1], a competing research group published a *Drosophila* cDNA sequence that was nearly identical to our DGR-1 cDNA [2]. This group also reported that their cDNA coded for a receptor for a *Drosophila* allatostatin, which is a neuropeptide that inhibits the release of juvenile hormone from the *corpora allata*, but that also has other inhibitory actions [2]. The other receptor gene that we cloned with our approach, DGR-2, codes for a receptor that is very closely related to DGR-1 (85% amino acid sequence identity) and, thus, very likely represents a second receptor for *Drosophila* allatostatin. Furthermore, by classical homology screening using PCR, we also cloned a presumed allatostatin receptor from the silkworm *Bombyx mori*.

[1] Lenz, C., Søndergaard, L., and Grimmelikhuijzen, C. J. P. (2000) Biochem. Biophys. Res. Commun., March 1 issue, in press.

[2] Birgül, N., Weise, C., Kreienkamp, H.-J., and Richter, D. (1999) EMBO J. 18: 5892-5900.

Index terms: *Drosophila melanogaster, Bombyx mori,* allatostatin, juvenile hormone, development, reproduction.

[2342] *DROSOPHILA* METABOTROPIC GLUTAMATE RECEPTORS: STRUCTURE AND FUNCTIONS

Y. Grau, M.L. Parmentier, A. Ramaekers & J. Bockaert, CNRS, UPR9023: Mecanismes Moleculaires des Communications Cellulaires, 141, rue de la Cardonille, 34094 Montpellier Cedex05, France

In *Drosophila*, glutamate is the excitatory neurotransmitter at the neuromuscular junction. Although it is also recognized as being a neurotransmitter in the central nervous system (CNS) of arthropods, little is known about its function. Glutamate is also the major excitatory neurotransmitter of the mammalian CNS. Its actions are mediated by glutamate-gated channels, and G protein-coupled receptors known as metabotropic receptors. Metabotropic receptors are thought to play key roles in important neuronal processes, ranging from developmental plasticity to memory. We cloned a *Drosophila* metabotropic glutamate receptor, that we called DmGluRA. This receptor shows a high affinity for glutamate and a remarkable conservation of the pharmacological profile and the transduction mechanism with that of group II mammalian mGluRs. We have constructed chimeric receptors between DmGluRA and the most distant mammalian mGluR and have shown that the extracellular domain and the seven transmembrane domain are interchangeable, the former being responsible for the ligand recognition, the latter for the G-protein activation. DmGluRA is expressed in the brain and the ventral nervous system, from embryo to the adult An antibody raised against a peptide based on the C-terminal derived amino acid sequence from DmGluRA was used to investigate localization of the receptor in the larvae and adult. Strong staining is detected in the antennal lobe glomeruli, and in the fan-shaped body of the central complex. Also stained are the medulla of the optic lobes. These results suggest possible roles for DmGluRA in the processing of olfactory, visual and locomotor information in the central nervous system of *Drosophila melanogaster*.

Index terms: G Protein-coupled receptors, pharmacology, central nervous system

[2343] MOLECULAR PROPERTIES OF BIOGENIC AMINE RECEPTORS CLONED FROM HONEYBEE (*APIS MELLIFERA*) BRAIN

W. Blenau[1] & A. Baumann[2], [1]University of Otago, Department of Zoology, P.O. Box 56, Dunedin, New Zealand, E-mail wolfgang.blenau@stonebow.otago.ac.nz; [2]Forschungszentrum Juelich, IBI-1, Postfach 1913, 52425 Juelich, Germany, E-mail a.baumann@fz-juelich.de

Biogenic amines and their receptors are important regulators of physiological and behavioural functions in both vertebrates and invertebrates. We have cloned the cDNAs encoding a dopamine D1 receptor (AmDOP1) and a tyramine receptor (AmTYR1) from the honeybee brain. In the transmembrane regions, AmDOP1 shares ~75% similarity with vertebrate D1/D5-receptors. The pharmacological profile of the heterologously expressed AmDOP1 is very similar to that of native receptors, which were previously analysed in membrane preparations of honeybee brains. [^{3}H]LSD specifically binds to the heterologously expressed receptor with K_D ~5 nM. Dopaminergic agonists and antagonists are potent displacers of [^{3}H]LSD binding. Of all biogenic amines tested, dopamine was the most potent competitor (K_i = 56 nM). Similar to dopamine D1-receptors from vertebrates and *Drosophila*, activation of AmDOP1 leads to cyclic AMP production. *In situ* hybridization revealed that the mRNA is expressed in perikarya of different brain neuropils, including those of intrinsic mushroom body neurons. From the cDNA library we isolated another clone which displayed the highest sequence similarity to tyramine receptors cloned from *Locusta* and *Drosophila* as well as to an octopamine receptor from *Heliothis*. Functional properties of the AmTYR1 receptor were studied in stably transformed HEK 293 cells. Tyramine reduces forskolin-induced cyclic AMP production in a dose-dependent manner with an EC_{50} ~130 nM. A similar effect of tyramine was observed in membrane preparations of honeybee brains. Octopamine also reduces cyclic AMP production in the transformed cell line but is both less potent (EC_{50} ~3 µM) and less efficacious than tyramine. Receptor-encoding mRNA has a widespread distribution in the brain and suboesophageal ganglion of the honeybee, suggesting that the tyramine receptor is involved in sensory signal processing as well as higher order brain functions.

This work was supported by grants from the Deutsche Forschungsgemeinschaft (Ba 1541/2-2; Bl 469/1-2) and a Feodor Lynen Fellowship of the Humboldt Foundation to W. Blenau.

Index terms: biogenic amine receptors, dopamine, cyclic AMP, tyramine.

[2344] DIFFERENTIAL ACTIVATION OF AN INSECT G PROTEIN-COUPLED PEPTIDE RECEPTOR BY INSECTATACHYKININ-LIKE AGONISTS

H. Torfs[1], R. Nachman[2], K. Åkerman[3], J. Poels[1], W. Van Poyer[1], A. De Loof[1], G. Vassart[4], M. Parmentier[4], F. Guerrero[5] & J. Vanden Broeck[1], [1]Zoological Institute K.U.Leuven, Naamsestraat 59, B-3000 Leuven, Belgium; [2]Food Animal Protection Research Laboratory, U.S.D.A., A.R.S., 2881 F&B Rd., College Station, TX 77845, U.S.A.; [3]Uppsala Biomedical Center, Husargatan 3, Box 570, S-75123 Uppsala, Sweden; U.S.A.; [4]IRIBHN ULB, Route de Lennik 808, B-1070 Brussels, Belgium; [5]Knipling-Bushland U.S. Livestock Insect Research Lab, 2700 Fredericksburg Rd., Kerrville, TX 78028, U.S.A.

STKR, a G protein-coupled receptor cloned from the stable fly, *Stomoxys calcitrans*, which shows sequence similarity to vertebrate tachykinin (or neurokinin, NK) receptors, was functionally expressed in stably transfected *Drosophila melanogaster* Schneider 2 (S2) cells. Dose-dependent calcium responses were visualized by fura-2 fluorescence detection methods in transfected cells that were challenged with insectatachykinin-like peptides (e.g. locustatachykinins). Vertebrate tachykinins, such as substance P, substance K, neuromedin K and physalaemin, and eledoisin were not able to produce a detectable response at concentrations up to 10 µM. The insectatachykinin-induced response was not dependent on extracellular calcium ions and was blocked by the phospholipase C (PLC) inhibitor U73122. The involvement of PLC was confirmed by the observation of a rapid agonist-induced increase in inositol 1,4,5-trisphosphate levels. The pharmacology of the agonist-induced calcium rise was further investigated in detail by studying the activity of a large variety of natural and artificial insectatachykinin peptide analogs. The effects of the most important antagonists for mammalian NK-receptors were also evaluated on STKR-expressing insect cells. In addition, STKR receptor pharmacology was compared with mammalian NK receptors and with the cockroach hindgut contractility bio-assay. Moreover, insectatachykinin agonists also exerted a stimulatory effect on cAMP accumulation. Dose-response curves were obtained with a variety of agonists, for both calcium and cAMP effects. High concentrations of the agonist *Lom*-TK III elicited a stimulatory effect on adenylyl cyclase (AC) activity. The EC_{50} values for the AC-effect were about a 100-fold higher than for the PLC-effect. Surprisingly, recent results obtained with a few naturally occurring insectatachykinin analogs, such as the endogenous stable fly peptide *Stc*-TK, suggest that differential receptor-effector coupling is highly dependent on the type of insectatachykinin analog that is used.

Index terms: adenylyl cyclase, calcium, cyclic AMP, neuropeptide, phospholipase C

[2345] MIMETIC INSECTATACHYKININ ANALOGS: INTERACTION WITH AN EXPRESSED STABLE FLY TACHYKININ-LIKE RECEPTOR AND ACTIVE CONFORMATION

R. J. Nachman[1], J. V. Broeck[2], H. Williams[3] & R. E. Isaac[4], [1]Veterinary Entomology Research Unit, Southern Plains Agricultural Research Center, USDA, ARS, 2881 F&B Road, College Station, TX, USA 77845, E-mail: nachman@acs.tamu.edu; [2]Laboratory for Developmental Physiology & Molecular Biology, Catholic University of Leuven, Naamsestraat 59, Leuven, Belgium, B-3000; [3] Department of Chemistry, Texas A&M University, College Station, TX, USA 77840; [4]Department of Biology, University of Leeds, Leeds, UK LS2 9JT.

A G-protein-coupled receptor, labeled STKR, cloned from the stable fly, *Stomoxys calcitrans*, shows sequence-similarity to vertebrate NK tachykinin receptors and has been functionally expressed in stably transfected *Drosophila* S2 cells. Natural insectatachykinin peptides, including an insectatachykinin recently isolated from the stable fly, activate the expressed receptor system whereas vertebrate tachykinins do not. Fragment analogs of an insectatachykinin nonapeptide demonstrate that receptor activation can be achieved up to and including the pentapeptide fragment FTGMRa. An Ala-replacement series of analogs indicated that receptor activity is retained except when the highly conserved C-terminal pentapeptide residues Phe (-5) and Arg (-1) are replaced by Ala. A comparison of solution conformations of active, analogous analogs of the insectatachykinin and the vertebrate tachykinin substace P, containing the hindered residue block NMeTyr-Aib, demonstrate that they share a very similar turn shape incorporating a *cis* peptide bond between the NMeTyr and Aib residues. The insectachykinin analog demonstrated binding to the expressed stable fly STKR receptor. This and related Aib-containing insectatachykinin analogs demonstrate enhanced resistance to the peptidases ACE and NEP. The very similar solution conformations of the two analogous restricted conformation analogs are consistent with a distant evolutionary relationship between the tachykinins and insectatachykinins, and can be considered along with evidence obtained from comparisons of physiological cross-activity, the shared antagonist response of spantide, sequence similarities and receptor homology.

Index terms: tachykinin, β-turn, *Stomoxys*, homology, peptidase-resistance.

[2346] INSECT DIURETIC HORMONES - A DIVERSITY OF MOLECULAR SPECIES ACTING VIA DIFFERENT SECOND MESSENGERS

G. M. Coast, Department of Biology, Birkbeck College, Malet Street, London WC1E 7HX, UK.

Diuretic hormones stimulate fluid secretion by Malpighian tubules. This may result in increased water loss from the excretory system, depending upon the rate of fluid reabsorption from the hindgut, which is separately regulated. Several classes of diuretic peptide have been described, in addition to which serotonin also has diuretic activity. Corticotropin releasing factor-related diuretic hormones (CRF-DH) have sequence similarity to mammalian CRF and act via cyclic AMP to stimulate active cation transport (K^+/Na^+) by principal cells, the driving force for Malpighian tubule secretion. A G protein-coupled receptor (GPCR) for a CRF-DH (Manse-DH) has been cloned from *Manduca sexta* and is similar to mammalian CRF receptors. Limited studies with natural isoforms of CRF-DH and N-terminal truncated analogues have tentatively identified regions important for receptor binding and signal transduction. In contrast to CRF-DH, the diuretic kinin neuropeptides elevate intracellular Ca^{2+} levels to bring about increased movement of Cl^- into the tubule lumen via a cellular or paracellular shunt. Using Ca^{2+} imaging techniques, myokinin activity is shown to be mediated by stellate cells located at the junctions between adjacent principal cells. A GPCR kinin receptor that binds insect kinins and couples positively to intracellular Ca^{2+} has been cloned from the pond snail *Lymnaea stagnalis*. Evidence for a similar receptor in insects comes from photoaffinity labeling studies, which identified a 55kDa receptor protein from Malpighian tubule plasma membrane preparations. The conformation adopted by the 'active core' of insect kinins when bound to receptors on *Acheta domesticus* tubules has been established. However, recent work with a kinin from *Musca domestica* indicates that N-terminal residues are also important for receptor binding. A third class of diuretic peptide was originally identified from its effect on heartbeat in *Manduca*. This cardioacceleratory peptide (CAP_{2b}) stimulates fluid secretion in fly tubules, but inhibits secretion by *Rhodnius* tubules. In *Drosophila*, CAP_{2b} increases Ca^{2+} levels in principal cells, activating nitric oxide synthase to produce nitric oxide, which appears to have a paracrine role in promoting Cl^- movement through neighboring stellate cells. Serotonin stimulates tubule secretion by binding to ketanserin-sensitive $5HT_{2A}$-type receptors. In *Rhodnius* tubules, these receptors are coupled positively to adenylyl cyclase, whereas in *Acheta* the actions of serotonin are identical to those of the diuretic kinins. All of the diuretics described above appear to function as circulating neurohormones, and evidence is now emerging of how they act both separately and co-operatively to control different aspects of diuresis.

Index terms: Diuretic peptides; serotonin; cyclic AMP; calcium; nitric oxide

[2347] BIOGENIC AMINES AS NEUROTRANSMITTERS AND NEUROMODULATORS

T. Roeder & M. Gewecke, University of Hamburg, Zoological Insitute, Dept Neurophysiology, Martin-Luther-King-Platz 3, D-20146 Hamburg, Germany.

Biogenic amines are members of a relatively small group of neuroactive compounds known to be important for the generation and control of numerous different behaviours. Most of them are G-protein coupled exerting its physiological role through second-messenger systems. Two biogenic amines, the monoamines octopamine and tyramine are unique for invertebrates as these compounds have no physiological relevance in vertebrates, where their role is occupied from adrenaline and noradrenaline. Especially octopamine is known to play a key role for the generation of numerous behaviours. This physiological importance together with its restriction to invertebrates focused the interest of pharmacologists on corresponding receptors. For octopamine, four different octopamine receptor subtypes where identified. In addition, one tyramine receptor subtype with almost unknown physiological significance was identified. Most octopamine receptors of the nervous system belong to a single class of receptors, the so called class 3 receptors. This receptor is believed to transmit most of the known action of octopaminergic insecticides, e.g. hyperactivity and reduced ability in learning tasks. We focused on the characterisation of this receptor subtype. A number of different agonists and antagonists with high affinity and specificity could be observed. Especially the antagonist epinastine ruled out to be very important for the characterisation of Octopaminergic neurotransmission in insects. Blocking of this kind of neurotransmission was shown to block some predicted effects of octopamine in insects e.g. in the control of visual information processing. Pharmacological studies across different invertebrate phyla revealed features common for all octopamine receptors studied. In addition, we found that octopamine has physiological roles in simple model invertebrates that are comparable to those found in insects.

Index terms: *Thrips tabaci, Thrips palmi*, TSWV, vector, antibody.

[2348] NITRIC OXIDE: AN UNCONVENTIONAL TRANSMITTER IN INSECT NERVOUS SYSTEMS

G. Bicker, O. Schmachtenberg, C. Seidel & B. Wildemann, Institut für und Tierökologie und Zellbiologie, Tierärztliche Hochschule Hannover, Bünteweg 17d, D-30559 Hannover, Germany, gbicker@zellbiologie.tiho-hannover.de; Supported by grants of the DFG.

In nerve cells, the short-lived signalling molecule nitric oxide (NO) is generated by Ca^{2+}/calmodulin stimulated NO synthases (NOS). NO activates soluble guanylyl cyclase (sGC) in target cells leading to the formation of cGMP. Using NADPH-diaphorase (NADPHd) staining as a marker for the enzyme nitric oxide synthase and an antiserum against cGMP, the cellular organisation of NO donor and target cells has been resolved in the locust and fruit fly. In this seminar, I will attempt to provide an overview about the cellular organization of NO signalling as well as to highlight some of its functions in vision, neuromuscular transmission, and neuronal development. Cytochemical stainings and electrophysiological experiments suggest that NO is a retrograde messer in the visual system of the locust. Using a fluorescent dye that is known to stain recycling synaptic vesicles it was demonstrated that NO donors and membrane permeant cGMP analogues cause vesicle release at the neuromuscular junction of *Drosophila*. The combined immunocytochemical and exocytosis imaging experiments imply the involvement of cGMP and NO in the regulation of vesicle release during the maturation of the larval NMJ. During the formation of the grasshopper nervous system, antennal pioneer neurons synthesize cGMP in response to NO stimulation To investigate a potential role of the NO/cGMP signaling system in axonal extension, the pattern of outgrowing pioneer neurons was examined in embryo culture. Axogenesis of both pairs of antennal pioneers is inhibited when specific NOS or sGC blockers were added to the culture medium; the observed effects include the loss axon emergence as well as retardation of outgrowth such that growth cones do not reach the CNS. These results indicate that NO/cGMP signaling is involved in axonal navigation of pioneer neurons in the antenna of the grasshopper.

Index terms: *Drosophila, Schistocerca*, cGMP, development, synapse

[2349] THE INTEGRATIVE ACTIONS OF PEPTIDES AND AMINES ON IDENTIFIED TARGET TISSUES OF *RHODNIUS PROLIXUS*

I. Orchard & V.A. Te Brugge, Dept. Zoology, Univ. Toronto, 25 Harbord St., Toronto, ON, Canada, M5S 3G5. Supported by NSERC.

A complex cascade of neuronal, hormonal, muscular and metabolic events leads to the initiation and maintenance of a behavioural act. These events are part of a transition of the animal into a new behavioural state. A critical aspect of this transition is the need to alter these events at the appropriate time. This coordinating function may not only depend on neuronal action but may also be attributed to chemical substances that bias, at many levels, neuronal, hormonal and muscular events towards the new functional state of the animal. A convenient model preparation for studying such transitions is found in the blood-sucking insect *Rhodnius prolixus*. This bug, which transmits Chagas' disease, and so is of some medical importance, remains in a state of arrested development until it ingests a blood meal which may be up to 10 times its initial body weight. This gorging then triggers growth and development. During gorging itself, the cuticle plasticises and the insect undergoes a rapid diuresis; the elimination of urine resulting in the loss of 40% of the weight of the meal. Plasticisation and diuresis are under the control of serotonin, and serotonin is also associated with other structures central to feeding, such as salivary glands and digestive tract. However, a variety of neuropeptides (CRF-related, kinins and FMRFamide-related) also appear to be involved in the control of diuresis and in the control of these digestive tissues. This paper will review the evidence that serotonin plays a role, along with neuropeptides, in the integration of feeding activity in *Rhodnius prolixus*.

Index terms: serotonin, neuropeptides, feeding, diuresis, digestive system

[2350] CELLULAR IMMUNITY IN DROSOPHILA

S. Govind

ABSTRACT NOT RECEIVED

[2351] GOMESIN, AN ANTIMICROBIAL PEPTIDE OF THE SPIDER HEMOCYTES: SPECTRUM OF ACTIVITY AND cDNA CLONING

D. Lorenzini[1], P. I. Silva Jr[1,2], P. Bulet[3] & S. Daffre[1]. 1Dep. Parasitologia, I.C.B., Universidade São Paulo, P.O.Box 66208, CEP 05389-970, São Paulo, Brasil; 2Lab. Artrópodes, Instituto Butantan, São Paulo, Brasil; 3Institut de Biologie Moléculaire et Cellulaire, 15 rue RENÉ DESCARTES, 67084, Strasbourg, France. *E-mail: sidaffre@icb.usp.br.

We have purified a small-size antimicrobial peptide, named gomesin, from the hemocytes of the unchallenged tarantula spider Acanthoscurria gomesiana. Gomesin has a molecular mass of 2270.4 Da, with 18 amino acids, including a pyroglutamic acid as the N-terminus, a C-terminal arginine (-amide, and four cysteine residues forming two disulfide bridges. This peptide shows marked sequence similarities to antimicrobial peptides from other arthropods such as tachyplesin and polyphemusin from horseshoe crabs, and androctonin from scorpions. Interestingly, it also shows marked sequence similarities to protegrins, antimicrobial peptides from porcine leukocytes. To analyze the antimicrobial spectrum activity of gomesin, we have made a synthetic peptide. Gomesin strongly affects bacterial growth, as well as the development of filamentous fungi and yeast. In addition, gomesin affects the viability of the parasite Leishmania amazonensis and has low hemolytic activity. Amino terminal sequencing of gomesin allowed us to design a degenerated gene-specific primer for 3'-RACE amplification of hemocytes cDNAs. A PCR amplified fragment (378 bp) was cloned and sequenced, and the deduced protein sequence was indentic to that obtained by Edman degradation. Analysis of the deduced amino acid sequences revealed that the mature peptide is processed from a precursor molecule. This cDNA clone will be used to determine the gene expression in different tissues and expression levels in infected animals.

Index terms: antimicrobial, peptide, cDNA, cloning, tachyplesin

[2352] THE IMMUNE RESPONSE IN *DROSOPHILA*, AND ITS REGULATION

D. Hultmark. Umeå Centre for Molecular Pathogenesis (UCMP), By. 6L, Umeå University, S-901 87 Umeå, Sweden.

The immune response in *Drosophila* and other insects has received much interest as a model for innate immune reactions. Evidence has accumulated that these reactions involve signal transduction pathways that converge on transcription factors of the Rel family. In *Drosophila* at least two of these pathways include membrane receptors of the Toll family, either Toll itself or the related *18-wheeler* gene product. Related receptors have now also been found to play a similar role in the activation of immune responses in mammals.
In *Drosophila*, three members of the Rel protein family have been found to mediate the immune responses, Dorsal, Dif and Relish. In this context, the *Relish* gene is of particular interest. It was discovered as a gene which is strongly upregulated after infection. It contains two major classes of sequence motifs. In addition to a Rel homology domain, which is potentially a DNA-binding motif, it has six ankyrin motifs in the C-terminal half of the molecule. We find that *Relish* is specifically required for the induction of the humoral immune response, including both antibacterial and antifungal peptides. As a result of this immune deficiency, *Relish* mutant flies are very sensitive to infection. A single cell of *Enterobacter cloacae* is sufficient to kill a mutant fly, and the mutants show increased susceptibility to fungal infection. We now study the mechanisms that lead to the activation of Relish and other transcription factors.
Index terms: insect immunity, Relish, antibacterial peptides, antifungal peptides

[2352] THIOESTER-CONTAINING PROTEINS IN INNATE IMMUNITY OF MOSQUITO *ANOPHELES GAMBIAE*

E.A. Levashina[1], L.F. Moita[1], S. Blandin[1], M. Lagueux[2], J.A. Hoffmann[2] & F.C. Kafatos[1], [1]EMBL, 1 Meyerhofstrasse, 69117 Heidelberg, Germany, E-mail levashin@embl-heidelberg.de; [2]UPR9022 du CNRS, IBMC, 15 rue Rene Descartes, 67084 Strasbourg Cedex, France.

Here we report a new family of proteins from human malaria insect vector *Anopheles gambiae* that share sequence and structural similarities with the family of C3/alpha2-macroglobulins. We show that these proteins play an important role in cellular immune response of mosquito. Developmental and immune-inducible expression of the genes encoding *Anopheles* thioester-containing proteins (aTEPs) will be presented with particular emphasis on aTEP-I. Western blotting analysis of aTEP-I demonstrates functionality of the aTEP-I thioester site and its specific role in binding to Gram-negative bacteria. Results of the phagocytic assays using a hemocyte-like mosquito cell line and of a RNAi knockout of aTEP-I will be discussed.

[2354] THE ROLE OF INNATE IMMUNE PEPTIDES TO REDUCE PARASITE DEVELOPMENT IN *AEDES AEGYPTI*

C. Lowenberger[1], S. Kamal[1], L. Cheng[1], L. Beaty[1], S. Higgs[2], K. Olson[2], B. Beaty[2], J. Vizioli[3], P. Bulet[3] & B.M. Christensen[1], [1] AHABS, Univ. of Wisconsin, 1656 Linden Drive, Madison WI 53706 USA; [2] AIDL, Colorado State Univ. Fort Collins CO, 80523, USA; [3] IBMC, UPR 9022 CNRS 15, Rue René Descartes 67084 Strasbourg France.

The innate immune response of the mosquito, *Aedes aegypti*, includes the production of potent anti-microbial peptides to prevent the establishment of bacterial infections in the hemocoel. To date we have characterized 3 isoforms of defensin, two of cecropin, and are now characterizing 3 novel peptides. Previous data indicated that immune activating *Ae. aegypti* prior to exposing them to parasites significantly reduced the prevalence and mean intensity of infection with filarial worms and Plasmodia, but the general immune activation process induces the expression of all immune peptide, and does not permit us to determine which peptide, acting alone or in concert with others, is affecting the parasites. We have engineered a Sindbis virus, a natural virus of mosquitoes, to express 2 isoforms of defensins. This virus is ingested by the mosquitoes, thus avoiding a generalized activation of the immune system. The success of infection, the tissue preference of the virus, the expression pattern of defensin, and the effects of immune peptide expression in this manner on parasite development will be discussed.
Index terms: Aedes aegypti, defensin, cecropin, Sindbis

[2355] DEFICIENCY OF A BLOOD SERPIN LEADS TO CONSTITUTIVE ACTIVATION OF THE TOLL-MEDIATED ANTIFUNGAL DEFENSE IN *DROSOPHILA*

J.-M. Reichhart, UPR 9022 CNRS IBMC, 15, rue Rene Descartes, 67084 - Strasbourg Cedex, FRANCE, JM.Reichhart@ibmc.u-strasbg.fr

Mutants of the *necrotic (nec)* gene in *Drosophila melanogaster* die in the late pupal stage as pharate adults, or hatch as weak, but relatively normal-looking, flies. Adults develop black melanized spots on the body and leg joints, the abdomen swells with hemolymph and flies die within three or four days of eclosion. Pleiotropic *nec* phenotypes include melanization, necrosis and proliferation of epidermal cells. These changes are consistent with activation of one, or more, proteolytic cascades. The *nec* gene corresponds to *Spn43Ac*, one a cluster of three putative serine proteinase inhibitors (serpins) at 43A1.2, on the right arm of chromosome two. Although serpins have been implicated in the activation of many diverse pathways, lack of an individual serpin rarely causes a detectable phenotype. Molecular models of the three Spn43A serpins are presented. We show that a loss-of-function mutation in Spn43Ac, leads to constitutive expression of the antifungal peptide drosomycin and that the *spaetzle* and *Toll* gene products mediate this effect.. We argue that Spn43Ac negatively regulates the Toll signaling pathway and that Toll does not function in the *Drosophila* host defense as a pattern recognition receptor.

[2356] REGULATION OF TISSUE-SPECIFIC AND LIPOPOLYSACCHARIDE-INDUCIBLE GENE EXPRESSION OF AN ANTIBACTERIAL PROTEIN FROM THE SILKWORM, *BOMBYX MORI*

H. Tanaka[1, 3], S. Furukawa[2], H. Nakazawa[1], J. Ishibashi[1] & M. Yamakawa[1, 2], [1]Lab. of Biol. Defense, Natl. Inst. Seric. Entomol. Sci., Tukuba, Ibaraki 305-8634, Japan, E-mail yamakawa@nises.affrc.go.jp; [2]Doctoral program in Agric. Sci., University of Tsukuba, Tsukuba, Ibaraki 305-8572, Japan; [3]Lab. of Genet. Resources, Natl. Inst. Seric. Entomol.Sci. Kobuchizawa, Yamanashi 408-0044, Japan (Present address).

Several antibacterial proteins such as cecropin, attacin, lebocin and moricin including their analogues are known to occur in the silkworm, *Bombyx mori*. cDNAs and genes encoding these antibacterial proteins have been cloned. Northern bolt analysis showed that tissue-specific gene expression of these antibacterial proteins occurs in the fat bodies and hemocytes, but not in other tissues such as the silk glands, midguts or Malpighian tubles. Antibacterial gene expression was found to be induced by bacteria or their cell wall components, e.g., lipopolysaccharide (LPS) and peptidoglycan. Although tissue-specific expression of insect antibacterial proteins is recognized as a general phenomenon, mechanisms still remain obscure. We analyzed *in vitro* gene expression of attacin using nuclear extracts from fat bodies (FB) and posterior silk glands (PSG). TATA box-dependent basal promoter activity was observed in vitro in FB and PSG, although the attacin gene is known to be expressed *in vivo* in the FB but not in the PSG. Comparison of nucleosomal structure around the attacin gene promoter regions between the 2 tissues indicated clear nucleosomal arrangement in the PSG but not in the FB, suggesting that regulatory tissue-specific attacin gene expression occurs at the chromatin level. We further analyzed the structure of the protein-attacin gene complex by *in vivo* footprinting using ligation-mediated PCR (LM-PCR). Protected and sensitive regions around the attacin promoter were detected when FB nuclei from LPS-injected larvae were compared with nontreated FB and/or LPS-treated PSG. Electrophoretic mobility shift assay (EMSA) was conducted using different regulatory regions of the attacin gene as probes. Results showed that nuclear proteins bind to a specific sequence (CATTT) in addition to a NF-□B site, suggesting the presence of a novel regulatory motif for attacin gene expression.
Index terms: attacin, chromatin structure, nuclear protein, EMSA.

[2357] PHENOLOXIDASES IN INSECTS; INTRODUCTORY REMARKS

E. Ohnishi, 405, 1-Chome, Idakadai, Meito-Ku Nagoya, 465-0028 Japan.

It has been revealed that insect phenoloxidases have several characteristics differing from tyrosinases of other eukaryotic organisms. Namely, (1) Presence of the cascade culminating the activation of inert prophenoloxidases, (2) Intimate relations with insect development and immune response systems, (3) Homology with arthropod hemocyanins. As introductory remarks, I would like to talk several critical works contributed to uncover these aspects.

[2358] GENOMIC STRUCTURE AND ECDYSONE REGULATION OF THE PROPHENOLOXIDASE 1 GENE IN THE MALARIA VECTOR ANOPHELES GAMBIAE

Ahmed, A.* , Martín, D. , Manetti, A.G.O.* §, Han, Sung-Jun*, Lee W-J. ¶, Mathiopoulos, K.D. **, Müller, H-M. , Kafatos, F. C., Raikhel, A. & Brey, P. T.*
*Laboratoire de Biochimie et Biologie Moléculaire des Insectes, Institut Pasteur, 25 rue du Dr. Roux 75724 Paris Cedex 15, France Ý Present address same as ýý Department of Entomology, S-150 Plant Biology Building, Michigan State University, East Lansing MI 48824, USA§ Present address: Dipartimento di Biologia Evolutiva, Università degli Studi di Siena, Via Mattioli 4, 53100 Siena, Italie¶ Laboratory of Immunology, Medical Research Center, College of Medicine, Yonsei University, CPO Box 8044, Seoul, South Koreall Istituto di Parassitologia, Istituto Pasteur-Fondazione Cenci Bolognetti, Università degli Studi di Roma " La Sapienza " 00185 Rome, Italy; ** Present address: Department of Biology, Division of Genetics, Cell and Developmental Biology, University of Patras, Patras 26500, Greece; ÝÝ European Molecular Biology Laboratory, Meyerhofstrasse 1, 69117 Heidelberg, Germany

Prophenoloxidase, a melanin synthesizing enzyme, is considered to be an important arthropod immune protein. In mosquitoes, prophenoloxidase has been shown to be involved in refractory mechanisms against malaria parasites. In our study we used Anopheles gambiae, the most important human malaria vector, to characterize the first arthropod prophenoloxidase gene at the genomic level. The complete nucleotide sequence, including the immediate 5' flanking sequence (-855 bp) of the prophenoloxidase 1 gene, was determined. The gene spans 10 kb and is composed of 5 exons and 4 introns coding for a 2.5 kb mRNA. In the 5' flanking sequence, we found several putative regulatory motifs, two of which were identified as ecdysteroid regulatory elements. Electromobility gel shift assays and supershift assays demonstrated that the Aedes aegypti ecdysone receptor/Ultraspiracle nuclear receptor complex, and seemingly the endogenous Anopheles gambiae nuclear receptor complex, was able to bind one of the ecdysteroid regulatory elements. Furthermore, 20-hydroxyecdysone stimulation was shown to upregulate the transcription of the prophenoloxidase 1 gene in an A. gambiae cell line. To our knowledge, this is the first natural ecdysteroid regulatory element described in an insect immune protein gene and the first functional demonstration of steroid hormone regulation of an insect immune protein gene.

[2359] THE MOLECULAR RELATIONSHIP BETWEEN PROPHENOLOXIDASE AND PROPHENOLOXIDASE-ACTIVATING FACTORS IN COLEOPTERAN INSECTS

B. L. Lee, College of Pharmacy, Pusan National Univ. Jangjeong Dong, Kum-jeong Ku, Pusan 609-735, Korea , E-mail brlee@hyowon.pusan.ac.kr

Although the significance of prophenoloxidase (pro-PO) activation system in insect physiology and immunology have been recognized for many years, molecular characterization of pro-PO activation factors involving in pro-PO activation has been reported only very recently from three insect systems. We have isolated and cloned a cDNA for pro-PO activating factors (PPAF-I) from the hemolymph of coleopteran, *Holotrichia diomphalia* larvae. The overall structure of PPAF-I is highly similar to that of *Drosophila* easter serine protease, an essential serine protease zymogen for pattern formation in normal embryonic development. Two other pro-PO activating enzymes showing similar structure with that of PPAF-I from *Manduca sexta* and *Bombyx mori* have been reported. However, the molecular mechanism of pro-PO activation system is still not well understood. The reason is that pro-PO activation occurs spontaneously upon collection of hemolymph through an integumental incision, and it is impossible to purify endogenous pro-PO and PPAF(s) to homogeneity from hemolymph on chromatography because of the formation of insoluble high molecular weight cross-linked protein adducts induced by PO. To elucidate the pro-PO activation system at molecular level, it is essential to purify and characterize pro-PO and pro-PO activating enzymes (or factors). Also, reconstitution experiments *in vitro* will be very useful in elucidating the relationship between the isolated pro-PO activating enzymes and pro-PO. Recently, we have succeeded to isolate and clone new PPAF from the hemolymph of *H. diomphalia* and *Tenebrio molitor* larvae. Also, we have established *in vitro* reconstitution experiments by using the purified pro-PO and the purified PPAFs. The molecular characterization of coleopteran pro-PO and PPAFs will be discussed.
Index terms: Insect immunity, cascade, coleopteran.

[2360] ACTIVATION OF PROPHENOLOXIDASE IN *MANDUCA SEXTA*

H. Jiang, Y. Wang & M. R. Kanost, Department of Biochemistry, Kansas State University, Manhattan, KS 66506, USA.

Extracellular serine proteinase cascades have evolved in vertebrates and invertebrates to mediate rapid defense reactions to wounding and infection. We have started to investigate such an enzyme system and to understand its regulation by proteinase inhibitors in the tobacco hornworm, *Manduca sexta*. Our research is currently focused on the prophenoloxidase activating pathway, a defense mechanism triggered by invading pathogens or parasites. Active phenoloxidase oxidizes phenolic compounds to form reactive intermediates which may be utilized to kill pathogens, seal wounds, sclerotize cuticle, and form melanin capsules around parasites. The proenzyme is activated through limited proteolysis by prophenoloxidase activating proteinase (PAP). We have purified from *Manduca* cuticle and hemolymph three different PAPs, designated cPAP, hPAP, and tPAP. Based on the N-terminal amino acid sequences of their catalytic domains, we have isolated cDNA clones for all three proteinases. Sequence analysis indicates that they are members of the clip-domain family of serine proteinases in arthropods. Although each PAP cleaves prophenoloxidase at Arg51, other proteins are required to assist the proteinase in the production of active phenoloxidase, perhaps through a second cleavage. These PAPs are negatively regulated by *Manduca* serpin-1J and other serpins in the hemolymph. Like phenoloxidase, PAP is also produced as a zymogen which requires proteolytic activation by another activating enzyme. In order to study this unknown proteinase, we have produced and purified the proenzyme of cPAP from a baculovirus system.
Index terms: insect immunity; phenoloxidase; clip domain; serine proteinase; serpin

[2361] PROPHENOLOXIDASE CASCADE OF THE SILKWORM, *BOMBYX MORI*

M. Ashida, Biochem. Lab., The Inst. Low Temperature Sci., Hokkaido Univ. Sapporo 065-0819, Japan E-mail ashida@pop.lowtem.hokudai.ac.jp.

The zymogen of the insect phenoloxidase (often referred to as injury phenoloxidase) has been demonstrated to be a protein homologous to arthropod hemocyanins. Whether or no the prophenoloxidase has the ability to bind and carry aerobic oxygen molecule is unclear at present. The silkworm prophenoloxidase is in hemolymph and cuticle. The prophenoloxidase becomes an active phenoloxidase after a peptide bond of each subunit of the zymogen is hydrolyzed by a specific serine protease (prophenoloxidase activating enzyme) which has two consecutive clip-domains. Melanin is a black pigment and the final product of the oxidation reactions of the phenolic substances by phenoloxidase. The pigment has been observed in the nodule, in the capsule around fungal hyphae, non-habitual parasites and aberrant tissues. Various quinones are formed in the process of melanin formation. Because of the high reactivity, the quinones have been considered cytotoxic and to facilitate the killing of organisms invading insects. Furthermore, the quinones are believed to function to make the capsules physically rigid by cross-linking proteins. The role of phenoloxidase in quinone formation is very important for insects. At the same time, as our understanding on the regulation mechanism for the activation of prophenoloxidae advances, it has increasingly been evident that the mechanism may have much more important implications for the insect defense mechanisms. In the silkworm, prophenoloxidase has unambiguously been proved to be activated through the action of a cascade. The cascade is composed of pattern (pathogen associated molecular pattern, PAMP) recognition proteins, several of protease zymogens, prophenoloxidase and components yet to be identified. Features of the cascade are the high sensitivity to bacterial and fungal cell wall components for its activation and the divergence of its route into two directions, one of which leads to the activation of prophenoloxidase and the other to the activation of a protease zymogen, which tentatively has been designated proBAEEase. For advancing our understanding on the cascade, it is important to answer the questions as follows: Is the cascade only for the activation of prophenoloxidase?; What is the endogenous substrate of the active form of the protease zymogen, proBAEEase; What is the mechanism for the merge of the routes from the two initiation points of the cascade, peptidoglycan recognition protein and □-**1,3-gucan recognition protein?; Does** the prophenoloxidase cascade relay the signal of the recognition of PAMPs to activate other defense mechanisms? The present status of our research to answer these questions is summarized.
Index terms: phenoloxidase, immunity, recognition, serine protease, clip domain

[2362] EVIDENCE FOR PHENOLOXIDASE ACTIVITY IN EARTHWORMS

A. Beschin[1], P. Köhlerová[2], M. Bilej[2], B. Stijlemans[1] & P. De Baetselier[1], [1]Dept Immunology, Parasitology and Ultrastructure, Flemish InterUniv. Inst. Biotech., Free Univ. Brussels (VUB), 65 Paardenstraat, B-1640 St-Genesius-Rode, Belgium ; [2]Dept Immunology, Inst. Microbiology, Prague, Czech Republic

Though prophenoloxidase (proPO)-activating system is well documented in arthropods, data in other protostomian groups are scarcer. Indeed, biochemical detection of PO activity was so far restricted to a few species with rather controversial results. In annelids, melanization reactions and formation of "brown bodies" or nodules have been described. Since the factors that recognize microbial saccharides and trigger the proPO system and proPO enzyme have not yet been described in annelids, investigations were initiated to identify such molecule in the coelomic fluid of *Eisenia foetida*. We have characterized a 42-kDa pattern recognition lectin named CCF for coelomic cytolytic factor that by binding microbial antigens, namely O-antigen of LPS, or beta-1,3-glucans or *N,N'*-diacetylchitobiose, present respectively on Gram negative bacteria or yeast cell walls, triggers the proPO activating pathway. To identify CCF lectin-like domains, deletion mutants were tested for their ability to reconstitute the prophenoloxidase cascade in *E. foetida* coelomic fluid depleted of native CCF in the presence of LPS, laminarin (beta-1,3-glucan) and *N,N'*-diacetylchitobiose. In addition, affinity chromatography on immobilized LPS, beta-1,3-glucans or *N,N'*-diacetylchitobiose of CCF peptides was performed. We found that CCF contains two saccharide-binding domains. Domain I showing homology with the saccharide-binding motif of beta-1,3-glucanases and invertebrate defense molecules, located in the N-terminal part of CCF, is implicated in interactions with LPS and beta-1,3-glucans. The C-terminal tryptophan-rich domain II mediates interactions of CCF with *N,N'*-diacetylchitobiose. Together these data provide evidence for the presence of spatially distinct lectin-like domains within invertebrate defense molecule. To isolate the proPO enzyme, coelomic fluid proteins were separated in native PAGE and PO activity was identified using L-DOPA as a substrate. In SDS-PAGE, the fraction having PO activity showed two protein bands of about 80 kDa. N-terminal amino acid sequence of one of the two 80-kDa protein bands showed homology with an endogenous inhibitor of PO from housefly. The second protein was blocked in its N-terminal part, excluding N-terminal amino acid sequencing by Edman degradation. Trials to identify the genes coding for the inhibitor of PO and proPO enzyme from a cDNA library of *E. foetida* are now in progress.

Index words: Lectins, pattern recognition, *Eisenia foetida*.

[2363] SUBOPTIMAL NUTRITION AND FEEDING BEHAVIOR OF HEMIPTERANS ON LESS PREFERRED PLANT FOOD SOURCES

A. R. Panizzi[1], [1]Centro Nacional de Pesquisa de Soja, EMBRAPA, Caixa Postal 231, Londrina, PR 86001-970, BRASIL, E-mail panizzi@cnpso.embrapa.br.

Phytophagous hemipterans (heteropterans) are, in general, polyphagous, feeding on a wide array of plants. Among these, less preferred plant food sources are also explored as food and/or shelter. To illustrate this, I will discuss the feeding behavior of the southern green stink bug, *Nezara viridula* (Pentatomidae) on less preferred plants in northern Paraná state. This bug feeds on several uncultivated- wild, and on cultivated plants, which are less preferred, changing its feeding behavior, from a typical seed/fruit sucking habit, to leaf/stem feeding, with consequences for its nymphal and adult performance. Other seed suckers, such as *Euschistus heros* and *Dichelops melacanthus* (Pentatomidae), and *Neomegalotomus parvus* (Alydidae), also change their feeding behavior from seeds to vegetative tissues (leaf, stems) when feeding on less preferred food plants. These and other examples mentioned, demonstrate that for this feeding guild in particular, the less preferred food plant sources play an important role in the life history of these bugs, and that this fact is, in general, underestimated.

Index terms: Insecta, Hemiptera, Pentatomidae, host plants, nutritional ecology

[2364] PHYSIOLOGICAL AND NUTRITIONAL INTERACTIONS BETWEEN THE PEA APHID AND THE ENDOPHAGOUS BRACONID *APHIDIUS ERVI*

F. Pennacchio[1], Y. Rahbé[2] & E. Tremblay[3], [1]Dipartimento di Biologia, Difesa e Biotecnologie Agro-Forestali, Università della Basilicata, via N. Sauro, 85, 85100 Potenza, Italy, E-mail: pennacchio@unibas.it; [2]Laboratoire de Biologie Appliquée UA INRA 203, INSA de Lyon, 20 Avenue Albert Einstein, 69621 Villeurbanne Cedex, France; [3]Dipartimento di Entomologia e Zoologia Agraria, Università di Napoli "Federico II", via Università, 100, 80055 Portici (NA), Italy.

Aphidius ervi Haliday (Hymenoptera, Braconidae) is an endophagous parasitoid of several macrosiphine aphid species. Host physiology and metabolism are considerably redirected by the parasitoid in order to support growth and development of its pre-imaginal stages. Parasitized pea aphids, *Acyrthosiphon pisum* (Harris) (Hemiptera, Aphididae), are castrated by the parasitoid venom, injected at the oviposition along with the egg. The two most abundant proteins of *A. ervi* venom (21 kD and 36 kD), when injected into nonparasitized hosts, target germarial cells of the ovarioles and induce cellular alterations similar to those observed in naturally parasitized hosts. Teratocytes, cells deriving from the embryonic membrane of *A. ervi*, show an intense histolytic activity, especially against formed host embryos, further contributing to the castration process. These cells of embryonic origin have an impressive metabolic capacity, as suggested by the massive exchange of material with the host environment and by the synthesis of two abundant parasitism specific proteins (15kD and 45 kD), which appear to be of nutritional importance for the developing *A. ervi* larva. This biosynthetic role of teratocytes is significantly supported by a parasitoid-mediated increase of the amino acid supply by aphid bacterial endosymbionts. Bacteriocytes (host cells harbouring bacterial symbionts of the genus *Buchnera*) of parasitized aphids strongly interact with teratocytes, and, unlike other host tissues, do not show any degeneration. Experimental evidence indicates that amino acid biosynthesis of endosymbionts is considerably enhanced, resulting in a much higher production of essential aromatic amino acids. A physiological model integrating the host regulation factors, both of maternal and embryonic origin, and describing the nutritional exploitation strategy of the host is proposed.

Index terms: pea aphid; Braconidae; *Buchnera*; teratocytes; venom; castration

[2365] CONSTRASTING THE NUTRITIONAL CHALLENGES OF ECTOAND ENDOPARASITOIDS

B. Vinson

ABSTRACT NOT RECEIVED

[2366] INTERACTIONS OF DIETARY PROTEIN AND BLOOD SUGAR LEVEL: EFFECTS ON LARVAL FEEDING BEHAVIOUR IN *MANDUCA SEXTA*

S. N. Thompson [1] & L.-W. Wang [1], [1] Anal. Chem. Instrumentation Facility & Dept. of Entomol., Univ. of Calif., Riverside, CA., U.S.A., 92521.

The interactions between dietary protein and carbohydrate levels and their effects on food utilization, blood sugar level and nutrient self-selection were examined in terminal 5th instar *Manduca sexta* larvae. Relative rates of growth, consumption and assimilation, as well as net conversion efficiency, were determined for insects maintained on a semi-synthetic diet with four levels of casein between 12.5 g/L to 75 g/L, with and without sucrose at 17 g/L. Growth was limiting at the lowest protein level regardless of whether sucrose was present or absent. This was, in part, the result of lower food consumption and net conversion efficiency at low dietary protein levels. Larvae maintained on diets containing sucrose had higher growth rates than those on diets without the carbohydrate and this was attributed to an increased deposition of fat. The depot fat concentration of larvae maintained with and without sucrose, however, was only different at the lower dietary protein levels. The non-homeostatic regulation of blood sugar was affected by nutritional status and, in the presence of dietary carbohydrate, trehalose concentration was determined by dietary casein level. Blood trehalose decreased from approximately 50 mM to 20 mM as dietary protein was increased. Larvae maintained on diets lacking sucrose displayed low blood sugar and were glucogenic, as demonstrated by the ^{13}C distribution in glutamine and trehalose synthesized from (3-^{13}C)alanine administered to larvae by injection. In these insects, trehalose concentration varied between approximately 5 mM to 15 mM. At the highest dietary casein level examined the blood sugar level was not significantly different between larvae maintained on diets with and without sucrose. Feeding studies established a relationship between nutritional status, blood sugar level and dietary self-selection. If insects were preconditioned for 1 day on diets lacking sucrose they had low blood sugar regardless of dietary protein level. When subsequently given a choice between a sucrose diet lacking protein and a casein diet lacking sucrose, these larvae selected the former, even at the protein level that was growth limiting. Larvae preconditioned on a diet containing sucrose and the lowest level of dietary protein had high blood trehalose levels and subsequently selected the casein diet lacking sucrose. Insects maintained on the sucrose diet with the highest casein level had low blood sugar and selected the sucrose diet lacking casein. When preconditioned on diets containing sucrose and the intermediate levels of casein tested, larvae selected more equally between the two choice diets. It is concluded that blood sugar level may be intimately involved in dietary self-selection by *M. sexta* larvae, and that in the absence of dietary carbohydrate, gluconeogenesis provides sufficient blood sugar to ensure that larvae choose a diet that produces an optimal intake of dietary protein and carbohydrate.

[2367] NUTRITION OF PHYTOPHAGOUS INSECTS AND THEIR PRODUCTION ON ARTIFICIAL DIETS

J. R. P. Parra[1], [1]Dep. Entomol., Fitop. e Zool. Agrícola, ESALQ-USP, 13418-900, Piracicaba-SP, Brasil, E-mail jrpparra@carpa.ciagri.usp.br

The qualitative nutritional requirements of insects were well defined in the 1950s through 1970s, and such requirements were very similar to those of invertebrates. Accordingly, diets to date are formulated with balanced protein (essential amino acids), carbohydrates (simple and complex sugars), lipids and sterols (fatty acids), vitamins (especially B complex) and minerals. Special nutrients can be added as phagostimulants and/or growth promoters. The components are set to a consistency (usually containing agar) based on the insect's feeding habits and with the proper pH and anticontaminants. Standard and generic diets were developed and became available in the market. In recent years, more attention has been given to the quality control of insects produced in laboratories and to the rearing and handling techniques, particularly based on thermal requirements; the selection of more adapted insects became an important approach (genetics). The quantitative nutrition called for more attention in the 1980s, especially by North American groups and more recently new study models have been proposed by the Europeans. For the past two decades a great advance towards entomophagous nutrition, which meets scope the picture of nutrition under the ecological point of view (nutritional ecology), focusing interactions with nutrition, ecology, behavior and physiology. Successful *in vitro* productions of idiobiontic parasitoids and predators followed. The interaction with symbionts and enzymatic studies are becoming more and more important to elucidate the mechanisms and the development of diets. In this lecture a parallel between insect rearing and artificial diets in developed and developing countries is established.

Index terms: artificial diets, dietetics, qualitative nutrition

[2368] LINKAGE OF NUTRITION AND SILK PRODUCTION IN *BOMBYX MORI*

M. Nakamura & C. Hirayama, Dept. of Sericulture, National Inst. of Sericultural and Entomological Sci., 1-2 Ohwashi Tsukuba Ibaraki 305-8634 Japan, E-mail nakamura@nises.affrc.go.jp.

Silkworm, *Bombyx mori*, is known to produce a large amount of silk-protein. There might exit unique mechanisms regarding silk production. Although Silkworm can be reared on artificial diets, silk production of the larvae reared on fresh leaves of mulberry, *Morus alba*, was larger than that of the larvae reared on artificial diets. This suggests mulberry leaves, the natural host of silkworm, have factors effective in silk production. Though usual artificial diets for silkworm contain mulberry leaf powder, it is possible to rear larvae on the diets contained no mulberry leaf powder. However, efficiency in silk production is lowered when larvae are reared on the diets without mulberry leaf power. Larvae reared on fresh mulberry leaves shows the highest silk production, then larvae reared on usual artificial diet comes next and larvae reared on the diets without mulberry leaf power is the lowest. These suggest that mulberry leaf have two kinds of factors effective in silk production. One exits only in fresh mulberry leaves and the effectiveness is lost during diet processing. The other shows its effectiveness even in mulberry leaf power produced by drying in oven. Though these factors are not clarified, mulberry leaf power extracted with water and MeOH is effective in silk production. One of the factors kept during diet processing might be dietary fiber. One of the candidates that lose activity during diet processing is mulberry leaf urease that may make a significant contribution to silk production by converting useless urea into nitrogen source of silk-protein. It has been reported that concentration of urea in the hemolymph of larvae reared on artificial diets steeply increases from the beginning of spinning, while it decreases rapidly when reared on fresh mulberry leaves. Interestingly, urease activity was found in the hemolymph of the spinning larvae reared on fresh mulberry leaves, while no urease activity was detected in the larvae reared on artificial diets. Cleavage of urea by urease produces toxic ammonia. However, ammonia could be finally assimilated into the silk-protein by the pathway that involve glutamine systhetase (GS) and NADPH-dependent glutamate synthase (GOGAT). The experiment using methionine sulfoximine, a specific inhibitor of GS, ruled out the contribution of glutamate dehydrogenase, another enzyme which could possibly be responsible for ammonia assimilation. As GOGAT activity have not been demonstrated in other animals, the occurrence of GS/GOGAT pathway would be unique.

Index terms: *Bombyx mori*, *Morus alba*, urease, urea, ammonia

[2369] THE REPRODUCTIVE BIOLOGY OF *PERILLUS BIOCULATUS*

T. S. Adams, USDA-ARS-BRL, 1605 Albrecht Blvd., Fargo, ND 58105-5674, USA. E-mail adamst@fargo.ars.usda.gov.

A method is presented to quantitatively score the degree of ovarian maturation in a predacious pentatomid with asynchronous follicle development. Ovarian scores were not influenced by mating status, but were significantly lower in females fed the artificial diet. Ovarian follicles start forming when females are 2.3 days old reaching a peak at 4.5 days. In controls, the rate of new follicle formation decreases after the onset of vitellogenesis. By 4.5 days, all control ovarioles contained at least one vitellogenic follicle and by 9.5 days all ovarioles had chorionated follicles. In contrast, females fed the artificial diet had 40% of the ovarioles with a vitellogenic and chorionated follicle at 10.5 days of age. Mating started when females were 3.5 days old and correlated with the start of vitellogenesis. Mating and an adequate diet are prerequisites for laying a full compliment of eggs in *Perillus bioculatus*. Virgins laid an average of 22 eggs compared with 138 in the multiply mated controls and 84 in singly mated females. Multiply mated females given an artificial diet only laid 42 eggs. Oviposition rates were calculated over five-d periods for each female and presented as eggs/ovariole/d (eod). In all experimental groups the rates of egg laying decreased as the females aged approaching 0.07eod by 27.5 d after the start of oviposition. Two factors affecting egg laying are: 1). Availability of mature ovarian follicles in the ovariole and 2). Mating. Unmated females develop mature ovarian follicles, but do not oviposit many of them. Mated females given the artificial diet develop fewer mature ovarian follicles, but oviposit them. Hemolymph vitellogenin titers were determined with an ELISA technique. Insects given the artificial diet had lower vitellogenin levels than those given prey. The interaction of diet with hormones required for ovarian maturation will be discussed.

Index terms: *Perillus bioculatus*, fecundity, artificial diet, oviposition rate, vitellogenin.

[2370] RELATIONSHIP BETWEEN NUTRITON, ENDOCRINES, INSECT REPRODUTION AND FEEDING BEHAVIOR

J. G. Stoffolano

ABSTRACT NOT RECEIVED

[2371] THE ROLE OF POLYDNAVIRUSES IN DEFINING PARASITOID HOST RANGES

M. R. Strand[1], K. D. CLARK, K. KADASH, D. TRUDEAU & E. M. M. GARDINER, Dept. of Entomology[1], Univ. Wisconsin, Madison, WI, USA.

Polydnaviruses have long been considered essential for the successful development of parasitoids in their hosts. In this regard, polydnaviruses have been considered especially important in disrupting host cellular immune responses. Here we discuss how immune responses like encapsulation are regulated in Lepidoptera. We then outline how bracoviruses disrupt capsule formation, and whether immunosuppression is sufficient to render a host suitable for parasitoid development. Our comparative studies of microgastrine braconids in the genus *Microplitis* suggest that host range is partially determined by the ability of polydnaviruses to disrupt encapsulation. However, our results also indicate that host compatibility involves is strongly influenced by other factors besides immunosuppression.

[2372] EXPRESSION OF *CARDIOCHILES NIGRICEPS* POLYDNAVIRUS IN PARASITIZED *HELIOTHIS VIRESCENS* LARVAE AND INDUCED HOST FUNCTIONAL ALTERATIONS

F. Pennacchio[1,2], P. Falabella[1], P. Varricchio[1], F. Graziani[2] & C. Malva[2], [1]Dipartimento di Biologia, Difesa e Biotecnologie Agro-Forestali, Università della Basilicata, via N. Sauro, 85, 85100 Potenza, Italy, E-mail pennacchio@unibas.it; [2]Istituto Internazionale di Genetica e Biofisica, C.N.R., via Marconi, 10, 80121 Napoli, Italy.

Cardiochiles nigriceps Viereck (Hymenoptera, Braconidae) is an endophagous parasitoid of the tobacco budworm, *Heliothis virescens* (F.) (Lepidoptera, Noctuidae). Parasitized host larvae show a complex array of pathological symptoms. The most evident alterations registered are the suppression of the immune response and the developmental arrest of host mature larvae, which, when parasitized, fail to pupate and provide the required nutritional resources to the developing parasitoid larva. Most of these syndromes observed in parasitized host larvae are induced by *C. nigriceps* polydnavirus (CnPDV) infection. CnPDV, like all the other members of the peculiar virus family Polydnaviridae, actively replicates only in the calyx region of the wasp's ovary while in the host tissues replication is not observed. However, CnPDV genes are actively expressed in various host tissues and their expression is associated to major parasitoid-induced host alterations. The present study analyses gene expression of CnPDV in tobacco budworm larvae parasitized by *C. nigriceps*, starting from a few hours after parasitoid oviposition. The screening of CnPDV genomic libraries and of cDNA libraries, prepared with RNA poly A^+ from parasitized host larvae, allowed the isolation of various viral genomic clones and of their corresponding cDNAs. Different viral genes have been cloned, fully sequenced and characterized so far. The expression of these CnPDV genes in different host tissues and organs has been analyzed by Northern blot experiments and *in situ* hybridization. A functional analysis, both *in vivo* and *in vitro*, of CnPDV gene products has been undertaken.

Index terms: host regulation; gene expression; physiological interactions; Braconidae

[2373] CHARACTERIZATION AND MODE OF ACTION OF A BIOLOGICALLY ACTIVE PROTEIN SECRETED BY TERATOCYTES

D. L. Dahlman & B. A. Webb[1], Dept. of Entomology, S-225 Ag. Sci. North, University of Kentucky, Lexington, KY 40546-0091, USA,E-mail ddahlman@ca.uky.edu.

Teratocytes are cells derived from the extra-embryonic membrane (serosa) of some braconid and scelionid endoparasites. The cells of the serosa dissociate after the parasite egg hatches, releasing teratocytes into circulation where they become greatly enlarged, synthetically hyperactive and secrete large amounts of biologically active protein. Physiological doses of teratocytes, or the proteins secreted by them, from *Microplitis croceipes*, persistently inhibit host larval growth and/or cause host (*Heliothis virescens*) death while parasite larvae are unaffected. Results from physiological studies of teratocyte function in vivo and in organ culture bioassays show that teratocytes inhibit host cell protein synthesis, apparently at the level of translation. These physiological, behavioral and developmental characteristics are similar to those associated with parasitized hosts. A cDNA encoding one teratocyte secreted protein has been cloned from a biologically active fraction of teratocyte secreted products. This cDNA, when expressed and purified from a recombinant baculovirus, inhibits protein synthesis in host tissues at the level of translation. Details related to the localization and function of this protein in vivo along with information on tissue specificity, species specificity, in vivo half-life in the absence of actively secreting teratocytes, and mode of action of the secreted protein will be discussed.

Index terms: *Microplitis croceipes, Heliothis virescens*, parasitoid

[2374] PARASITISM SPECIFIC PROTEINS AND A SYMBIOTIC ENTOMOPOXVIRUS FROM *DIACHASMIMORPHA LONGICAUDATA*, A PARASITE OF TEPHRITID FRUIT FLIES

P. O. Lawrence, Dept. of Entomology and Nematology, Univ. of Florida, P.O. Box 110620, Gainesville, FL. 32611-0620, USA; E-mail: pol@gnv.ifas.ufl.edu.

A 24 kDa parasitism-specific protein (PSP24) occurs in the hemolymph of larvae and pharate pupae of the Caribbean fruit fly, *Anastrepha suspensa* (Diptera: Tephritidae) after parasitization of larvae by the wasp *Diachasmimorpha longicaudata* (*Dl*) (Hymenoptera: Braconidae). PSP24 occurs as isoforms of pI 6.3 and 6.7 in the host's hemolymph along with an antigenically related 10 kDa protein (PSP10). The proteins are highly glycosylated and have the same N-terminus amino acids and 5' nucleotide sequences in their cDNAs but differ toward their 3' ends. Their sequence similarities suggest that they are either members of the same gene family or the result of post-translational modification of the PSP24 message. The protein is encoded by both *A. suspensa* and *Dl* genes and its expression is induced in the host by the entomopoxvirus (*Dl*EPV) from the poison glands of the female wasp. The objectives of the present study are to (1) determine whether PSP24-like proteins are expressed in *Dl* as they are in parasitized *A. suspensa* and (2) determine the effect of PSP24 on *A. suspensa* cells in vitro. Using a rabbit anti-PSP24 polyclonal serum and Western blot hybridization techniques, we now show that PSP24 is highly expressed in wasp larvae and in the poison gland reservoir of females, where *Dl*EPV also occurs. PSP24-like proteins are released from wasp larvae cultured in vitro from embryonated eggs. We also detected *Dl*EPV in male wasps by probing (i) Western blots of their proteins with a mouse anti-*Dl*EPV polyclonal serum and (ii) dot blots of their DNA with digoxigenin (DIG-) labeled *Dl*EPV genomic DNA. The co-occurrence of *Dl*EPV and PSP24 in the wasps and the induction of the proteins in the host by *Dl*EPV, suggest that PSP24 may serve some beneficial role in both wasp and host. Progress on the effects of PSP24 on *A. suspensa* cells in vitro, independent of *Dl*EPV infection will be reported.

Index terms: *Anastrepha suspensa*, Caribbean fruit fly, parasitoid, fruit fly cell line, virus-induced proteins.

[2375] PHYSIOLOGY OF THE MORPHOTYPE DIFFERENTIATION IN THE PARASITIC WASP *MELITTOBIA DIGITATA* (HYMENOPTERA, EULOPHIDAE)

F. L. Cônsoli & S. B. Vinson, Dept. of Entomology, Texas A&M University, College Station, TX 77843-2475, USA, E-mail f-consoli@tamu.edu.

Morphotype differentiation has been shown to be under hormonal control in many species of insects, and hormonal changes may be triggered by many factors, such as population density. *Melittobia digitata* is a pupal ectoparasitoid of solitary wasps. This wasp can develop three wing morphotypes. Morphotype differentiation in this genus was associated with the clutch size, especially in the beginning of their development. The short-wing adults develop in small clutch sizes. These adults will continue in the nest to explore the remaining of the host. On the other hand, the long-wing will develop in large clutch sizes, and the host will be completely fed. These wasps have to disperse, and find a new host to lay their eggs. These morphotypes also vary in the ovarian function. The short-wings are provigenic while the log-wings are synovigenic. We have demonstrated that the morphotype differentiation in *M. digitata* is dependent on the nutritional quality of the host resource that has being exploited. The proportion of the short-wing adults will decrease in proportion to the availability of the host hemolymph as a food resource. Soon they have to start feeding on the tissues of the host, more of the long-wing type will develop. The role of hormones on the morphotype differentiation of *M. digitata* and mechanisms of nutritional control of hormone levels will be discussed.

Index terms: nutritional requirements, hormones, oogenesis, vitellogenin, host feeding

[2376] THE ROLE OF PLASMATOCYTE SPREADING PEPTIDE IN REGULATION OF ENCAPSULATION

K. D. Clark[1], B. Volkman[2] & M. R. Strand[1], Dept. of Entomology[1] and Biochemistry[2] Univ. Wisconsin, Madison, WI, USA.

Circulating blood cells (hemocytes) play an essential role in defending insects against invading organisms. Hemocytes usually kill metazoan parasites by encapsulation; a process in which certain types of hemocytes spread across the surface of the foreign target to form a multilayered sheath of cells. Despite the fundamental importance of this defense response to invertebrates, the specific cellular and molecular mechanisms coordinating capsule formation are not well understood. In this competing renewal application, we propose to continue our studies on capsule formation in the lepidopteran *Pseudoplusia includens*. Our results indicate that encapsulation requires two types of hemocytes called granular cells and plasmatocytes. Neither of these hemocyte types is able to encapsulate targets alone. However, plasmatocytes encapsulate targets if either granular cells are present or if targets are preincubated in medium conditioned by granular cells. These results suggest that after attaching to a foreign surface, granular cells release factors into plasma that induce a change in the adhesive state of plasmatocytes. In this regard, we identified plasmatocyte spreading peptide (PSP1) which induces plasmatocytes to undergo a change in adhesive state and to release specific effector molecules. In this presentation we discuss how PSP1 activates plasmatocytes and the potential significance of this signaling pathway in defense against parasitoids.

[2377] PHYSIOLOGICAL AND BEHAVIORAL STRATEGIES USED BY COCKROACHES TO REDUCE WATER LOSS: AN OVERVIEW

A. G. Appel, Dept. of Entomology and Plant Pathology, Auburn University, Auburn, AL 36849-5413, USA, E-mail aappel@acesag.auburn.edu.

Cockroaches are among the oldest groups of insects and are found in a variety of habitats ranging from aquatic to desert. Cockroaches have evolved behavioral and physiological strategies to limit cuticular, respiratory, and fecal water loss in stressful environments. In addition, at least one species, *Arenivaga investigata*, has evolved the ability to absorb water vapor to aid total water balance. Cuticular water loss can be reduced by acclimation to low humidity environments by increased synthesis or secretion of high molecular weight epicuticular hydrocarbons, dehydration of the endocuticle, and physical layering of fat body on the basal lamina of the epidermis. Increased concentration of melanin in *Blattella germanica* also reduces cutaneous water loss. Cockroaches can rapidly lower their cuticular permeability in response to changes in humidity and physical stress. This hormone-mediated reduction in permeability can occur in <10 min and presumably is caused by changes in cuticle water content and ion concentration. Resting cockroaches reduce respiratory water loss by initiating discontinuous gas exchange cycles (DGC). Spiracles are closed during most of the DGC reducing respiratory water loss. However, only fully-hydrated cockroaches (such as *Diploptera punctata* and *Periplaneta americana*) in their resting posture exhibit DGC. Because of the surface area to volume relationship, and strategies that reduce the relative amount of surface area exposed to the environment will reduce cutaneous water loss. Cockroaches alter their posture by closely pressing the body against a substrate. Cockroaches are also highly aggregative and will rest next to or on other individuals resulting in a significant reduction of exposed surface area and water conservation. The relative importance of each strategy and combined strategies in reducing water loss by cockroaches will be discussed.

Index terms: *Blattella germanica, Diploptera punctata, Periplaneta americana,* cuticular permeability.

[2378] ROLE OF ATP IN REGULATING AND INTEGRATING TRANSPORT ACROSS PRINCIPAL CELLS OF MALPIGHIAN TUBULES?

K. W. Beyenbach, Dept. of Biomedical Sciences, Cornell University, VRT 8014, Ithaca, NY 14853, USA, E-mail kwb1@cornell.edu.

Using X-ray analysis, we showed that cAMP causes diuresis by stimulating transepithelial secretion of NaCl and not KCl in Malpighian tubules of the yellow fever mosquito *Aedes aegypti* (Williams & Beyenbach, J. Comp. Physiol., B 154, 301, 1984). Cyclic AMP was later identified as second messenger of mosquito natriuretic peptide and other CRF-like diuretic peptides. Cyclic AMP increases basolateral membrane Na^+ conductance in principal cells, thereby increasing Na^+ entry and stimulating active transport into the lumen (Sawyer & Beyenbach, Am. J. Physiol. 248, R339, 1985). Using electrophysiological methods, we found that transepithelial Cl^- secretion is passive, mediated outside principal cells, and driven by the transepithelial lumen-positive voltage (Hayes et al., Life Sciences 44, 1259, 1989). Cl^- passing through the shunt serves as counterion for active Na^+ and K^+ transport through principal cells. Leucokinin stimulates secretion of both NaCl and KCl by increasing shunt Cl^- conductance (Pannabecker et al., J. Membr. Biol. 132, 63, 1993). Though the site of the shunt, stellate cells or paracellular junctions, is controversial, there is agreement on separate active (Na^+, K^+) and passive (Cl^-) transport pathways, controlled respectively by CRF-like and leucokinin-like diuretic peptides (O'Donnell et al., J. exp. Biol. 199, 173, 1996; Beyenbach, J. Insect Physiol. 41, 197, 1995). Using the methods of two electrode voltage clamp in a single principal cell, we now have learned that apical and basolateral membrane voltages are electrically coupled via the shunt. Thus, the voltage generated by the vacuolar H^+-ATPase at the apical membrane determines the electrical driving force for Na^+ and K^+ entry at the basolateral membrane, coupling entry and exit steps. Inhibition of metabolism by dinitrophenol (DNP) reversibly increases basolateral membrane resistance almost 8-fold (652 KΩ to 5038 KΩ) and increases apical membrane resistance nearly 20-fold (340 KΩ to 6718 KΩ). Hence, conductive pathways shut down at both membranes, allowing transport to spring back again upon DNP washout. The effects of DNP can be duplicated (reversibly) by cyanide (CN^-) and fluoride (F^-). DNP collapses the mitochondrial proton gradient, CN^- inhibits cytochrome oxidase, and F^- inhibits glycolysis, but all inhibit ATP synthesis. Effects shared in common by DNP, CN^- and F^- suggest a role of ATP in regulating and integrating diverse conductive pathways (pumps, carriers and channels) at basolateral and apical membranes. The on/off effect of DNP with switch-like speed points to high turnover rates of ATP.
(NSF IBN 9604394)
Index terms: CRF-like peptides, leucokinin, cAMP, ATP, principal cells, shunt.

[2379] MIDGUT SYSTEM: TRANSPORT MECHANISMS

J. T. Dow

ABSTRACT NOT RECEIVED

[2380] NEUROPEPTIDE CONTROL OF INSECT HINDGUT REABSORPTION: RECENT MOLECULAR ADVANCES

J. Phillips[1], J. Meredith[1], Y. Wang[1], Y. Zhao[1] & H. Brock[1], [1]Dept. of Zoology, Univ. of British Columbia, Vancouver, BC V6T 1Z4, Canada, E-mail phillips@zoology.ubc.ca.

We previously have described epithelial transport mechanisms in locust (*Schistocerca gregaria*) hindgut responsible for water/ionic homeostasis, pH regulation, and nitrogen excretion, leading to the first models for insect reabsorptive epithelia. The dominant process is an electrogenic Cl^- pump that drives K^+ and fluid reabsorption. Chloride transport can be continuously monitored *in vitro* as a short-circuit current, and this has served as a very specific bioassay to identify several neuropeptide stimulants of hindgut transport processes, including the major one in nervous corpora cardiaca acting on the ileum, Ion Transport Peptide (ITP). ITP is 72 amino acids long, terminally amidated, and has 3 disulphide bridges which are conserved relative to a large family of crustacean neurohormones to which ITP belongs. ITP is the first member of this protein family to be synthesized and its cDNA expressed using several insect cell/viral vector systems. Both transient and stably transformed Drosophila Kc1 cells secrete a very active form of ITP (KcITP) that is cleaved from its prepropeptide correctly at the N-terminus (unlike baculovirus-infected Sf9 cells). This system has allowed us to use site-directed mutagenesis to identify specific amino acids at both the N and C termini that are essential for activation of the ITP receptor (ITP-R). Similar studies show that each of the disulphide bridges is required for full activity of KcITP. Inactive mutant forms of ITP were also tested for antagonistic activity on ITP-R stimulated by native ITP with potential pest control strategies in mind. We are using molecular techniques and bioassays to study evolutionary divergence of ITP homologues, including those in the most important agricultural pests (Lepidoptera, Coleoptera) and disease vectors (Diptera).
Index terms: *Schistocerca gregaria*, neuropeptide, expression, mutagenesis

[2381] ACTIVE AND PASSIVE COMPONENTS OF WATER VAPOUR ABSORPTION

J. Noble-Nesbitt, School of Biological Sciences, Univ. East Anglia, Norwich NR4 7TJ, UK. e-mail j.noble-nesbitt@uea.ac.uk.

Radioisotopic analysis provides a very sensitive measure of unidirectional water flux and an equally sensitive means of distinguishing passive and active components of water movements between compartments. This powerful technique has been applied to investigate the absorption of water vapour from different ambient humidities in two insect species that are known to be capable of showing net gain of water in high humidity. Earlier reports on water vapour absorption in the firebrat, *Thermobia domestica*, based on the less sensitive gravimetric method, have shown that late nymphs and adults are able to make a net gain of water in humidities above 43% RH, but indicated that the eggs and early nymphal instars cannot. Using the radioisotopic technique, these earlier results have been clearly and unequivocally confirmed. In low or high ambient humidity, only passive exchange occurs in eggs and first instar nymphs. Both of these stages in the life history are incapable of making a net gain to their internal water pool by absorption of water from the vapour phase of the surrounding air, even in high humidity. Net gain of water from air of high humidity (75% RH) begins during the second instar and reaches maximal rates normalised to body mass in the third and fourth instars. In all of these stages passive flux equates closely with transpiratory water loss into dry air as measured gravimetrically. In the vapour absorptive state, vapour absorption by the vapour absorptive organ works against the passive loss of water over the general body surface, so providing a net gain of water to the internal water pool. In absolute terms, the rate of absorption is almost an order of magnitude greater than passive flux under identical water activity gradient. Studies on the cigarette beetle, *Lasioderma serricorne*, using the same technique yield similar conclusions. They confirm that the larva is able to make a net gain of water in high humidity (75% RH) but not in low humidity (33% RH) and show that, as in the mealworm beetle, *Tenebrio molitor*, the adult is incapable of making a net gain in either of these humidities.
Index terms: *Thermobia domestica, Lasioderma serricorne,* radioisotope, humidity

[2382] HORMONAL REGULATION OF CUTICLE FORMATION AND CHITIN SYNTHESIS

A. Retnakaran[1], W. Tomkins[1], M. Primavera[1], T. Ladd[1], Q.-L. Feng[1], B. M. Arif[1] and S.R. Palli[1,2], [1]Great Lakes Forestry Centre, Canadian Forest Service, P.O. Box 490, Sault Ste. Marie, Ontario, Canada, P6A 5M7; [2]Rohm and Haas Research Laboratories, 727 Norristown Road, Spring House, Penn., 19477, USA; E-mail: aretnak@nrcan.gc.ca

Cuticle formation, chitin synthesis and endocuticular elaboration occur during the intermolt period early in each stadium prior to the appearance of the ecdysone peak in the hemolymph. The formation of the cuticulin layer, dense epicuticle and the secretion of the molting fluid are up-regulated by ecdysone whereas sclerotization, chitin synthesis, endocuticular elaboration and ecdysis are down-regulated by this hormone. Juvenile hormone modulates the effects of ecdysone and alteration of its titer leads to phenotypic changes in the cuticle. Structural and sclerotization genes such as LCP-14 and DDC are expressed in the absence of ecdysone whereas molt genes such as the transcription factors E75 and CHR3 that transactivate genes responsible for the molting fluid, cuticulin, epicuticle and ecdysis are expressed in the presence of ecdysone. Elucidation of the molecular regulatory mechanism and ultrastuctural changes in cuticle morphogenesis using a non-steroidal ecdysone agonist, RH-5992, in the spruce budworm, *Choristoneura fumiferana*, will be described.
Key Words: Cuticle, Chitin, Ecdysone, Sclerotization, Juvenile hormone, Transcription factors, RH-5992, *Choristoneura fumiferana*

[2383] SEX, BUTTERFLIES AND BATESIAN MIMICRY: COLOUR PATTERN FORMATION IN THE TIGER SWALLOWTAIL

R.H. ffrench-Constant[1]; P. B. Koch & B. Behnecke[2,1] Department of Biology, University of Bath, Bath, BA2 7AY UK; [2]Department of General Zoology and Endocrinology, University of Ulm, Ulm, D-89069 Germany.

Melanism in lepidoptera, either industrial melanism or melanism involved in mimicry, is one of the most commonly cited examples of natural selection. However, despite extensive studies on the frequency and maintenance of melanic genes in insect populations, there has been little work addressing the underlying molecular mechanisms involved. Nowhere is butterfly melanism more striking than in the Eastern Tiger Swallowtail (*Papilio glaucus*) of North America. In this species females can be either yellow (wild-type) or black (melanic). The melanic form is a Batesian mimic of the distasteful Pipevine Swallowtail (*Battus philenor*) which is also black in overall color. Melanism in *P. glaucus* is controlled by a single Y-linked (female) *black* gene. Melanic females therefore always have melanic daughters. Melanic females show a replacement of the background yellow with black melanin. Here we show that the key enzyme involved is N-□-**alanyl-dopamine-synthase (BAS) which shunts dopamine from the melanin** pathway into the production of the yellow color pigment papiliochrome and also provides products for cuticle sclerotization. In melanic females this enzyme is suppressed leading to abnormal melanisation of a formerly yellow area and wing scale development is also delayed in the same area. This raises the possibility that either reduced BAS activity itself is preventing scale sclerotization (maturation) or, in contrast, that the delay in scale development precludes expression of BAS at the correct stage. BAS is probably homologous to the product of the *ebony* gene of *Drosophila*, mutants of which show black body color.

[2384] COMPARATIVE BIOCHEMISTRY OF CUTICLE SCLEROTIZATION AND DEFENSE REACTIONS

M. Sugumaran

ABSTRACT NOT RECEIVED

[2385] OXIDATIVE CONJUGATION OF CATECHOLS FOR INSECT CUTICLE SCLEROTIZATION

K. J. Kramer[1], M. R. Kanost[2], T. L. Hopkins[3], H. Jiang[2], R. Suderman[2], R. Xu[3], [1]Grain Marketing and Production Research Center, ARS, USDA, Manhattan, KS 66502, USA, E-mail kramer@usgmrl.ksu.edu; [2]Dept. of Biochemistry and [3]Entomology, Kansas State University, Manhattan, KS 66506, USA

Cuticle sclerotization or tanning is a vital process that occurs during each stage of insect development to harden and stabilize the newly secreted exoskeleton. The structural polymers, protein and chitin, make up the bulk of the cuticle, and chemical interactions between these biopolymers with quinonoid tanning agents are largely responsible for the final properties of the exoskeleton. The main hypothesis for sclerotization involves the formation of cross-links between nucleophilic imidazole nitrogens of histidyl residues in cuticular proteins and electrophilic ring or side chain carbons of ortho-quinones and para-quinone methides derived from two catechols, N-beta-alanyldopamine and 3,4-dihydroxyphenylethanol. C-N and C-O linkages between tanning agents and proteins in a variety of insect cuticles from several orders of insects have been elucidated. cDNAs for both the tyrosinase and laccase types of phenoloxidases that catalyze the cross-linking reactions have been isolated and sequenced. The sequences of laccase cDNAs from two insect species demonstrate that insect laccases are more similar to fungal laccases than to those from plants. These results provide insight into how insects use structural proteins, catechols, and oxidative enzymes to form catechol-amino acid adducts, which help to stabilize their exoskeletons. This research was supported in part by the National Science Foundation.
Index terms: *Manduca sexta*, *Anopheles gambiae*, cross-linking, oxidation, metabolism.

[2386] ß-ALANYL DERIVATIVES IN CUTICLE AND NEURAL TISSUE

L. A. Quesada-Allué, P. Wappner and M. M. Pérez, Instituto de Investigaciones Bioquímicas, (Fundación Campomar, CONICET and University of Buenos Aires), Patricias Argentinas 435, Bs Aires (1405), Argentina. E-mail: lualque@iib.uba.ar.

In brown insect cuticles of several insects, N-ß-alanylcatecholamines seem more important precursors for sclerotization than N-acetylcatecholamines. N-β-alanyldopamine (NBAD) and N-β-alanylnorepinephrine (NBANE) are the main β-alanyl derivatives found in most dictyopteran, dipteran and lepidopteran, NBAD being the more abundant in several cuticles. NBAD is also a precursor of papilochrome II, a pteridine formed in lepidopteran wings by conjugation with kynurenine. 1,2-dehydro-NBAD has been reported as intermediate in *Calliphora* cuticular sclerotization. Other β-alanyl derivatives unrelated to cuticle have been described in insects, like sarcophagine (β-ala-Tyr) in *Sarcophaga* and the novel antibacterial substance N-ß-alanyl-5-S-glutathionyl-3,4-dihydroxyphenylalanine (5-S-GAD) in the same flesh fly. Glycosyl-conjugates of NBAD and NBANE have been found in haemolymph, whereas these N-ß-alanylcatecholamines also occur in neural tissue. Recent results on the synthesis of these and other conjugates by a putative catecholamine-β-alanine ligase (CBAL), able to use alternative substrates, will be discussed. This enzyme is extremely unstable and seems responsible of the synthesis of both NBAD and NBANE in *Ceratitis capitata* tissues. Similar enzymatic activities have been measured in *Drosophila melanogaster* and other insects. Melanic mutants like *Drosophila ebony* and *Ceratitis niger* will be revisited and their expression discussed.
Index terms: N-ß-alanylcatecholamines; sclerotization; dopamine; norepinephrine

[2387] ORIGIN AND FUNCTION OF INSECT PERITROPHIC MEMBRANE

W. R. Terra, Departamento de Bioquímica, Instituto de Química, Universidade de São Paulo, C.P. 26077, 05513-970, São Paulo, Brazil, E-mail warterra@iq.usp.br. Supported by FAPESP, CNPq and PRONEX

The food is separated from midgut cells in insects by two kinds of structures. The perimicrovillar membranes found in Hemiptera consist of lipid membranes ensheathing the cell microvilli and extending to the luminal compartment with dead ends. The peritrophic mantle is a film surrounding the food bolus in most insects. The peritrophic mantle may be fluid (peritrophic fluid) or membranous (peritrophic membrane). The peritrophic membrane (PM) is composed of a network of proteins and chitin (peritrophic matrix) to which enzymes and other components associate. Frequently less evolved insects have a peritrophic fluid, instead of a PM, in anterior midgut. PM proteins (peritrophins) have chitin-binding domains and other domains with overall structure similar to mucins. Mucins are components of the gastrointestinal mucus of most animals, and are involved in the protection of the mucosa against mechanical damage, in microorganism trapping and in prevention of non-specific binding of undigested material onto membrane-bound hydrolases and/or transporting proteins. It is proposed here that during evolution midgut cells began synthesizing chitin and peritrophins derived from mucins by acquiring chitin-binding domains, thus permitting the formation of PM. PM may compartmentalize the midgut, thus adding new physiological roles to those of the ancestral mucus. Based on digestive enzyme compartmentalization data, secretory mechanisms, excretory rates and midgut fluid fluxes the new putative PM roles are: (1) prevention of enzyme excretion by allowing the recycling of digestive enzymes powered by a counter-current water flow through the ectoperitrophic space (space between PM and midgut tissue); (2) to permit monomers to be produced from food oligomers in close proximity to the surface of midgut cells (because of the restriction of enzymes involved in intermediary digestion to the ectoperitrophic space). Current data on the spatial organizaton of digestive events suggest that PMs of all insects have function (1), whereas function (2) is demonstrable only in PMs of mosquitoes, flies, moths and bufferflies.
Index terms: PM permeability, digestion, midgut compartmentalization

[2388] LEPIDOPTERAN PERITROPHIC MEMBRANE STRUCTURE AND EFFECTS OF WHEAT GERM AGGLUTININ ON FORMATION

T.L. Hopkins & M.S. Harper, Dept. Entomology, Kansas State Univ. Manhattan, KS 66506 USA. E-mail: thopkins@oz.oznet.ksu.edu

Peritrophic membrane (PM) structure and the effects of dietary wheat germ agglutinin (WGA) on its formation was studied in the larvae of the European corn borer, (ECB) *Ostrinia nubilalis* and the tobacco hornworm, (THW) *Manduca sexta* by light and electron microscopy techniques. Growth and development of ECB is strongly inhibited by low amounts of WGA in the diet (0.05%), whereas THW is not affected by amounts of up to 2 %. ECB larvae secrete a chitinous meshwork in the anterior midgut where it becomes embedded in a proteinacous matrix to form a thin single-layered PM that quickly becomes multilayed as it moves posteriorly. Chitin microfibrils, as visualized by binding with WGA-gold, form an orthogonal meshwork within the outer region of the microvilli, which then moves to the tips of the microvilli where proteinacious matrix is added. The PM then delaminates from the surface of the brush border into the lumen where it encloses ingested food material. WGA at 0.05% w/w in the diet causes hypersecretion of unorganized PM in the anterior midgut lumen, disintegration of microvilli and cessation of feeding. Large amounts of WGA became localized in the PM as indicated by staining with anti-WGA. WGA was shown to bind to both the the chitinous meshwork with WGA-gold, and to several PM proteins by western blotting. Voids in the chitinous meshwork and sparse matrix material are indicated to be caused WGA binding to these PM components. This allows the passage of plant cell wall fragments and bacteria through a defective PM into the ectoperitrophic space and penetration into the brush border. Stimulation of PM secretion and cessation of feeding maybe in response to damage to the brush border by abrasive food particles. Unlike ECB, the chitinous meshwork of THW is a felt-like structure with no apparent geometric pattern, and it is embedded in a proteinaceous matrix that is very stable to solubilization. The PM is secreted as a thin single layered structure in the most anterior region of the midgut, but becomes multilayered as it moves posteriorly in the lumen. THW tolerates high amounts of WGA in its diet with no disruption of PM formation or inhibition of feeding, growth or development. WGA does accumulate in large masses embedded in the PM perhaps by binding to certain components, but does not cause any abnormalities or voids that allow the penetration of food particles and subsequent damage to the brush border. Therefore, large differences in PM formation or structure between two lepidopterous species greatly affects WGA interaction with chitinous and proteinaceous PM components and inhibition of larval growth.

[2389] MOLECULAR STRUCTURE OF THE PERITROPHIC MEMBRANE AND ITS IMPLICATION FOR INSECT CONTROL

P. Wang & R. R. Granados, Boyce Thompson Inst., Cornell Univ., Ithaca, NY 14853, USA, E-mail: pw15@cornell.edu.

Chitin/protein structures perform important protective functions in microorganisms and invertebrate animals. The peritrophic membrane (PM) is such a protective chitin/protein structure in the midgut of most insects, lining the intestinal tract and performing multiple functions in food digestion and in defense against pathogens and toxic compounds. Proteins are major PM constituents and play essential roles in PM formation and for PM protective functions. We used *Trichoplusia ni* as a model lepidopteran insect to study the PM structure and functions. Our results from biochemical and molecular analyses revealed that the PM proteins (=peritrophins) are predominantly composed of two types: insect intestinal mucin (IIM) and chitin binding proteins. The characteristics of IIM which is present as a major protein in *T. ni* PM demonstrated that the insect PM is virtually an intestinal mucus layer reinforced by chitin and revealed a midgut defense mechanism. In addition to the IIM, most of the PM proteins are chitin binding proteins in nature, playing essential roles in PM formation. Our understanding on the biochemical and molecular characteristics PM proteins provided a basis for us to model the PM structure and its formation. Key features of the PM proteins include extensive O-glycosylation of the IIM for their protease resistant nature, susceptibility of IIM to proteolytic degradation by baculovirus enhancins, necessity of disulfide bonding in IIM for its stability, and unique multiple chitin binding domain structures which serve as the major driving force for PM formation and stability. Understanding of these PM features has suggested new approaches to design strategies to disrupt the PM structure. Those strategies can be demonstrated *in vitro* or *in vivo* assaying systems and may be further developed towards novel strategies for insect control.
Index terms: *Trichoplusia ni*, midgut, chitin/protein structure

[2390] THE MOSQUITO PERITROPHIC MATRIX

M. J. Edwards, M. Donnelly-Doman, L. Shao & M. Jacobs-Lorena, Case Western Reserve University, Dept. of Genetics, 10900 Euclid Ave., Cleveland, OH 44106-4955, USA. Email: mxj3@po.cwru.edu.

The mosquito is an obligatory vector for transmission of malaria, a disease that kills 2 million people every year. *Plasmodium*, the causative agent of malaria, must physically traverse the mosquito peritrophic matrix (PM) in order to complete its life cycle in the mosquito. In both larvae and adults, the PM completely surrounds the food bolus. Enzymes secreted by the midgut epithelium must cross the PM to reach the ingested food and the products of digestion must cross the PM in the opposite direction to be absorbed by the midgut epithelial cells. We devised a new non-invasive *in vivo* assay for estimating larval PM permeability. The assay also allows for assessment of permeability of the caecal membrane, a structure that separates each caecum from the gut lumen. Permeability was estimated by appearance of fluorescently-labeled dextrans (size range 4.4 - 2,000 kDa) within the gastric caecae of mosquito larvae. The larval PM was permeable to dextrans of 148 kDa and smaller, while the caecal membrane was permeable to dextrans 19.5 kDa and smaller. The assay was also used to devise a treatment that disrupts the PM sufficiently to allow the passage of virus-sized particles. Dithiothreitol was effective and chitinase only partially effective in disrupting the PM. Both agents did not have any toxic effects on the larvae. Cycloheximide, Polyoxin D, Pronase and Calcofluor had no effect on permeability. The results will be discussed in terms of the physiology of digestion and the ability of rendering the larval midgut epithelium accessible to viruses and other large particles. To clone *Anopheles gambiae* larval PM genes we prepared a [cardia-minus-midgut] subtraction library enriched for cardia sequences. One clone from this library - *Ag-Lper1* - was further characterized. Anti-*Ag-Lper1* antibodies react strongly with cytoplasmic vesicles of cells in the outer cell layer of the cardia. Northern blots detects a ~750 nucleotide-long RNA in cardia but not in gut or carcass RNA samples. The predicted 183 amino acid protein contains a signal sequence and a glutamine-rich (11%) amino acid sequence with similarity to involucrin, which is a major structural protein in the mammalian epidermis. Both the PM and the epidermis form barriers separating two compartments. A cDNA encoding a putative PM protein that is also rich in glutamine was isolated from an ADULT library. To isolate *Aedes aegypti* PM gene counterparts, we are currently immunoscreening an adult midgut cDNA expression library with an anti-PM serum.

Index terms: *Anopheles gambiae*, *Aedes aegypti*, permeability, cardia, caecal membrane, peritrophic matrix genes

[2391] CHARACTERIZATION OF THREE MEMBRANE-BOUND AMINOPEPTIDASES ISOLATED FROM *STOMOXYS CALCITRANS* (DIPTERA: MUSCIDAE) MIDGUTS

L. C. Alexander & B. P. Jordão, Depto. de Fisiologia, Insituto de Biociências, Universidade de São Paulo, R. do Matão, trav. 14, no. 101, 05508-900, Brazil. E-mail - bpjordao@quim.iq.usp.br. Supported by: FAPESP and PRONEX.

S. calcitrans midgut membranes were submitted to two consecutive papain treatments. The final solubilized material was 2.1 ± 0.3 (n=3) times enriched in aminopeptidase activity (relative to the initial membrane material). Three aminopeptidases (APs) were isolated from the papain solubilized material by using High Q ion exchange, Phenyl Superose hydrophobic and Mono Q ion exchange chromatographies, and named HQ1, PS1 and PS2 following the order in which they were obtained. Thermal inactivation of HQ1 at 60°C follows an apparent 1st order kinetics, with a $T_{1/2}$ of 7.88 min. PS1 and PS2 when incubated at 65°C, also inactivated according to an apparent 1st order kinetics, with $T_{1/2}$'s of 22.5 min and 23.1 min, respectively. Km and Vmax values were determined for the three APs using the following p-nitroanilide substrates (pNA): Arg, Leu, Met, Ala and Glu. None of three APs successfully hydrolized GlupNA. The calculated Vmax/ Km values indicate that: HQ1 hydrolizes Leu much more efficiently than Met, Arg or Ala; PS1 hydrolizes Arg, Leu and Met much more efficiently than Ala.; PS2 hydrolizes Leu and Arg much more efficiently than Ala and Met. Results thus indicate that the three APs have different substrate specificity, but are capable of using a relatively broad range of substrates. PS1 and PS2 activities on LeupNA and ArgpNA were inhibited by Leu hydroxamate (HLeu) and by Arg hydroxamate (HArg). In the case of both APs, Ki values for each inhibitor was similar independently of the substrate used, indicating that Leu and Arg bind (and presumably hydrolized) at the same site in PS1 and PS2. The chelating agent EDTA (100mM, pH 6.5) inactivates PS1 and PS2 activities at 30°C. Both activity losses can be partially prevented by the addition of HLeu at a concentration 25x that of the Ki value, thus indicating these APs are dependent on a metal ion at their active site for hydrolitic activity.

Index terms: kinetics, digestion, enzyme, substrate specificity.

[2392] BEHAVIORAL RESPONSE OF *STOMOXYS CALCITRANS* (DIPTERA: MUSCIDAE) TO ITS OWN FECES

R. A. Alzogaray[1,2*] & D. A. Carlson[2], [1] Centro de Investigaciones de Plagas e Insecticidas (CIPEIN/CITEFA-CONICET-UNSAM), Zufriategui 4380, (1603) Villa Martelli, Buenos Aires, Argentina. E-mail: raizogaray@hotmail.com; [2] Center for Medical, Agricultural and Veterinary Entomology (CMAVE-USDA-ARS), 1600/1700 SW 23rd Drive, Gainesville, FL 32604, USA. E-mail: dcarlson@gainesville.usda.ufl.edu. * This work was carried out while RAA was in receipt of a fellowship from the Consejo Nacional de Investigaciones Científicas y Técnicas de Argentina (CONICET).

The universally distributed stable fly, *Stomoxys calcitrans*, is a haematophagous insect that lives in close association with large mammals. Both sexes suck blood and their feeding activity has been indicated as a cause of weight loss in livestock. Though humans are not the primary source of blood for *S. calcitrans*, attacks are regularly reported along the Gulf Coast near the Florida-Alabama border and the Midwestern United States. There is no good chemical attractant for this pest. The objective of this study was to evaluate the behavioral response of *S. calcitrans* to feces from the same species. Adult females (24-36 h old) were tested in a triple cage olfactometer with dual insect traps. Attraction was expressed as: (flies trapped in attractant trap- flies trapped in control trap) x 100 / total number of flies in the cage. Rectangular cellulose sponges (11.4 x 3.8 x 0.8 cm) were suspended in colony cages for 1, 3 or 6 days to collect feces. The most active extracts were obtained by washing the feces sponges or the cages with a mixture of chloroform:methanol (2:1). Both time-response and dose-response relationships were obtained for females exposed to feces sponges or to filter papers treated with a choloroform:methanol extract of fly feces. Attraction to feces collected on sponges decreased as the air flow increased. Three-day feces sponges held for 14 or 28 days remained fully attractive. The activity of filter paper treated with extract was lost after 15 h in air. The attraction response of female flies (26%) to feces sponges was twice that of males. These results indicate that a potent attractant factor is present in *S. calcitrans* feces. We plan to identify the bioactive compounds, then evaluate their use in insect traps.

Index terms: *Stomoxys calcitrans*, attractants,fly feces, olfactometer.

[2393] TRANSPORT OF PRO-PHENOLOXIDASE FROM HEMOLYMPH TO CUTICLE

T. Asano[1] & M. Ashida[2], Biochem. Lab., Inst. of Low Temp. Sci., Hokkaido Univ. Sapporo, 060-0189 Japan, E-mail [1]ingemar@pop.lowtem.hokudai.ac.jp, [2]ashida@pop.lowtem. hokudai.ac.jp

Insect cuticle is a non-living matrix composed of proteins, carbohydrates and lipids. All of cuticular proteins are not synthesized in epidermal cells. Some of them are synthesized and secreted to hemolymph by fat body or hemocytes, and then transported to cuticle. The mechanism of protein transport across the epidermal cell layer in insect is an important problem to be studied. Pro-phenol oxidase (proPO) is one of the proteins which have been suggested to be transported from hemolymph to cuticle. We chose this proPO as a probe to study a mechanism for the trans-epithelial transport of macromolecules from hemolymph to cuticle. In each of hemolymph and cuticle, two types of proPO isoforms, which were designated F- and S-type proPOs, were detected. F-type proPO migrates faster than S-type proPO in electrophoresis under non-denaturing condition. Irrespective of the origin, proPO belonging to one of the two types had the same mobility. All the proPO isoforms were purified and characterized. Several amino acid substitutions between the two isoforms in hemolymph were detected and the same substitutions were also observed with the isoforms in the cuticle. The primary structures of F- and S-type proPO from hemolymph were the same as those of F- and S-type proPOs from cuticle, respectively. The transport of proPO was studied by using one of the isoforms in hemolymph (S-type proPO) and the larvae (F-type larvae) that have only F-type proPO in the hemolymph and the cuticles. 2 days post injection of the hemolymph S-type proPO into the hemocoel of the F-type larva, S-type proPO was detected in the cuticle extract of the larvae. This clearly shows the transport of proPO. With the analysis of peptide fragments by post sourse decay method in matrix assisted laser desorption ionization mass spectrometry, several methionyl residues of both cuticular proPO isoforms were identified as methionine sulfoxides. When cuticular S-type isoform was injected into the hemocoel of the F-type larva, the injected proPO was not transported appreciably to the cuticle. All proPO isoforms from hemolymph and cuticle were converted by proPO-activating enzyme to active phenoloxidases that had very similar enzymatic properties. Although, for the physiology of insect integument, the meaning of the oxidation of methionyl residues in cuticular proPO isoforms is not clear at present, our observation seems to indicate the existence of mechanisms which determine whether particular hemolymph proteins are qualified to be transported to cuticle through epidermal cells.

Index terms:pro-phenol oxidase, cuticle, transport, methionine sulfoxide, epidermal cell.

[2394] SUCCESSIVE GENERATIONS OF THE EUROPEAN CORN BORER OBTAINED BY MASS REARING ON ARTIFICIAL DIET

A. Bărbulescu, Research Inst. for Cereals and Industrial Crops, 8264 Fundulea, N. Titulescu Str., 1, Calarasi District, Romania, E-mail: fundulea@cons.incerc.ro

In Romania, research on maize resistance to *Ostrinia nubilalis* imposed approach of investigations on rearing this insect on artificial diet. The objectiv of the paper is to estimate the influence in time of nutritive value of diet on the behaviour of insect reared under continuous flow. Methodology. During 1978-1999 a different number of colonies resulted from the natural population has been set, each in a certain experimental year, with the aim to simultaneous study of different generations reared on artificial diet. The first colony was set up in 1978 and in 1997 the last one. Periodically tests have been performed with these colonies, to assess the nutritive value by the number of pupae obtained from a rearing dish, duration of larval and pupal instars, and the number of egg-masses laid by one female. In order to study the behaviour of various European Corn Borer generations reared at the same time span, in separate trials fecundity and life-span of adults have been studied. These parameters have been separately recorded for each colony and generation. Results. It was found that ECB reared on artificial diet reached up to the end of 1999, in agreement with the experimental colony, the 260-th generation of the older colony started in 1979, and the 34-th generation of the younger colony founded in 1997. The number of pupae per rearing dish, development duration (days) of larval and pupal instars, adult life-span (days), and the number of egg-masses/female were not influenced by the number of generation the insect reared on artificial diet belonged to. Variations recorded in all colonies, between the values of analysed parameters have been substantially caused by the experimental conditions. It was noted that for the same experimental period, the number of pupae per rearing dish was very low in all cases for the early generations, as compared to the following ones. Conclusions. *Ostrinia nubilalis* has been reared on artificial diet under continuous flow for a variable number of generations, as depending on the colony generated from the natural population. The number of pupae/rearing dish, the length (days) of larval of pupal instars, the adult life-span (days), and the number of egg-masses laid by one female, irrespective of the number of generations of insect reared under steady flow, showed that the artificial diet used for insect rearing had suitable nutritive value.

Index terms: Ostrinia nubilalis, mass rearing, artificial diet, egg-masses.

[2395] MOLECULAR CHARACTERIZATION OF THE ALLATOSTATIN PEPTIDE FAMILY

W. G. Bendena[1] & S. S. Tobe[2], [1]Dept. of Biology, Queen's University, Kingston, ON, Canada K7L 3N6, Email: bendenaw@biology.queensu.ca; 2)Dept. of Zoology, University of Toronto, Toronto ON, Canada M5S 1A1.

Juvenile hormone (JH) plays a central role in the metamorphosis and reproduction of most insect species. The biosynthesis of JH within the corpora allata of insects can either be stimulated or inhibited by the neuropeptides allatotropin and allatostatin(AST), respectively. The allatostatin precursor from 6 cockroach species has been cloned and characterized. Each precursor contains either 13 or 14 related peptides that represent an intraphylectic family of peptides whose C-termini contain the sequence Tyr/PheXaaPheGlyLeu/Ile-NH_2. Analysis of AST sequences suggest that the AST sequences were generated through a process of internal gene duplication which occurred before these species diverged from each other in evolutionary time. The AST peptide family also appears to function as potent inhibitors of muscle contraction and are synthesized in, and potentially secreted from a population of granulated hemocytes suggesting additional functions. The diversity of action of this peptide family suggests that multiple receptors may exist for ASTs. Approaches to identifying these receptors will be presented.

Index terms: *Diploptera punctata,* neuropeptide, receptors.

[2396] CELLULAR IMMUNE RESPONSE OF THE MOSQUITO *CULEX QUINQUEFASCIATUS* (DIPTERA-CULICIDAE) TO *CANDIDA ALBICANS* INFECTION

J. S. Bento[1], E. C. de Araújo[1], C. M. R. de Albuquerque[1], C. A. Peixoto[2] & H. Hurd[3], [1]Mest. em Biologia Animal, Dept. de Zoologia Univ. Federal de Pernambuco-Recife PE, Brazil, E-mail cleide@npd.ufpe.br. [2]Centro de Pesquisas Aggeu Magalhães, Dept. de Patologia e Biologia Celular - Recife PE, Brazil. [3]Centre for Applied Entomology and Parasitology School of Life Sciences Huxley Building, Keele Univ., Staffordshire, ST5 5BG, UK. Financial support Wellcome Trust, CNPQ and FACEPE

Insects have an efficient defense system against infection. The cellular immune defense mechanism initiated by the mosquito *Culex quinquefasciatus* infected with the fungi *Candida albicans* was investigate in this study. Differences in haemocyte counts in the haemolymph perfused from uninoculated, saline-inoculated and *C. albicans* infected mosquitoes were compared using an optical microscopic. This showed that the relative proportion of plasmatocytes (48.6%; 50.7%; 45%) was higher and the proportion of cells granular was concomitantly lower (38%; 36.8%; 35%) in infected mosquitoes respectively at 3, 6 and 18h after inoculation. Electron microscopy demonstrated that yeast cells were phagocytized. Melanized nodules were found attached to different insect tissues at 24 to 72h following infection. Treatment of adults with the phospholipase A2, inihibitor of dexametasose, significantly inhibit nodulation in vivo. These results suggested that phagocytosis followed by nodule formation were capable of clearing the *C. albicans* from the haemolymph and that eicosanoids may mediate cellular immune reactions of the mosquito *C.quinquefasciatus.*

Index terms:*Culex quinquefasciatus*, *Candida albicans*, cellular immune response

[2397] EFFECT OF PHLOXIN "B" INGESTION IN IMMATURE STAGES OF THE MEDFLY, *CERATITIS CAPITATA*

J. Berni[1], J. Bustamante[2], A. Rabossi[1], A. Boveris[2] & L. A. Quesada-Allué[1], [1]Inst. de Investigaciones Bioquímicas (Fundación Campomar, Univ. de Buenos Aires & CONICET). Patricias Argentinas 435 (1405) Buenos Aires, Argentina; E-mail: lualque@iib.uba.ar; [2]Facultad de Farmacia y Bioquímica, Univ. de Buenos Aires. Junín 956 (1113). Buenos Aires, Argentina.

Certain eosin homologues ingested by insects become toxic when these are exposed to sunlight. The light-activated dyes generate oxygen singlets thus probably photo-oxydating key enzymes. The main objective of our project is to study the effects of Phloxin B (Ph.B), in particular trying to understand which cellular targets become impaired by the phototoxic effect. Well synchronyzed *Ceratitis capitata* larvae were fed with different concentrations of Ph.B and maintained in the dark up to the moment of the jumping stage, *i.e.* 8 hours before puparium formation (8h bpf). From this time up to the onset of metamorphosis (zero time) the larvae were exposed to 5.500 Lux afterwich they were returned to the dark until imago ecdysis. Ph.B phototoxicity was demonstrated in the exposed pharate insects when compared with non-illuminated controls: in these conditions the Ph.B LD_{50} for the life cycle from embryo to adult ecdysis was found to be 0.56 mM. Surprisingly, the dye also showed low light-independent chemical toxicity (LD_{50}=7.2 mM) under continous dark conditions. Moreover, under these conditions and Ph.B sublethal (3 mM) treatments, the toxic effect produced a 12 h retard in the larva III jumping behaviour. This cannot be attributed to differences in food ingestion since the "delayed" insects were identical in weight and size to controls. This is the first time such light-independent effects of Ph. B have been demonstrated in dipterans. General data on toxicity, survival and life cycle-dependent sensitivity as well as images of Ph.B-dependent malformations are also shown. We obtained preliminary results on the effect of Ph. B on mitochondria viability of treated insects. The mitochondrial nitric oxide (NO) production decreases 70 % in 8h bpf larva and 51% in 46h after puparium formation (apf) pupa, as compared with untreated controls. A concomitant 62% increase in oxygen uptake compared with untreated mitochondrial pupa was found when α-Glycerolphosphate was used as substrate. This could be due to the marked decrease in NO production, that induces a mitochondrial disfunction with a disturbance of the energetic metabolism. Moreover, an important increase in the levels of □**-carotene and ubiquinol-10 was observed in treated mitochondrial from the pupal stage.**

Index terms: Phototoxicity, mitochondria, metamorphosis, nitric oxide

[2398] TWO ELECTRODE VOLTAGE CLAMP METHODS IN SINGLE PRINCIPAL CELLS OF MALPIGHIAN TUBULES OF *AEDES AEGYPTI*: VALIDATION OF THE METHOD

K. W. Beyenbach[1], W. Nagel[2] & R. Masia[1], [1]Dept. of Biomedical Sciences, Cornell University, VRT 8014, Ithaca, NY 14853, USA, E-mail kwb1@cornell.edu.; [2]Dept. of Physiology, Univ. of Munich, D-80336 Munich, Germany.

In view of the large size of principal cells in Malpighian tubules of the yellow fever mosquito *Aedes aegypti*, we explored the application of two electrode voltage clamp methods (TEVC) that usually are employed to study transport proteins over-expressed in *Xenopus* oocytes. A single principal cell of the isolated Malpighian tubule was impaled with current and voltage electrodes. In 49 principal cells the intracellular voltage (V_{pc}) was -86.7 mV, and the input resistance (R_{pc}) was 388.5 KΩ. In a subset of 6 principal cells, Ba^{2+} (15 mM) hyperpolarized V_{pc} and increased R_{pc} from 325.3 KΩ to 684.5 KΩ ($p<0.001$). In the presence of Ba^{2+}, leucokinin-VIII (1 μM) increased V_{pc} to –101.8 mV ($p<0.001$), and reduced R_{pc} to 340.2 KΩ ($p<0.002$). These data were analyzed on the basis of an electrical equivalent circuit model of transepithelial NaCl and KCl secretion (Pannabecker et al., J. Membr. Biol. 132, 63, 1993). Circuit analysis revealed: basolateral membrane resistance R_{bl} = 652.0 KΩ, apical membrane resistance R_a = 340.2 KΩ, shunt resistance R_{sh} = 344.3 KΩ. It follows that the transcellular resistance $R_{cell} = R_{bl} + R_a$ is 992.2 KΩ, that R_{cell}/R_{sh} = 3.53, and that the fractional resistance of apical membrane $f_{Ra} = R_a/R_{cell}$ is 0.35. Estimates of R_{cell}/R_{sh} and f_{Ra} obtained using a different method (cable analysis of in vitro perfused tubules, CA) yield 3.33 and 0.32 respectively, validating the use of TEVC methods in principal cells of *Aedes* Malpighian tubules. Further comparison of data from TEVC experiments with data obtained using CA in isolated perfused tubules suggests electrical coupling of five to six principal cells. As shown in other abstracts presented at this meeting, TEVC methods allow the functional dissection of transport systems operating at basolateral and apical membranes in intact principal cells in situ. (NSF IBN 9604394)

Index terms: Malpighian tubules, electrolyte and fluid secretion, principal cells, shunt pathway.

[2399] ISOLATION OF PERITROPHIC MEMBRANE PROTEINS AND THEIR SECRETION BY *SPODOPTERA FRUGIPERDA* (LEPIDOPTERA) LARVAE

R. Bolognesi[1], A.F. Ribeiro[2], W.R.Terra[1] & C. Ferreira[1], [1]Dept. of Biochemistry, Inst. of Chemistry, Univ. of São Paulo. Av. Lineu Prestes, 748, São Paulo, 05599-970, Brazil. E-mail: rbologne@iq.usp.br; [2]Dept. of Biology, Univ. of São Paulo, R. do Matão, 277, São Paulo, 05508-900, Brazil.. Suprted by FAPESP, PRONEX and CNPq.

Insects have a peritrophic membrane (PM) which lines the midgut and has important roles in digestive processes and in resistance to infection by microrganisms. The PM is composed of chitin and proteins. *Spodoptera frugiperda* is an economically important pest, and it has type I PM, which is secreted by epithelial cells of the entire midgut. The understanding of the structure and functions of the PM may help in developing insect pest control procedures. PM proteins (peritrophins) were solubilized by treating sequentially the PM with NaCl, Chaps and urea. Two main proteins were isolated with Mr 27,000 and 33,000. Antibody raised against the Mr 33,000 protein recognized two proteins in membranes from anterior midgut microvilli and in membranes of vesicles present in the ectoperitrophic fluid. These vesicles are also associated to trypsin secretion in *Spodoptera frugiperda*. The antibody was used to immunocytolocalize the proteins in *Spodoptera frugiperda* midgut. Results showed that the peritrophins are secreted mainly by the anterior midgut and that in this part of the midgut the secretion seems to be microapocrine, with the protein present in small vesicles. In the posterior midgut, the secretion seems to be exocytic. These secretion routes are the same presented for trypsin (Jordão et al, J. Insect Physiol.45,29-37,1999), suggesting that the small vesicles present in the ectoperitrophic fluid secrete enzymes as well as PM structural proteins.

Index terms: insect midgut, peritrophins, antibody.

[2400] IMMUNOHISTOCHEMICAL CONTRIBUTION TO THE STUDY OF MORPHINE METABOLISM IN CALLIPHORIDAE LARVAE AND IMPLICATIONS IN FORENSIC ENTOMOTOXICOLOGY

B. Bourel[1,2], L. Fleurisse[3], V. Hédouin[2], J.C. Cailliez[1], C. Creusy[3], M.L. Goff[4] & D. Gosset[2], 1. Laboratoire Environnement et Santé, Faculté Libre des Sciences et Faculté Libre de Médecine, 56 rue du port, 59046 LILLE CEDEX, FRANCE ; 2. Institut de Médecine Légale et Sociale, Faculté de Médecine, Place Théo Varlet, 59000 LILLE, FRANCE ; 3. Service d'Anatomie et Cytologie Pathologique, Faculté Libre de Médecine, Hôpital Saint-Vincent, Boulevard de Belfort, 59000 LILLE, FRANCE ; 4. Department of Entomology, University of Hawaii at Manoa, Honolulu, Hawaii, 96822, USA

Morphine was detected by immunohistochemistry on sections of third stage larvae of *Calliphora vomitoria* (Diptera, Calliphoridae) reared on beef minced meat previously incorporated with morphine hydrochloride. The detection was performed with an avidin-biotin-peroxydase-complex method. Positive specimens showed specific staining of the haemolymph and a more intense immunoreaction in an area located at the limit between exocuticle and endocuticle. These results constitue an evidence of morphine accumulation inside the cuticle of Diptera larvae and point out the possibilities of analysing empty puparia when suitable tissues or living necrophagous insects are absent.

Key words: Immunohistochemistry, morphine, *Calliphora vomitoria*, forensic entomology

[2401] MORPHINE EXTRACTION IN NECROPHAGOUS INSECTS REMAINS FOR DETERMINING ANTE-MORTEM OPIATE INTOXICATION

B. Bourel[1,2], G. Tournel[2], V. Hédouin[2], M. Deveaux[2] & D. Gosset[2], 1. Laboratoire Environnement et Santé, Faculté Libre des Sciences et Faculté Libre de Médecine, 56 rue du port, 59046 LILLE CEDEX, FRANCE ; 2. Institut de Médecine Légale et Sociale, Faculté de Médecine, Place Théo Varlet, 59000 LILLE, FRANCE

First the enzymatic cuticle extraction of morphine (pronase digestion preceded by a two hours incubation with a dithiothreitol solution) was perfected with various substrates (Calliphoridae puparial cases and dessicated adults, dessicated pupae of Dermestidae), and tested to identify possible interferences with the radioimmunoassay procedure. Then this procedure was performed on puparial cases and dessicated adults of *Lucilia sericata* previously reared on minced meat containing various morphine concentrations. Morphine was detected only in cuticle powder from insects reared on meats containing 100 and 1000 mg/kg. Higher concentrations were mesured in puparial cases. Rearings on psoas from eight heroin overdose victims confirmed previous experimental results. Necrophagous insects remains and particularly puparial cases are often preserved for a long time, and consequently can serve as late alternative specimens for toxicological analysis when suitable tissues are not available.

Key words: morphine, *Calliphoridae*, *Dermestes frischi*, forensic entomology, radioimmunoassay

[2402] IDENTIFICATION OF TWO NEW BRAIN/MIDGUT PEPTIDES IN A MOSQUITO

M. R. Brown[1], D. A. Stanek[2], & J. Pohl[3], [1]Department of Entomology, [2]Department of Biochemistry and Molecular Biology, University of Georgia, Athens, GA 30602, USA, Email mbrown@bugs.ent.uga.edu. [3]Microchemical Facility, Winship Cancer Institute, Emory University School of Medicine, Atlanta, GA 30322, USA.

To identify peptides originating from the midgut endocrine system of the mosquito, *Aedes aegypti*, several hundred thousand adult abdomens were extracted in a boiling acetic acid solution. A radioimmunoassay for *Drosophila* neuropeptide F (NPF) was used to monitor purification of immunoreactive peptides from the extracted material. Solid-phase extraction and two steps of semi-preparative, reversed-phase HPLC yielded four groups of immunoreactive fractions. From these groups, a total of eight peptides were isolated individually after five or more steps of HPLC. Five of the peptides were purified in sufficient quantity for amino-terminal sequencing, mass spectroscopy, and amino acid composition. Based on sequence similarity, three of the peptides are "head peptides": *Aea*-HP-1 and 3 and a new octapeptide, which is more closely related to the misnamed "neuropeptide F I and II" of the Colorado potato beetle. Isolation of the *Aea*-HP's was expected, but the characterization of a new mosquito "head peptide", not encoded by the *Aea*-HP gene, is significant. This lengthening list of related "head peptides" from *Limulus* to *Drosophila* suggests the existence of a subfamily of arthropod Arg-Phe-amide peptides. Sequences for the other two mosquito peptides show that they are members of the invertebrate neuropeptide F (NPF) family and the vertebrate NPY/peptide YY (PYY)/pancreatic polypeptide (PP) family. One of the mosquito peptides is an amino-terminus truncated form (3100 MW) of the other one (31 residues, 3600 MW). As revealed with an antiserum to the *Drosophila* NPF, the putative mosquito NPF is found in a few brain cells and in a hundred or more midgut endocrine cells. To date, only the mosquito and *Drosophila* NPF's are known for arthropods, and comparison of these sequences to those identified in other invertebrates and the vertebrate NPY/PYY/PP family reveals important conserved domains. The amino acid sequences for the new "head peptide" and the mosquito NPF will allow us to identify the encoding cDNAs and to synthesize the peptides for antiserum production to develop immunoassays and for bioassays. The bioassays will determine whether the peptides directly affect digestion of a blood meal or interact with other peptides known to regulate aspects of reproduction in mosquitoes.

Index terms: Head peptides, neuropeptide F, radioimmunoassay, HPLC

[2403] METABOLIC PATHWAYS FOR DIACYLGLYCEROL BIOSYNTHESIS AND RELEASE IN THE MIDGUT OF LARVAL *MANDUCA SEXTA*

L.E. Canavoso & M.A. Wells, Biochemistry Department and Center for Insect Science. University of Arizona, Tucson, AZ 85721-0088, USA. E-mail: lilianc@u.arizona.edu

In the caterpillar *Manduca sexta*, the metabolic pathways whereby diacylglycerol (DAG) is synthesized from dietary lipids in midgut and released to hemolymph are unknown. Previous studies had not distinguished between possible alternative pathways. In order to begin characterizing the mechanism of lipid absorption and export from the midgut in *M. sexta*, we have studied the pathway for the synthesis of DAG. In addition, by using a dual-labeling technique, a kinetic model for the overall metabolism of DAG in the midgut is proposed. Fifth instar larvae were fed [9,10-^{3}H]-oleic acid-labeled triolein and the incorporation of the label into lipid intermediates was analyzed as a function of time. The results showed that the triacylglycerol (TAG) was hydrolyzed to fatty acids (FAs) and glycerol in the midgut lumen. In midgut tissue, the labeled FAs were rapidly incorporated into phosphatidic acid (PA), DAG and TAG, but no significant labeling of monoacylglycerol (MAG) was observed. To characterize the kinetics of DAG biosynthesis in the midgut, its incorporation into hemolymph lipophorin and its clearance from hemolymph, midgut lipids were first pre-labeled with [9,10 (n)-^{3}H]-oleic acid to constant specific activity to provide a measure of mass. Insects with pre-labeled midgut lipids then received a pulse of [1-^{14}C]-oleic acid. After the pulse, the specific activities as measured by the [^{14}C]/[^{3}H] ratio, of the DAG and TAG pools increased significantly and then slowly declined. The specific activity of DAG in hemolymph increased more slowly than in the midgut and finally decreased as DAG was taken into tissues. These results were best described by a model in which the rate-limiting step in DAG biosynthesis was the uptake of FA from the lumen of the midgut. Once in the cell the FA was rapidly incorporated in phosphatidic acid and DAG. Diacylglycerol was converted to TAG or exported into hemolymph. The interconversion of DAG and TAG was fairly rapid, suggesting that TAG serves as a reservoir from which DAG can be produced. This mechanism permits the cell to maintain a low steady-state concentration of DAG and yet efficiently absorb fatty acids from the lumen of the midgut. *Supported by NIH grant 50008.*

Index terms: *Manduca sexta*, midgut, diacylgycerol, phosphatidic acid, triacylglycerol.

[2404] RELEASE OF DIACYLGLYCEROL FROM THE LARVAL MIDGUT OF *MANDUCA SEXTA: IN VITRO* ROLE OF THE LIPID TRANSFER PARTICLE

L. E. Canavoso & Michael A. Wells, Biochemistry Department and Center for Insect Science. University of Arizona, Tucson, AZ 85721-0088, USA. E-mail: lilianc@u.arizona.edu

The tobacco hornworm *Manduca sexta* is widely used as a model for studies of lipid transport in insects. During its development as larvae, the major hemolymph lipoprotein, lipophorin (Lp), works as re-utilizable shuttle transporting diacylglycerol (DAG) from the midgut to the fat body, where the DAG is stored as triacylglycerol (TAG). Since in this process Lp is not degraded in the tissues, how is DAG transferred from the midgut cell to Lp?. The answer to this question has yet to be achieved, but the hemolymph Lipid Transfer Particle (LTP), which serves to redistribute hydrophobic lipids among lipoproteins and between lipoproteins and membranes, appears to play an important role. In the present work we focus on the function of the *M. sexta* LTP during the process of exporting DAG from larval midgut cells. For this purpose, we used an *in vitro* system conformed by [^{3}H]-prelabeled midgut sacs and LTP isolated from the hemolymph of 5th instar larvae by KBr gradient ultracentrifugation and ion exchange chromatography. [^{3}H]-prelabeled midgut sacs were incubated under the following conditions: a) in the presence of Lp; b) with anti-LTP and then transferred to a medium with Lp and c) with anti-LTP and transferred to a medium containing both, Lp and LTP. After [^{3}H]-prelabeled midgut sacs were incubated with Lp, a significant amount of radioactivity was recovered as [^{3}H]-DAG-Lp. By contrast, in the absence of Lp almost no radiolabel was released to the medium. This indicates that the radioactivity recovered in Lp after incubation with labeled midgut sacs is due to loading lipid from the midgut by Lp present in the medium. The transfer of DAG from the midgut sacs to Lp was blocked by preincubation of [^{3}H]-prelabeled midgut with anti-LTP and then transferred to a medium with Lp. The DAG transfer was restored by the addition of both, LTP and Lp in the medium. The amount of **transfer DAG was a function of the LTP concentration, up to 80 µg. These are the first** results showing that LTP is necessary in exporting DAG from the midgut. These results also shown that midgut tissue contains enough LTP bound to promote the release of DAG. *Supported by NIH grant 50008.*

Index terms: *Manduca sexta*, midgut, diacylglycerol, Lipid Transfer Particle, Lipophorin

[2405] THE ANTENNAL LOBE – A FUNCTIONAL OLFACTORY MAP IN NEURAL SPACE?

M. A. Carlsson, B. S. Hansson, Department of Ecology, Lund University, S-223 62 Lund Sweden

The primary centra for olfactory processing in an insect brain are the antennal lobes. In the lobes, olfactory receptor neurons converge on spherical neuropils called glomeruli where synapses are made with projection neurons that send their axons into protocerebrum. In addition there are local interneurons connecting the glomeruli in the lobes. A question of paramount interest is the function of glomeruli. Do all types of receptor neurons terminate in all glomeruli or does a certain glomerulus represent a specific receptor type, i.e. are glomeruli functional units. To answer this question we have optically measured calcium activity *in vivo* in the moth *Spodoptera littoralis*. The animals were stimulated with sex pheromones and behaviorally active environmental odorants. Different odorants evoked different activity patterns that were consistent between individuals. Certain odorants showed response in distinct parts of the lobe but the activity patterns of many odorants were overlapping suggesting that the same glomeruli were activated by several odorants. The sex pheromone components elicited strong response in males only in the area close to the antennal nerve where the macroglomerular complex (MGC) is located. The MGC is a male-specific cluster of glomeruli where pheromone detecting receptor neurons terminate. The individual components of the pheromone activated different parts of the MGC area. Plant and flower odours did normally not activate this area. Two extremes of information coding schemes in the antennal lobes have been proposed. In a labeled line system each glomerulus should represent a specific odorant with no overlap whereas in across-fiber coding an odour is represented by a combination of activity in a number of glomeruli. Our results suggest that both strategies are used. But all odorants tested evoked distinct, reproducable patterns which indicates that the identity of an odorant is encoded in the lobe.

Index terms: *Spodoptera littoralis*, optical imaging, odour-coding

[2406] CHARACTERIZATION OF THE DIGESTIVE PROCESS IN NEOTROPICAL ANOPHELINES

Caroci, A. de S.*; Valle, D.°; Lima, J. B. °; Marinotti, O.* & Ribolla, P.E.M.*, *Departamento de Parasitologia, ICB II – USP, São Paulo – SP, Brazil, °Fundação Instituto Osvaldo Cruz, Manguinhos – RJ, Brazil

Trypsin is the major protease present in blood-fed mosquitoes midgut. The trypsin is responsible for the initial breakdown of hemoglobin and serum proteins, however several other digestive enzymes are involved with blood digestion. Blood meal induction of digestive enzymes synthesis and secretion has been studied in several mosquito species, however only few data are available for neotropical anophelines. Our data indicate some differences on the pattern of digestive enzymes induction of Brazilian anophelines, when compared to the African and Asian mosquitoes (*Anopheles gambiae* and *Anopheles stephensi*). These differences could influence the capacity of Brazilian mosquitoes to transmit malaria, since the parasites have to survive and suffer modifications in the midgut lumen. We purified two different trypsin in An. *aquasalis* and in *An. albitarsis*. The first step of trypsin purification consists of an affinity chromatography using benzamidine agarose resin. After elution with soluble benzamidine, the sample was submitted to RP-HPLC (column Jupiter C-18 (analytical)). The chromatography elution profile showed 2 major peaks that represent two polypeptides with molecular weight of about 33 kDa and 34 kDa for the two anophelines species. Both proteins of both mosquitoes were submitted to NH_2-terminal sequencing. The sequences of all proteins, when compared with GenBank show similarities with *A. gambiae* trypsins. The first 19 amino acids of the 4 enzymes are the same. The sequences show that both mosquitoes have at least 2 different major trypsins after a blood meal.

[2407] DETERMINATION AND DISTRIBUTION OF FEMALE-SPECIFIC PROTEINS IN THE BROWN PLANTHOPPER, *NILAPARVATA LUGENS*

Dor-Jih Cheng & Roger F. Hou, *Department of Entomology, National Chung Hsing University, Taichung, Taiwan 402,* R.O.C. E-mail: rhou@dragon.nchu.edu.tw

Electrophoretic analyses of hemolymph and body or ovary homogenates from reproducing females, males, and 5th instar nymphs of the brown planthopper, *Nilaparvata lugens* Stal, revealed a protein band of 175 kDa in females with an isoelectric point (pI) of pH 7.3. An immunoblot by using antibody against this protein showed a positive reaction with a 175kDa protein from female body or ovary homogenates. It is likely that this protein in hemolymph is vitellogenin (Vg). An ELISA assay of Vg content revealed that the highest concentration of this protein was ca. 24 µg/female, equivalent to 7.9µg/mg total protein, at 4 days after adult emergence. This value was about 1,800 fold higher than the concentration of the protein in the newly emerged adult female. The highest Vg content is ca. 6.8% of the total protein. Distribution of Vg was determined by immunofluorescence and immunogold labeling techniques. The results showed that the positive immunofluorescence reactions were present in yolk particles, the intercellular space of follicle cells, hemolymph, and the epithelial plug of ovarioles. In addition the yeast-like symbiotes (YLS) in mycetocytes of adults and various nymphal instars, as well as those free in hemolymph or entering oocytes, also exhibited a positive reaction. Electron micrographs showed that immunogold particles were found most in YLS over other tissues. Especially the YLS in various developmental stages all contained immunogold particles, implying that the symbiote is involved in some way in Vg production. The gold particles were also found in yolk and the microvilli between follicle cells and oocytes. However, the fat body cells contained less gold particles compared with other tissues in this insect.

[2408] A TRANSPORTER-LIKE PROTEIN INEBRIATED, WHICH RESPONDS TO OSMOTIC STIMULI, IS INVOLVED IN POTASSIUM TRANSPORT

C. S. Chiu, L. S. Ross & S. S. Gill, Dept. Cell Biol. & Neuroscience, Univ. California, Riverside, CA 92521, USA, E-mail Sarjeet.gill@ucr.edu.

The Na^+/Cl^- dependent neurotransmitter transporter superfamily consists of proteins involved in transport of neurotransmitters (GABA, serotonin, dopamine, norepinephrine, epinephrine, glycine, proline), osmolytes (taurine, betaine), and a metabolite (creatine). Recently we cloned a transporter-like protein inebriated, MasIne, from *Manduca sexta*. Phylogenetic analysis shows this protein is divergent from other neurotransmitter transporters, suggesting it probably has a distinct function from that of the other transporters. Using heterologous expression in *Xenopus* we show that oocytes expressing MasIne do not transport any of the commonly known ligands but respond to hyperosmotic stimulation, which causes the release of intracellular Ca^{2+}. In *Xenopus* oocytes this release stimulates endogenous calcium-activated Cl^- currents. This Ca^{2+} release requires the N-terminus and occurs via the IP_3 signaling pathway. Fusion of this N-terminus to the rat γ-aminobutyric acid transporter (rGAT1) also renders rGAT1 responsive to hyperosmotic stimulation. Immunohistochemical analyses show MasIne is distributed in tissues involved in potassium transport, including the goblet cells in the midgut, the Malpighian tubules, the hindgut and the central nervous system. We propose that stimulation of MasIne releases intracellular Ca^{2+} in native tissues, activating Ca^{2+}-dependent K^+ channels, leading to K^+ transport. This is the first report showing involvement of the IP_3 signaling cascade in a member of the Na^+/Cl^- dependent neurotransmitter transporter. The ability of a transporter protein to activate intracellular signaling suggests these transporter proteins may have more diverse functions than previously believed. (Supported in part from a grant from the US National Institutes of Health)
Index terms: *Manduca sexta;* IP_3, calcium-activated, channels

[2409] PROCESSING OF *DROSOPHILA SPÄTZLE* PROTEIN BY A SERINE PROTEASE IN THE PROPHENOLOXIDASE CASCADE OF THE SILKWORM PLASMA

N. Chosa, M. Ochiai & M. Ashida[1], Biochem. Lab., The Inst. of Low Temp. Sci., Hokkaido Univ., Sapporo 060-0819, Japan. [1]E-mail ashida@pop.lowtem.hokudai.ac.jp

Two extra-cellular serine protease cascades have been recorded from insects. One of them is the prophenoloxidase cascade and the other is the cascade that is present in perivitelline space and functions in determining dorsal-ventral polarity of the *Drosophila melanogaster* embryo. The prophenoloxidase cascade of the silkworm *Bombyx mori* has two initiation points where minute amounts of peptidoglycan and ß-1,3-glucan work as elicitors for the activation. The cascade has been shown to diverge into two pathways: one of them leads to the activation of prophenoloxidase and the other leads to the activation of a serine protease zymogen that is tentatively designated proBAEEase. To date, several serine protease zymogens have been suggested to be members of the cascade and two of them have been purified. ProBAEEase is one of the two zymogens and its active form, BAEEase was found by its ability to hydrolyze benzoyl-L-arginine ethyl ester. We have reported the purification of the proBAEEase and BAEEase. The endogenous substrate of the BAEEase, however, remains to be studied. Consequently, physiological functions of proBAEEase and BAEEase are currently unclear. In the present study, we report the molecular properties of the zymogen and the active enzyme, and the result of the experiments to explore the physiological functions of BAEEase. We cloned a cDNA encoding the proBAEEase from silkworm cDNA library. The amino acid sequence of proBAEEase was deduced from the base sequence of the cDNA clone. The proBAEEase showed a very high sequence similarity to *easter* protease which is known to be a member of the cascade in the perivitelline space of the *Drosophila* embryo. In order to get information of the physiological functions of BAEEase, we chose *Drosophila spätzle* protein as a candidate for the substrate of the enzyme. The *spätzle* protein is the immediate downstream neighbour of *easter* protease in the extra-cellular signaling pathway for determining the dorsal-ventral polarity. We produced a recombinant *spätzle* protein using an *E. coli* expression system. This recombinant *spätzle* protein was cleaved by a limited proteolysis when incubated with BAEEase. The cleavage site of recombinant *spätzle* protein by BAEEase was shown to be the same as the one by *easter* protease. Our result indicates that the prophenoloxidase cascade of insect plays roles not only for the melanin formation but also for the induction of anti-microbial peptide synthesis.
Index terms: prophenoloxidase cascade, serine protease, *easter*, *spätzle*, insect immunity

[2410] DEFENCE MECHANISMS OF NORWAY SPRUCE AGAINST BARK BEETLE-FUNGUS ATTACKS

E. Christiansen[1], A. A. Berryman[2], V. R. Franceschi[3], T. Krekling[4], P. Krokene[5], N. E. Nagy[6] & H. Solheim[7], **1,5,6,7 Norwegian For. Res. Inst., N-1432 Ås, Norway; 2,3 Washington State Univ., Pullman, Washington, 99164-4238, USA**
4 Agricultural University of Norway, N-1432 Ås, Norway.

The poster will present studies where various microscopic and biochemical techniques (LM, SEM, TEM, CLSM, immunolocalisation, in situ hybridisation) were used to characterise constitutive and inducible defence mechanisms in Norway spruce, focusing on: (1) the role of polyphenolic parenchyma cells (PP cells) in the phloem and (2) the formation and function of traumatic resin ducts in the sapwood. Together these mechanisms may prevent infection of the trees and contribute to wound healing, particularly in connection to attacks by bark beetles and their associated blue-stain fungi.
Index terms: blue-stain fungi, defence, resistance, polyphenolic parenchyma cells, traumatic resin ducts

[2411] INTERACTION OF SOME PROTEINS ON BIOLOGY OF GRAIN APHID (SITOBION AVENAE /F./)

A.P. Ciepiela, I. Sprawka, C. Sempruch, A. Klimek, Dept. of Molecular Biology and Biophysics, Univ. of Podlasie, Prusa 12, 08-110 Siedlce, POLAND, e-mail: GrzegorzC@ap.siedlce.pl.

The diet of aphids contains low-protein phloem sap which often does not cover feeding requirements of the insects. Proteins occur also in plant cell membranes, and are produced by the aphids themselves during plant tissue penetration. Thus, aphid feeding activity may be affected by many proteins, some of them being even toxic. In the present work the effects of some commercial proteins such bromelain, bee venom, concanavalin A, lysozyme, lectin, and 2 fractions of soluble protein (albumin and globulin) isolated from resistant to S. avenae triticale cultivar Malno, and susceptible cultivar Tewo on behavior, feeding, and survival of grain aphid were studied. The effect of protein concentration, and preferences of various developmental stages of S. avenae (larvae L3, wingless females, migrants) were also studied, as well as the effect of the proteins on food assimilation, and aphid body mass. The results indicate that protein concentration of 250 µg/cm3 affected aphid behavior more than 50 µg/cm3. At that concentration migrants avoided feeding on parafilm containing bee venom, concanavalin A, and Tewo globulin. On the contrary, Tewo and Malno albumin, and lectin stimulated feeding. Malno globulins and concanavalin A were avoided by the wingless females of S. avenae, while bee venom, Tewo albumin, and lectin were preferred. No protein avoidance by the larvae was observed at the concentration of 250 µg/cm3. Larval feeding was stimulated by Tewo albumin and globulin, and Malno globulin. Wingless female growth after 24 hours of feeding was stimulated most by bromelain, bee venom, and lysozyme. After 48 hours aphid growth was fastest on Dagro cultivar seedlings soaked in aqueous solution of Malno albumin, lysozyme, and Tewo globulin. Bee venom, lysozyme, and bromelain were most easily assimilated by the females during 24 hours of feeding. After 48 hours, however, they assimilated most lysozyme, bromelain, and concanavalin A. All proteins at the concentration of 250 µg/cm3 increased aphid survival, especially Tewo albumin and globulin, and Malno albumin. The authors suppose that constitutive resistance of grains to aphids may be related to the presence of specific proteins reducing aphid feeding, growth, and survival, and rather not – to the total protein contain.
Index terms: behavior, feeding, survival, body mass, food assimilation.

[2411] INTERACTION OF SOME PROTEINS ON BIOLOGY OF GRAIN APHID (SITOBION AVENAE /F./)

A.P. Ciepiela, I. Sprawka, C. Sempruch, A. Klimek, Dept. of Molecular Biology and Biophysics, Univ. of Podlasie, Prusa 12, 08-110 Siedlce, POLAND, e-mail: GrzegorzC@ap.siedlce.pl.

The diet of aphids contains low-protein phloem sap which often does not cover feeding requirements of the insects. Proteins occur also in plant cell membranes, and are produced by the aphids themselves during plant tissue penetration. Thus, aphid feeding activity may be affected by many proteins, some of them being even toxic. In the present work the effects of some commercial proteins such bromelain, bee venom, concanavalin A, lysozyme, lectin, and 2 fractions of soluble protein (albumin and globulin) isolated from resistant to S. avenae triticale cultivar Malno, and susceptible cultivar Tewo on behavior, feeding, and survival of grain aphid were studied. The effect of protein concentration, and preferences of various developmental stages of S. avenae (larvae L3, wingless females, migrants) were also studied, as well as the effect of the proteins on food assimilation, and aphid body mass. The results indicate that protein concentration of 250 µg/cm3 affected aphid behavior more than 50 µg/cm3. At that concentration migrants avoided feeding on parafilm containing bee venom, concanavalin A, and Tewo globulin. On the contrary, Tewo and Malno albumin, and lectin stimulated feeding. Malno globulins and concanavalin A were avoided by the wingless females of S. avenae, while bee venom, Tewo albumin, and lectin were preferred. No protein avoidance by the larvae was observed at the concentration of 250 µg/cm3. Larval feeding was stimulated by Tewo albumin and globulin, and Malno globulin. Wingless female growth after 24 hours of feeding was stimulated most by bromelain, bee venom, and lysozyme. After 48 hours aphid growth was fastest on Dagro cultivar seedlings soaked in aqueous solution of Malno albumin, lysozyme, and Tewo globulin. Bee venom, lysozyme, and bromelain were most easily assimilated by the females during 24 hours of feeding. After 48 hours, however, they assimilated most lysozyme, bromelain, and concanavalin A. All proteins at the concentration of 250 µg/cm3 increased aphid survival, especially Tewo albumin and globulin, and Malno albumin. The authors suppose that constitutive resistance of grains to aphids may be related to the presence of specific proteins reducing aphid feeding, growth, and survival, and rather not – to the total protein contain.
Index terms: behavior, feeding, survival, body mass, food assimilation.

[2412] REGULATION OF CASTE FATE IN POLYEMBRYONIC WASPS

L. Corley, J. A. Harvey & M. R. Strand[1], [1]Dept. of Entomology, Univ. Wisconsin, Madison, WI, USA.

Polyphenism refers to the ability of a single genotype to produce alternative phenotypes. Distinct morphological castes are commonly seen in eusocial insects like ants and termites. However, castes have also evolved in a few other insect groups including polyembryonic wasps in the family Encyrtidae. Each egg laid by polyembryonic wasps divides clonally to produce a brood of genetically identical siblings that feed together inside the host. In the case of *Copidosoma floridanum*, each egg laid into a host proliferates to form more than 1000 embryos. Most embryos give rise to reproductive larvae that develop into adult wasps. Some embryos, however, develop into precocious larvae that have soldier functions. In this study, we discuss the proximate mechanisms that regulate embryo proliferation and caste formation in *C. floridanum*. Transplantation and lineaging experiments together indicate that proliferation and caste determination are affected by both host environment and intrinsic regulatory factors in embryos. Factors that have favored the evolution of distinct castes in polyembryonic wasps are also discussed.

[2413] ENZYMATIC ANALYSIS OF THE HYPOPHARYNGEAL GLANDS AND LARVAL FOOD OF WORKERS AND MALES OF *SCAPTOTRIGONA POSTICA* (HYMENOPTERA, APIDAE, MELIPONINAE)

R.A.C. Costa & C. Cruz-Landim, Dept. Biologia, Inst. Biociências, Univ. Estadual Paulista, Ave. 24A N. 1515, Bela Vista, Rio Claro, SP, Brasil, 13506-900, Fax: 55.21.19.5340009, E-mails: rosacosta3@yahoo.com.br; cclandim@rc.unesp.br. Financial Support from FAPESP (Processo nº. 98/00870-3R)

The hypopharyngeal glands of eusocial bees are constituted by a pair of long bunches of secretory units, rolled up around the brain and pharynx, and delivering their secretion ventrally in the bucal cavity. In *Apis mellifera* these glands produce food for the larvae and queen, the royal jelly, and important enzymes for the bee metabolism. The bees used in these experiment were *Scaptotrigona postica*, a brazilian native stingless bee, and *Apis mellifera*, both obtained from the apiary of Unesp- Rio Claro Campus. From *S. postica* were used hypopharyngeal gland extracts from: 1) newly emerged, nurse and forager workers; 2) newly emerged and mature males; 3) the superficial layer of the food provisions from the worker brood cells. From *A. mellifera* were used: 1) hypopharyngeal gland extracts from nurse workers; 2) larval food of worker and queen. The protein dosage was made by the Coomassie blue method and the enzymatic analysis using the Api zym kit from Bio Merrieux Laboratory. The protein dosage showed that the larval food of *S. postica* have more protein by extract gram than royal jelly of *A. mellifera*. However the hypopharyngeal gland extract is very rich in enzymes in both species: 15 of the 19 enzymes tested by the Api zym kit are present. The main differences between the hypopharyngeal gland extracts of both species refere only to the quantity of some enzymes: in *S. postica*, the enzymes that digest carbohydrates such as the α-galactosidase, the β-glicosidase and the α-manosidase are in small amounts and the esterase lipase, that digest lipidic substances, is in great amounts.

Index Terms: bees, enzymes, proteins, royal jelly, esterase.

[2414] HERITABILITY OF IMMUNE FUNCTION IN THE CATERPILLAR, *SPODOPTERA LITTORALIS*

S.C. Cotter[1], R.S. Hails[2], J.S. Cory[2] & K. Wilson[1], [1]Institute of Biological Sciences, University of Stirling, Stirling FK9 4LA, UK, e-mail: s.c.cotter@stir.ac.uk; [2] NERC Institute of Virology and Environmental Microbiology, CEH-Oxford, Mansfield Road, Oxford OX1 3SR, UK;

Phenoloxidase is believed to be a key mediator of immune function in insects. This enzyme has been implicated in non-self recognition and in resistance to a variety of parasites and pathogens, including baculoviruses and parasitoids. Using larvae of the Egyptian armyworm, *Spodoptera littoralis*, we found that, despite its apparent importance, haemolymph phenoloxidase activity varies markedly between individuals. This is the case even amongst insects reared under apparently identical conditions. Sib-analysis methods were used to determine whether individuals varied genetically in their phenoloxidase activity, and hence in their immunocompetence. Phenoloxidase heritability was estimated to be high ($h^2 = 0.60$). In order to determine whether variation in phenoloxidase is linked to immune defence, the relationship between phenoloxidase activity and the ability of larvae to encapsulate a synthetic parasite (a small piece of nylon) was investigated. Strong positive correlations ($r \geq 0.65$) were found between phenoloxidase activity and the degree to which the nylon was encapsulated and melanized, indicating that the encapsulation response is also heritable. The mechanism maintaining genetic variation in the encapsulation response has yet to be elucidated.

Index terms: phenoloxidase, encapsulation, immunity

[2415] DIETARY SELF-SELECTION IN *ANASTREPHA OBLIQUA* WILD FEMALES (DIPTERA, TEPHRITIDAE)

C. Cresoni-Pereira & F. S. Zucoloto, Dept. of Biology, FFCLRP, USP, Av. Bandeirantes, 3900, Ribeirão Preto, SP, Brazil, 14040-901, E-mail: cresoni@usp.br.

It has been shown that some insect species are able to select, among different food, a ratio which provides a suitable balance of nutrients. This behavior is called self-selection, and its two basic rules are non-casualty and its current benefit to insect. *Anastrepha obliqua*, a fruitfly species, needs to feed on an optimum quantity of protein when adult to produce eggs; therefore it would be advantageous if these insects could select optimum levels of carbohydrates and proteins. The object of present study was to verify whether *A. obliqua* females are self-selective and whether there is a variation in this behavior during the all life. Recently emerged wild females were separated at random in 6 groups with 6 repetitions each (10 females/repetition). Diets containing these sucrose: brewer yeast ratio were offered to groups from 1 to 5: 5.0g:6.5g (≈1:1), 11.0g:6.5g (≈2:1), 19.5:6.5 (3:1), 27.0g:6.5g (≈4:1) e 35.0g:6.5g (≈5:1), respectively. To group 6 sucrose (11.0g) and yeast (6.5g) were offered in separated diets, in order to verify if females would select the same nutrients ratio that provided the best performance in the first 5 groups. Analysed parameters were ingestion, longevity and egg production. Ingestion was greater in groups 1 and 2 than in other groups, including the group 6, which ingested statistically less from the 2 diets than all other groups. Ingestion of sucrose and yeast by this group during the reproductive phase , (1^{st} to 60^{th} day after emergence) was 0.69±0.10 and 0.33±0.06 mg/female/day, respectively, indicating that females are self-selective, because this ratio is ≈2:1, coinciding with the sucrose: yeast ratios that provided the best performances in groups 1 to 5: ≈1:1 and ≈2:1. The other ratios were efficient to longevity, but no eggs were produced. The sucrose and yeast ingestion, after reproductive phase, was 0.42±0.16 and 0.02±0.02 mg/female/day, respectively. There is not an yeast preferential ingestion here because the nutritional target is no longer the reproduction. This fact proves the self-selection ability of *A. obliqua* females and shows the role of insect's nutritional status and development stage on behavioral variations with regard to food choices.

Index terms: fruitfly, nutrition, protein, carbohydrates

[2416] POST-EMBRYONIC DEVELOPMENT OF CALYPTRATE FLIES IN ARTIFICIAL DIETS. I. *CHRYSOMYA MEGACEPHALA* (DIPTERA: CALLIPHORIDAE)

J. M. d'Almeida[1], M. B. Fraga[1], Cristtiane Lisbôa Ferro[1], S. G. Oliveira[2], J. R. Almeida[2,3], [1]Laboratório de Biologia e Controle de Insetos Vetores, Departamento de Biologia, Instituto Oswaldo Cruz, Av. Brasil 4365, 21045-900 Rio de Janeiro, RJ, Brasil / Laboratório de Entomologia Médica, CCS, UFRJ [2] Univ. do Est. Rio de Janeiro, Departamento de Biologia Animal e Vegetal, Setor de Ecologia, Rua São Francisco Xavier, 524, Maracanã – 20559-900, E-mail: sigomes@uerj.br ; [3] Univ. Fed. do Rio de Janeiro, Escola de Engenharia, Departamento de Hidráulica e Saneamento, CT – COPPE, bloco C, sala 211 Ilha do Fundão, 21941-590, E-mail: josimar@ppe.ufrj.br

The post-embryonic development of Chrysomya megacephala was compared on three different artificial diets (whole dried milk plus dried brewer's, soybean milk plus corn germ, ornamental fish dietary plus dried brewer's yeast) and bovine meat (control). The biology was studied in an incubator (BOD) at 27±1 °C and 80±10% RH. The developmental time from larvae to adult, the developmental time and viability of larvae and pupae, the weight of pupae as well as the sex ratio of the emerging adults were also determined. Bovine meat (control) was the more efficient diet, when compared with artificial diets.

Index terms: Chrysomya megacephala - post-embryonic development – artificial diets

[2417] NEURONAL CONTROL OF HEART REVERSAL IN THE HAWKMOTH *MANDUCA SEXTA*

N. T. Davis, D. Dulcis & J. G. Hildebrand, **Div. Neurobiol., Univ. AZ, PO Box 210077, Tucson, AZ 85721-0077, USA.**

The insect heart is myogenic, but its contraction is modulated by hormonal and neural input. In adult Lepidoptera heart pumping is usually anterograde but is reversed periodically from anterograde to retrograde. External stimuli can initiate an abrupt reversal, indicating that there is a cardiac reversal reflex. Anterograde contraction begins at the caudal end of the heart and moves rapidly as a peristaltic wave terminating near the anterior end of the aorta. Thus, the caudal end of the heart serves as an anterograde pacemaker. We have studied the neural mechanism of heart reversal in the hawkmoth *Manduca sexta*, using neuronal tracing, immuno-cytochemical, and electrophysiological techniques, and we have discovered that the anterograde pacemaker is innervated by caudal cardiac nerves, branches of each 8th dorsal nerve of the terminal abdominal ganglion (TAG). Each caudal cardiac nerve contains a single axon, and neuronal tracing indicates that this axon originates from a contralateral neuron in the TAG. Transection of the caudal cardiac nerves blocks heart reversal, suggesting that its innervation is inhibitory on the anterograde pacemaker. The anterograde pacemaker is also innervated by the 8th segmental cardiac nerves. This innervation is crustacean cardioactive peptide-immunoreactive (CCAP-ir). Neuronal tracing indicates that the axons originate from a pair of contralateral, CCAP-ir neurons in the TAG. CCAP is found in *M. sexta* and is cardioacceleratory. Retrograde contraction of the heart begins near the anterior end of the aorta, and this region serves as the retrograde pacemaker. The corpora cardiaca and allata are fused to each side of the aorta near this pacemaker. Backfills of the third cardiacal nerve (NCC3) reveal a pair of axons that project through the corpora cardiaca to endings on the retrograde pacemaker of the aorta. These axons originate from a CCAP-ir and a FMRFamide-ir neuron in the subesophageal ganglion. Transection of NCC3 results in disinhibition of the retrograde pacemaker. No innervation of the heart and aorta was found, other than that of the pacemakers, but the alary muscles are innervated by CCAP-ir axons. We propose the following model for control of heart reversal: The anterograde pacemaker is dominant, but sensory stimuli can result in its inhibition via the caudal cardiac nerves. This effect is followed immediately by stimulation of the retrograde pacemaker and heart reversal occurs. When the anterograde pacemaker is no longer inhibited, it again becomes dominant and contraction reverts to anterograde. The ballance between excitatory and inhibitory humoral factors determines the rate of heart contraction.
Index words: CCAP, FMRFamide, pacemaker, cardiac, Lepidoptera

[2418] SURVEY OF MIDGUT ENZYMES AND MIDGUT PH IN INSECTS OF DIFFERENT ORDERS

A. B. Dias & W. R. Terra, Dep. of Biochemistry, Univ. of São Paulo, P. O. Box 26077, São Paulo, SP 05513-970, Brazil, E-mail alcbatjr@usp.br. Supported by FAPESP, CNPq and PRONEX.

The midgut is an important interface between the insects and the environment. Transgenic plants have been produced that affect the digestive functions of the target insects. The development of new transgenic plants needs more data on insect digestive physiology. Considering the great variety of insects, it is necessary the development of generalisations that allow the elaboration of hypotheses relative to an insect for which the there are no data from those yet known. This can be done by studying the digestive system characteristics of insects of different orders followed by a cladistic analysis of the results. With this aim, *Periplaneta americana* (Dictyoptera: Blattodea) adults, *Migdolus fryanus* (Coleoptera: Cerambycidae), *Sphenophorus levis* (Coleoptera: Curculionidae), *Corydalus* sp. (Megaloptera) and *Themos malaisei* (Hymenoptera: Symphyta: Argidae) larvae were studied. In *M. fryanus* and *S. levis* the midgut is acid in the anterior two thirds (pH~5.0) and more alkaline (pH 6.5~7.5) in the posterior third. In *Corydalus* sp., the crop and midgut displays neutral pH (pH~7.2), whereas the hindgut is alkaline (pH~8.5). The midgut of *T. malaisei* is very alkaline: about 9.6 in the anterior two thirds and about 8.5 in its posterior third. *P. americana* displays an anterior acid midgut (pH~5.7) and a slightly acid posterior midgut (pH~6.1). Amylase, maltase and aminopeptidase were assayed in the midgut of the four insect larvae and adults of *P. americana*. Based on their activities, amylase and maltase are probably secretory enzymes and aminopeptidase is at least in part membrane bound. Amylase pH optima is acid in *M. fryanus, S. levis* and *Corydalus* sp. larvae and *P americana* adults (pH 5 – 6.5) and it is alkaline in *T. malaisei* larvae (pH~9.0). Maltase pH optima are similar to those observed for amylase: acid (pH4~5) in *M. fryanus, S. levis* and *Corydalus* sp. larvae and alkaline in *T. malaisei* larvae (pH 7.0). Aminopeptidase has a pH optimum of about 6.8 in *M. fryanus* larvae, 7.3 in *Corydalus* sp. larvae and 8.3 in *S. levis* and *T. malaisei* larvae. These results are in agreement with our proposal on the evolution of insect digestive systems, although data on *T. malaisei* suggest that Hymenoptera ancestors may differ from Coleoptera ancestors more than previously assumed.
Index terms: *Periplaneta americana, Migdolus fryanus, Sphenophorus levis, Corydalus* sp., *Themos malaisei.*

[2419] EVALUATION OF VELVETBEEN CATERPILLAR SUSCEPTIBILITY TO ETANOLIC EXTRACTS ISOLATED FROM SEEDS OF *CRYPTOCARIA MOSCHATA*

II.O.S.Dória[1], N.M.M.S.S. Albegaria[2], S.A. De Bortoli[1], A.J.Cavalheiro[3] & A.T.Murata[4]
[1,2]Dept. de Fitossanidade, FCAV, Unesp, Via de Acesso Prof. Paulo donato Castellane, s/n, 14884-900, Jaboticabal, SP, Brasil ([1]CNPq Fellowship) ([2]FAPESP Fellowship), [3]Dept. Química Orgânica, IQ, Unesp, Araraquara, SP, Brasil; [3]Dept. de Biologia, Fac. Filosofia, Ciências e Letras de Ribeirão Preto, Univ. de São Paulo, Av. dos Bandeirantes, 3900, 14040-901, Ribeirão Preto, SP, Brasil (FAPESP Fellowship) , E-mail: murataat@asbyte.com.br

Cryptocaria moschata (Lauraceae) (Nees & Mart.) Mez., is an arboreal plant that reaches 25 to 30 m of height. It is found frequently in the Atlantic forest, mainly in São Paulo and Paraná State. In these areas that plant is known as cinnamon-white and nut-moscata of Brazil. It was exist 210 species belonging to the genus *Cryptocaria*. About 22 already have deserved some study of phytochemistry, that describe mainly secondary metabolites alkaloids and flavonoids, from the stem and leaves. The brazilian specie more studied, *C. moschata*, showed several estirylphyrones. Among the biological activities already described metabolites of *Cryptocaria* species have medical, citotoxy, antiviral and teratogenic activities. The work was carried out in the Laboratory of Insect Biology located at FCAV-UNESP-Jaboticabal, under controlled conditions (27 ± 2°C 70 ± 10% RH and 14 H photophase). The test consisted of the topical application of the etanolic extracts from *C. moschata* seeds on the mesotorax of 3thr instar caterpillars. It was used a syringe of 100 ul mounted in an microaplicator Berkard 900-X (Berkard Manufacturing Co. Ktd). the syringe was gauged to release drops of 1ul of solution per larvae, in the concentrations: 0; 0.04; 0.06; 0.08; 0.10; 0.12 and 0.14mg i.a./insect. The evaluations were made 24, 48, 72 H after the application. The results showed that DL_{50} was 4.8mg i.a./insect, demonstrating the potential of the extract as insecticide.
Index terms: Insecticide, secondary substances, *Anticarsia gemmatalis*, nut-moschata.

[2420] PROTEINASE INHIBITORS IN THE MIDGUT OF THE COCKROACH

E. N. Elpidina[1], Y. A. Rudenskaja[2], K. S. Vinokurov[3], V. A. Gromenko[1], Y. E. Dunaevsky[1] & D. P. Zhuzhikov[3], [1]A. N. Belozersky Inst. of Physico-Chemical Biology, Moscow State Univ., Moscow 119899, Russia, E-mail elp@genebee.msu.su; [2]Dept. of Molecular Biology & [3]Dept. of Entomology, Biological Faculty, Moscow State Univ., Moscow 119899, Russia.

Midgut is the main site of protein digestion in insects. Investigation of distribution of digestive proteinases in the midgut of omnivorous cockroach *Nauphoeta cinerea* revealed, that the majority of proteolytic enzyme types and the main part of their total activity was localized in posterior half of the midgut (PM). In anterior midgut (AM), conversely, the bulk of activity of proteinase inhibitors was detected. Fractionation on Sephadex G-50 column of AM protein preparation revealed one fraction of bovine trypsin inhibitor (NCTI) and 3 fractions of bacterial subtilisin inhibitors. M_r value of NCTI was 8.0 kDa, and of subtilisin inhibitors – 13.0, 8.0 and 4.5 kDa. NCTI inhibited activities of trypsin-like proteinase and SH-dependent serine proteinase from the midgut of the cockroach, and all 3 fractions of subtilisin inhibitors efficiently suppressed 3 fractions of subtilisin-like activities from the cockroach midgut. NCTI was 120-fold purified using FPLC ion exchange chromatography. An isoelectric point of NCTI was estimated to be 4.3. Investigation of pH stability of NCTI revealed that its activity was maximal at neutral pH and decreased in alkaline region, being completely lost at pH 10.0. pH of gut luminal content was slightly acidic in AM, about 6.4-7.6 in the first half of PM, and 8.8-9.3 in the second half. These data suggest that moving along PM NCTI loses its activity, and intensity of proteolysis increases. Functions of proteinase inhibitors in the midgut are unknown. We propose that they protect carbohydrases, and □-amylases among them, from proteolysis, since we have shown, that the main part of activity of □-amylases was localized in AM and this activity decreased under the action of several enzyme fractions from the midgut of the cockroach.
Index terms: *Nauphoeta cinerea,* digestion, trypsin inhibitor, subtilisin inhibitor

[2421] ENZYME ACTIVITIES IN ARTHROPODA COLLECTED FROM HEAVY METAL POLLUTED SITES

O.Yu. Eremina[1], R.O. Butovski[2], [1]Dept. of Entomology, Inst. of Disinfectology, Nauchny pr., 18, Moscow, 117246, Russia, E-mail: eremin@bochvar.ru.[2]Inst. of Nature Protection, Sadky-Znamenskoe, Moscow 113628, Russia.

Imaginal stage of carabid beetles *Agonum assimile*, and wolf spider fam. Lycosidae (Pardosa), and earthworms *Nicodrilus caliginosus* and *Lumbricus rubellus* were collected by hand-sorting in Shekinski region of Tulskaya oblast (northern forest-steppe zone of Central Russia) at different distances from Kosogorski metallurgical plant: 0.1 km (test site) and 6.7 km (control site). The activity of non-specific esterases (NE) in carabids *A.assimile* and earthworms *N.caliginosus* and *L.rubellus* did not differ significantly between test and control sites. The activity of NE in test site was significantly lower only in spiders. NE of earthworm *L.rubellus* collected on test site was 2 times more tolerant to OP-inhibitor paraoxon, when compared to control site. The differences on I_{50} value were not found in *N.caliginosus* in both sites. The activity of acid phosphatase (AP) in studied species was lower in test site, but the differences were insignificant. By PAAG electrophoresis the spectra of NE and AP were obtained in all investigated species. Individual variability of ferments in carabids and earthworms did not allow to find differences between test and control sites. Spiders fam. Lycosidae and earthworms *L.rubellus* and *N.caliginosus* collected in test site had more cholinesterases (ChE) (substrates ATChI and PrTChI), and with the same quantity of colored zones, the intensity of colouring in test site was much higher. Whereas the activity zones of ChE with use of both thiocholin ethers had the same Rf, it is possible, that both these ethers were hydrolyzed by the same ferment. The differences were only quantitative, and the new forms of ferments did not appear. The significant differences between the activity of AP in studied variants for all groups of invertebrates were not found. During study of heavy metal (Cu, Zn, Pb, Cd) influence *in vitro* on the activity of AP the high tolerance of this ferment to copper salts was found in earthworms, collected in test site.

Index terms: heavy metal, enzyme, carabid, spider, earthworm

[2422] IMPACT OF HEAVY METALS ON INSECT ENZYME ACTIVITIES

O. Yu. Eremina, Dept. of Entomology, Inst. of Disinfectology, Nauchny pr., 18, Moscow, 117246, Russia, E-mail: eremin@bochvar.ru

The changes of mass and population vitality of house flies *Musca domestica* as related to heavy metals (HM) (Zn, Cu, Pb, Cd) was shown. After the application of sublethal and especially lethal metal concentrations we observed a decrease of larval growth and an increase in the duration of the preimaginal development of house flies. In the treatment Pb (100 mg/l), Cd (100 mg/l), Cu (1000 mg/l) and Cd (500 mg/l) 20, 20, 60 and 90% of larvae did not pupate and thus were eliminated from the population. The pupation process and imaginal emergency from pupa were influenced significally by Cu-1000 and Cd-500. We assume this was connected with hormonal disbalance since pupa had a low level of melanization. The impact of HM acetate salts on enzymatic activities – nonspecific esterases (NE), acid phosphatase (AP) monophenolmonooxigenase (MPMO) in house fly larvae *in vivo* and *in vitro* were studied. The part of the population was relative more tolerant to the toxicant, and part less tolerant. This may be explained by different hormonal and enzymatic activities of individuals in the population. The mortality of stage III larvae and the delay of the larval development suggests the involvement of ecdysone. Cd-500 influenced larvae did not reach more than 10 mg by weight and had low activity of MPMO. The influence on the eclosion hormone and bursicon may be assumed. HM affected the vitality of organisms and the level of enzymatic activity (NE and AP) after their injection in cockroaches *Nauphoeta cinerea* in different ways, both after feeding watery solutions of acetate salts, and after topical application. Physiological disturbances for instance gut swelling in cockroaches, were observed after 10-20 d, after 30 d insects adapted to all studied HM-salts except Cu. Antifeedant activity with further decrease of body weight and desiccation were observed only for Cu-1000. Impact of HM on the AP and NE enzymatic systems revealed different mechanisms of action. AP activity was higher in the fat body in comparison with gut walls, however, the adaptation processes took place more intensively in gut. During the 50-day experiment activity peaks of AP in gut walls were observed after 20-40 days for all metals, except Cu, which caused a persistent inhibition of AP in gut starting 10 d after treatment. NE activity was low after 10 d experiment both in fat body and gut. Then the increase of NE with a peak after 20-30 d, especially for Pb and Cu, was observed.

Index terms: insect, heavy metals, enzyme activities, NE, AP, MPMO, adaptation

[2423] PRELIMINARY INVESTIGATION ON INDIVIDUAL RESPIRATION OF ADULTS AND PUPAE OF *OSMIA CORNUTA* DURING DIAPAUSE BY MEANS OF A CO_2 ANALYZER BASED ON AN INFRARED TUNABLE DIODE LASER

A. Felicioli[1], F. D'Amato[2], M. De Rosa[3] & M. Pinzauti[1], [1]Dept. C.D.S.L., Sect., Agricultural Entomology. Via S. Michele degli Scalzi n°2, 56124 Pisa Italy E-mail mpinzaut@agr.unipi.it; [2] SIT Srl, Via Masaccio n°116, 50132 Florence Italy; [3] LENS, L.go E. Fermi n°1, 50125 Florence Italy.

During the period November 1999 February 2000 measurements of two diapausing adults and two diapausing pupae of *Osmia cornuta* were carried out. *Osmia cornuta* diapausing pupae were obtained in a laboratory by controlling the temperature during larvae growth. The bees, still inside their cocoons, were obtained by a Releasing and Rearing campaign carried out in Spring 1998. Since November 1999 they were kept at a constant temperature of 15°C. They were then placed still at the above mentioned temperature in a pyrex cell and their respiration was measured over 36 hours. The measurement was carried out by means of a CO_2 atmospheric analyzer, based on an infrared tunable diode laser, developed jointly by LENS (European Laboratory for Non-Linear Spectroscopy) and Scienza Industria Tecnologia, SIT Srl, both located in Florence. The operating principle of this instrument is simple: the laser beam of a diode laser at 2.004 μm is sent through a 1 meter long, 0.5 liter volume, pyrex cell. From the attenuation of the beam it is possible to retrieve the CO_2 concentration. The quantity of CO_2 released by the insect is easily calculated starting from volume and concentration. The novelty of the instrument is in the electronic and software techniques for noise reduction. The main features of the instrument are: concentration range 300÷1300 ppm; short term stability (15') better than 1 ppm, long term stability (24 h) better than 10 ppm. The diapausing adult bees clearly show a discontinuous gas exchange cycle (DGC) throughout the investigation period while the diapausing pupae show a continous pattern in their gas exchange. At the beginning of recording the DGC of diapausing adult bees shows four cycles every 10 hours. The cycles increased to 6 on the 10th of December, to 8 on the 24th of January and reaches 12 on the 10th of February. The concentration (ppm) of CO_2 in the pyrex cell gradually increases throughout the experiment. At the beginning of recording the concentration rise of CO_2 was 4.5 ppm every hour. On the 10th of December it was 7ppm, on the 24th of January it was 8ppm and on the 10th of February it reached 22ppm every hour. The concentration of CO_2 in the pyrex cell containing the diapausing pupae increases throughout the experiment. At the beginning of recording the concentration rise of CO_2 was 7.5 ppm every hour. On the 20th of December it was 8ppm, on the 25th of January it was 8ppm and on the 14th of February it reached 27ppm every hour.

Index terms: Respiration, DGC, CO_2.

[2424] PURIFICATION AND CHARACTERIZATION OF *TENEBRIO MOLITOR* MIDGUT β-GLYCOSIDASES

A.H.P. Ferreira, W.R. Terra & C. Ferreira, Dep. of Biochemistry, Univ. of São Paulo, P. O. Box 26077, São Paulo, SP 05513-970, Brazil, E-mail alehfp@iq.usp.br. Supported by FAPESP, CNPq and PRONEX

In the midgut lumen of *Tenebrio molitor* larvae there are 3 β-glucosidases (named 1, 2 and 3) and one β-galactosidase, not present in the animal food. We purified them by using electrophoresis and ionic exchange and hydrophobic chromatographies under high or low pressure. The β-glucosidases called 2 and 3 (relative molecular weight -Mr- 64K) seem to be isoforms, since they have similar kinetical parameters, identical HPLC peptide profile after proteolytic cleavage and the same amino acid sequence of an internal peptide. They hydrolyse glucosides better than galactosides. Laminaribiose (glucose β1,3 glucose), cellobiose (glucose β1,4 glucose), and gentiobiose (glucose β1,6 glucose) are good enzyme substrate. These β-glucosidases have higher activity upon cellotriose, cellotetraose, and cellopentaose than upon cellobiose. They also hydrolyse alkyl-β-glucosides from which the best substrate is octyl-βGlu and hydrolyse the polysaccharide laminarin (β1,3 and β1,6). The data obtained with oligocellodextrins and alkyl β-glucosides suggest that these enzymes have at least four subsites for glucose binding in their active site. These results suggest that these enzyme have an important role in intermediate and final digestion of hemiceluloses. The number 1 β-glucosidase (Mr 56K) is unstable at 30°C but is stabilized by substrates. It is almost inactive upon p-nitrophenyl-β-galactoside (NPβGal) and lactose. The results suggest that the deglycosylation is the limitant step in catalysis and that the enzyme is probably the major activity upon disaccharides. The three β-glucosidases can hydrolyse, besides dissaccharides and alkyl glucosides toxic plant glucosides. Substrate competition experiments showed that the 3 enzymes have only one active site responsible for the hydrolysis of all substrates. The β-galactosidase (Mr 66K) is unable to hydrolyse NPβGlu and cellobiose. This enzyme needs further characterization.

Index terms: *Tenebrio molitor*, digestion, β-glycosidase, and enzyme.

[2425] ELETROFORETIC PROFILES FROM ADULTS OF *CHRYSOPERLA EXTERNA* FED ON DIFFERENT DIETS

R. J. Ferreira[1] & S. A. De Bortoli[2], [1]Depto. de Biologia, Univ. de São Paulo, CEP 14040-901, Ribeirão Preto, SP, Brasil (Fapesp Felowship), E-mail: raimundo@usp.br; [2]Depto. de Fitossanidade, Univ. Estadual Paulista, CEP 14870-000, Jaboticabal, SP, Brasil, E-mail: bortoli@fcav.unesp.br

In studies with biochemical markers, it is indispensible the standardization of the methodology for each system and the chemicals used should have high quality in order to obtain good precision to the results. It was verified that variations in the enzimatic profiles, as the absence and lower spot resolutions, can happened according to the nutritional condition of the insects sampled. This factor problably can cause more mistakes than ones related to the insect age, once insects in different ages and fed on rich diets did not show important differences in the intensity acid amounts of eletroforetic spots. This work was carried out to evaluated the eletroforetic profiles to the *C. externa* adults fed on: 1-) honey + pollen + yeast + water; 2-) pollen + water; 3-) molasse + water; 4-) honey + water; 5-) water. To the eletroforetic analyses were used poliacrilamide gels (PAGE) and the α and β esterases systems. The samples obtained from crisopids fed on diets with high concentrations in sugars and small amount of proteins presented spots with low resolutions and intensities.
Index terms: crisopid, isozyme analyses, esterase, nutrition.

[2426] TROUBLES ABOUT THE USAGE OF ANGOUMOIS GRAIN MOTH EGGS TO FEEDING CHRYSOPID LARVAE

R. J. Ferreira[1], H. O. S. Dória[2], N. M. M. S. Albergaria[2] & S. de Freitas[2], [1]Depto. de Biologia, Univ. de São Paulo, CEP 14040-901, Ribeirão Preto, SP, Brasil, E-mail raimundo@usp.br (Fapesp Fellowship); [2]Depto. de Fitossanidade, Univ. Estadual Paulista, CEP 14870-000, Jaboticabal, SP, Brasil,

The chrysopids lacewing used for pest control has being thoroughly diffused at several countries. Mass rearing of these agents of biological control demands, in most of the cases, the usage of a substitution prey, like eggs of *Sitotroga cerealella* Oliver, 1819 (Lepidoptera: Gelechiidae). It was verified a great number of unfeasible crisopid pupae due to attack of *S. cerealella* larvae newly hatched. The larvae of the moths perforate the the cocoons, feeding on the pupae recently formed. Even eating the pupae's tissue, the larvae does not complete its development, dying during the first instar. In this way, the procedure adopted was to offer unfeasible eggs (treated in lower temperature) to the chrysopids larvae or remove the newly cocoons to the other places.
Index terms: mass rearing; *Sitotroga cerealella*; Neuroptera, Chrysopidae.

[2427] DIET SELECTION WITH DIFFERENT SUCROSE CONCENTRATIONS BY *ANASTREPHA OBLIQUA* (DIPTERA, TEPHRITIDAE)

T. M. L. Fontellas & F. S. Zucoloto, Dept. of Biology, FFCLRP, USP, Av. Bandeirantes, 3900, Ribeirão Preto, SP, Brazil, 14040-901, E-mail: fontella@usp.br

Insect studies have shown that a strict relation exists between nutritional requirements and feeding behavior. Experiments with *Ceratitis capitata* fruitflies proved that adults can discriminate among different nutrients and they can choice optimum ratios of these nutrients to increase their performance. Although in holometabolic species the females choice the food for immature at oviposition, in some species, including *C. capitata*, the immatures are able to choice suitable food. The behavioral and physiological mechanisms that guide the food selection by insects are little known yet. Possibly informations about nutritional quality of certain food proceed from activity of many sensorial receptors attached to haemolymph. The carbohydrates are the most abundant nutrient in the food of *Anastrepha obliqua*. The object of present study is to find whether *A. obliqua* adult females are able to choice the most nutritive diet among different concentrations of sucrose, which has high nutritive value to this species. The 11.0g concentration was used as control because it is the approximated value found in the *A. obliqua* hosts.Ten wild females were separated at random in acylic boxes with lateral holes through which water and diets were offered. Five repetitions were made to each choice test (1 box= 1 repetition). Artificial diets composition was: brewer's yeast – 6.5g; distilled water – 100.0ml; agar – 3.0g; nipagin – 1.5ml and different sucrose concentrations (0.0g; 2.0g; 5.0g; 8.0g; 14.0g and 17.0g). Each concentration was offered against the control diet (11.0g). Ingestion measurements were made during 3 days. Ingestion was statistically smaller in diets with 0.0g; 2.0g and 5.0g of sucrose and similars in diets with 8.0g, 14.0g and 17.0g, always against 11.0g diet. These results indicated that females don't select diets based on nutritive value, so that previous studies showed that the consumption of greater concentrations than 11.0g and lower than 2.0g don't promote egg production. It is possible that fagostimulation be determinant to choice, and no nutritive value.
Index terms: fruitflies, carbohydrates, behavior, nutrition

[2428] EFFECT OF LARVAL DIETS ON THE SURVIVAL AND DEVELOPMENT OF LARVAE IN THE COTTON BOLLWORM, *HELICOVERPA ARMIGERA* (LEPIDOPTERA: NOCTUIDAE)

K. Fujisaki & V. Casimero, Faculty of Agriculture, Okayama Univ., Okayama 700-8530, Japan. E-mail: fujisaki@cc.okayama-u.ac.jp

The influence of seven natural diets (cotton boll, cotton leaf, okra fruit, soybean seed, tomato fruit, tomato leaf, and corn kernel) and an artificial diet (*Insecta LF*) on the larval survival rate, larval duration, frequency of larval stadium types and pupal weight was examined in *Helicoverpa armigera*. On most diets, the survival rate was notably lower in the early larval stage compared to the late one. The percentage of larvae that survived from the first- stadium to the end of the larval stage was highest on okra fruit and *Insecta LF* (>60%). Less than 60% of the larvae fed on the other diets completed their larval period. The mean larval period was significantly shorter for individuals reared on plant fruits or seeds as well as on *Insecta LF* than for those reared on plant leaves. The shortest larval duration was recorded on cotton boll while the longest was seen on cotton leaf. The number of larval stadia ranged from 5 to 6 on cotton boll, soybean seed, corn kernel and *Insecta LF*, 5 to 7 on okra and tomato fruits, and 6 to 7 on cotton and tomato leaves. The five-stadium type was dominant on cotton boll, okra fruit, corn kernel and *Insecta LF*, while the six-stadium type was common on soybean seed, tomato fruit, cotton leaf and tomato leaf. Mean pupal weight was greatest in individuals fed on *Insecta LF* and least in those fed on tomato leaf.
Index terms: survival rate, larval duration, larval stadium.

[2429] POSSIBLE DIGESTIVE FUNCTION OF LYSOZYME IN A WOOD-FEEDING TERMITE, *RETICULITERMES SPERATUS*

A. Fujita[1], I. Shimizu[1] & T. Abe[1], [1]Center for Ecological Research, Kyoto Univ., Hiranocho, Kamitanakami, Otsu, Shiga 520-2113, Japan, E-mail ai@ecology.kyoto-u.ac.jp

Lysozyme catalyzes the hidrolysis of the 1, 4-*B*-gucosidic linkage between N-acetylmuramic acid and N-acetylglucosamine of peptidoglucan present in the cell wall of many bacteria, causing cell lysis. Lysozyme is part of the defense mechanism against bacteria and has been distributed in most animals, including insects. Lysozyme has also implied in the midgut digestion of bacteria by organisms which ingest large amounts of them, or that harbor a bacterial culture in their guts, exemplified by vertebrate foregut fermenters Similarly, among the insects, digesting lysozymes are reported from saprophagous Diptera. These insects lysis bacteria in their food with stomach lysozyme and absorb microbial tissue in the midgut. On the other hand, wood-feeding termites re also oligonitrotrophic, and possibility that how they get enough nitrogen to construct living body is intriguing. We suspected the possibility that termites have digestive lysozyme to utilize their hindgut bacteria as nutrient source. We measured lysozyme and protease activities of enzyme extract prepared from termite tissues. Using amino acid analyzer, we analyzed amino acid composition in the termite guts, and calculated the concentration of total free amino acid in each part of guts. Total activity of lysozyme was found predominantly in salivary gland and to a minor extent in digestive tract. However, high specific activity of lysozyme was detected in foregut as well as in salivary gland. The similarity of lysozyme pH-profile in salivary gland and foregut suggested that foregut lysozyme came from salivary gland. The highest protease activity having the optimum pH 7.5 was found in midgut. Total amino acid content and concentration of midgut ware higher than foregut and hindgut. From these results, the possibility that lysozyme secreted from salivary gland to foregut digest the symbiont bacteria transferred by trophallaxis of the termite for use of nitrogen source is suggested. Provided that termites utilized their hindgut bacteria, it would be reasonable for them to ingest gut bacteria through proctodeal trophallaxis and lysis them in their foreguts, because their fermentative tissue is hindgut. Although, Breznak suspected the possibility of nutritive potential of bacterial cell material through trophallaxis in termites, there has been no study on this problem. In this study, we observed the behavior of *R. speratus*, and indicate termites digest a part of hindgut bacteria as nitrogen resource through proctodeal trophallaxis in the enzymologic way.
Index terms: Reticulitermes speratus, Lysozyme, Trophallaxis, Nitrogen Metabolism

[2430] PRELIMINARY RESULTS ON THERBIOLOGICAL STUDIES ON NEOTROPICAL STINK BUGS *OEBALUS POECILUS* (HEMIPTERA, PENTATOMIDAE)

R. Garrouste[1,2] & G. Vannier[2], [1]Muséum National d'Histoire Naturelle (MNHN), Antenne de Guyane c/o IRD BP 165 F-97323 Cayenne cedex, French Guyana, E-mail : garroust@mnhn.fr ; [2]MNHN Laboratoire d'Ecologie, 4, avenue du Petit-Château F-91800 Brunoy, France

Oebalus poecilus is a very common species in neotropical ricefield (as a serious pest from Panama to Argentina) and grasslands. Supercooling point (SCP, low temperatures) and thermostupor (TP, high temperatures) analysis were realized in laboratory on *Oebalus poecilus* (OP) French Guyana (FG) populations (collected in Mana ricefield area, NW of FG), to study the thermobiological limits of these populations. Effects of relative high temperature where also analysed to study transpiration. *Oebalus poecilus* have a relative high mean thermobiologic span, caused by both low supercooling point and high temperature resistance (before thermostupor), regarding of tropical (subequatorial : 5°N) populations. Despite an important polymorphism (including sexual dimorphism), there is no significant sex differences, no significant morphs differences (studies were carried out on the two OP morphs, because it is a polyphenic species). These results appoint that OP populations in FG may have a temperate origin, as residual "seasonal" polyphenism also indicate. Further studies will include biological and morphological analysis crossing SCP and TP, to verify phenology, size and weight effects on invidual thermobiological limits.
Index terms:, supercooling point (SCP), thermostupor (TP), temperatures effect, seasonal polyphenism, polymorphism.

[2431] TIMING AND ECDYSTEROID REGULATION OF THE MOLT IN LAST INSTAR GREENHOUSE AND SILVERLEAF WHITEFLIES

D. B. Gelman, M. B. Blackburn & J. S. Hu, Insect Biocontrol Lab, U.S. Dept. of Agric., Bldg. 306, Rm. 322, BARC East, Beltsville, MD 20705 U.S.A.

A system of markers has been devised to track the development of 4th instar and pharate adult greenhouse (*Trialeurodes vaporariorum)* and silverleaf whiteflies (*Bemisia argentifolii).* Measurement of body length and depth as well as color of the developing adult eye were used to divide the instar into 9 stages. Maximum body thickness was attained in stage 5 whiteflies, and adult eye development commenced at stage six. The adult eye was fully developed by stage 8. An enzyme- immunoassay was used to measure ecdysteroid titers in whole body homogenates of greenhouse whiteflies. Titers ranged from 68 to 380 femtograms per whitefly. In the early part of the 4th instar, titers were relatively low. Titers increased as the body thickened and peaked at stage 5. Titers then decreased during pharate adult development. Based on an external examination of developing 4th instars and the fluctuations in ecdysteroid titer, it appears that apolysis (the separation of the larval cuticle from the epidermis, i.e., the initiation of the molt to the pharate adult) probably occurs in stage-5 4th instars. Results from histological studies support this view. Stage-4 4th instars possessed eye and wing development characteristic of earlier, immature stages. The eyes appeared as thin lobes adjacent to the brain, and the wings consisted of simple bilayers of columnar epithelial cells. By stage-5, adult eye and wing development had been initiated. The eyes appeared thicker and more differentiated; the columnar cells composing the wing had begun to flatten and the wing surfaces had started to fold. In stage-6 4th instars, the wing buds were deeply folded, and by stage 7, spines were observed on the new cuticle, indicating that the adult cuticle was well-formed by this stage. Typically, in preparations of stage 6 or older 4th instars (actually pharate adults), the larval cuticle was either separated from the epidermis or had become detached during processing. Thus, evidence is strong that apolysis has occurred prior to this stage. Histological studies of *B. argentifolii* 4th instars/pharate adults yielded similar results.
Index terms: molting hormone, ecdysone, staging of 4th instars, development, histology.

[2432] PUPAL DIAPAUSE OF *COLORADIA PANDORA*: THERMAL CONSTRAINTS ON SUCCESSFUL PUPATION

E. A. Gerson[1], R. G. Kelsey[1] & D. W. Ross[2], [1]U.S. Forest Serv., PNW Research Station, 3200 Jefferson Way, Corvallis, OR 97331, USA, E-mail kelseyr@fsl.orst.edu; [2]Dept. of Forest Science, Oregon State Univ., Corvallis, OR 97331, USA.

The pandora moth, *Coloradia pandora*, is a native lepidopteran that periodically defoliates large areas of pine forest in the western U.S. In central Oregon, pupation occurs in loose soil over winter, and the pupal phase generally lasts 12 to 13 months of a 2-year life cycle. To determine the minimum cold storage time required to break diapause we held pupae at 5° C for 8 to 24 weeks, then incubated them at 25° C and measured the time until adults emerged. The minimum cold time required under these conditions was 12 weeks, but emergence rates were highest (87.5%) for 14 to 18 weeks at 5° C. Cold storage in excess of 20 weeks resulted in emergence rates of less than 40%. In a separate experiment, 1000 pupae were maintained in field enclosures for 3 years while soil temperature was monitored. Seventy-two percent of these pupae emerged in Year 1. Prolonged (extended) diapause was observed in only 0.6% of the sample population. Soil temperatures fell below 5° C for μ 21.7, 22.9, and 25.1 weeks over the three consecutive winters, and the minimum soil temperature was -2° C. Based on results from the cold storage experiment, the 72% emergence rate for Year 1 in the field was higher than expected for μ 21.7 weeks of soil temperatures below 5° C. However, the soil temperature profiles indicated that pupae used in the cold storage experiment probably were exposed to several weeks of cold soil in the field prior to collection for the lab study. In this case, emergence rates in the lab and field experiments correspond well. Soil temperature monitoring in the field revealed the duration of cold may be lethal to a large proportion of the pupal population in winters such as Year 3 with 25.1 weeks below 5° C. From the bell curve for emergence rates established in the lab experiment, less than 40% of pupae would be expected to successfully complete diapause after a long winter (such as Year 3), compared to the 72% successful pupation rate observed for the shorter winter of Year 1. Together, the laboratory and field studies suggest duration of cold during the pupal phase is a variable, but potentially significant, mortality factor for pandora moths in central Oregon.
Index terms: pandora moth, Saturniidae, rearing, adult emergence, winter mortality.

[2433] FUNCTION-SPECIFIC TRANSCRIPTION IN THE NERVOUS SYSTEM AND SENSE ORGANS OF INSECTS

M. Gewecke, O. Franz, G. Schramm & T. Roeder, Zoologisches Inst., Neurophysiologie, Univ. Hamburg, Martin-Luther-King-Platz 3, 20146 Hamburg, Germany. Supported by the DFG (Ge 249)

The brain and sensory systems of both vertebrates and invertebrates could be structurally ad functionally devided into different parts. The parts of the brain, e.g. the optic lobe of insects, have different functional roles, in this case the processing of visual information. Most of these specific abilities rely on the expression of specific proteins. The knowledge of these proteins should allow a deeper understanding of the brain in general. Insect systems are less complex than the respective systems of vertebrates, making the analysis of function-specific transcription in insects preferable. We choose the desert locust (*Schistocerca gregaria* F.) as experimental animal, and a modified differential display PCR approach for m-RNA analysis (Liang, P., Pardee, A.B., 1992, Science 257: 967; Franz, O., Roeder, T., Gewecke, M., 1998, J. Comp. Physiol. 182: 627). By this DD-PCR method about 60 differentially expressed mRNAs could be identified in either of the tissues mentioned above. In the optic lobes and retinae a gene coding for a glutathione-S-transferase was described that might be required to protect these tissues against photo-induced radicals. Another mRNA found in the optic lobes only in young adults represents a centrosomin, the first one analysed in insects. This could be required for cell division and, therefore, can serve as a marker for neurogenesis in the insect brain. Within the antennae there are various specifically expressed transcripts. One of them hybridizes with three different transcripts almost exclusively found in the antennae. Expression in male antennae is at least two orders of magnitude higher compared with female antennae. One of these transcripts is not present in females. Interestingly, the smallest of the antennae-specific transcripts is also expressed in the optic lobes. Sequence analysis revealed no significant homology to known sequences, especially those for Pheromone or odorant binding proteins. This led to the attemption that it is a new type of sex-specific protein in the insect olfactory system. The largest number of differentially transcribed RNA's could be identified in the thoracic ganglia. Among them are several putative neuropeptide precursors, and also transcription factors belonging to either the zinc-finger or leucine zipper family.

Index terms: *Schistocerca gregaria* F., diff. display PCR, mRNA, gene expression.

[2434] AN EST PROJECT ON *AEDES AEGYPTI* IDENTIFIES PROTEINS INVOLVED IN ION TRANSPORT IN THE MIDGUT AND MALPIGHIAN TUBULES

S. S. Gill, L. S. Ross & H. Wadiak, Dept. Cell Biol. & Neuroscience, Univ. California, Riverside, CA 92521, USA, E-mail Sarjeet.gill@ucr.edu.

Ion and nutrient transport plays a critical role for the success of mosquitoes in a variety of environments. While some of these transport processes have been physiologically characterized there is very little molecular data on the nature of these proteins and the diversity of these proteins. To identify these proteins we used an expressed sequence tag (EST) approach using cDNA libraries that were generated from the midgut and Malpighian tubules from larval and adult *Aedes aegypti*. Microbore chromatography was used to size fractionate DNA and enrich for full-length cDNAs. Single pass 5' sequencing showed many of the clones obtained were full-length clones. The EST sequences identified many of the putative proteins involved in ion and nutrient transport. These include many of the subunits of the V-ATPase pump that generates a potential gradient both in the midgut and Malpighian tubules; the NaKCl cotransporter, which is involved in basolateral membrane transport of Na^+, K^+ and Cl^-; the NaH antiporter, which is thought to be involved in apical transport of Na^+; Cl^- channels and a number of transporter-like proteins involved in nutrient transport. Using antibodies developed against these proteins we are presently identifying the distribution of these proteins in mosquito midgut and Malpighian tubules. Data on EST sequences and immunohistochemistry will be presented. (Supported in part from a grant from the US National Institutes of Health).

Index terms: *Aedes aegypti*, NaKCl, NaH, V-ATPase, transporter.

[2435] INDUCTION OF HUMORAL IMMUNITY IN LARVAE OF *LYMANTRIA DISPAR* (LEPIDOPTERA: LYMANTRIDAE)

T.V.Golubeva, Dept. of Forest Protection, Forest Institute of the National Academy of Sciences of Belarus, P.O.Box 41, 246012, Gomel-12, Belarus, E-mail tana@goldim,gomel.by

The gypsy moth is a dangerous forest pest occuring in outbreaks in Asia, Europe and America. It goes without saying that this evolutionary success could only be achieved by organisms with powerful immune systems. The cell-free immune system composed of antibacterial proteins has so far been demonstrated in many lepidopterans but not in Lymantria dispar. The results of antibacterial zone assays show that the native haemolymph have activity against gram-positive bacteria that corresponds with the synthesis of lysozyme. It was noticed considerable differences in the activity of lysozyme as different individuals as different population of gypsy moth. Injection with live, non-pathogenic E.cloacae or E.coli induces the synthesis of lysozyme and cecropins. Immune responses and susceptibility to infection E.cloacae or E.coli differences from the physiological state of insect. The antibacterial activity of lysozyme was drastically reduced, but activity of cecropins disappears in larvae gypsy moth, when actinomycin D or cycloheximide was given at an early time post-immunization with E. cloacae. It is concluded that the de novo synthesis of ribonucleic acid and immune proteins is required for expression of antibacterial activity in larvae haemolymphs. This was demonstrated inactivation of the cecropin-like activity in insect blood by immune inhibitor from Bacillus thuringiensis, Serratia marcescens and Pseudomonas aeruginosa. The isolation factors responsible for the induction and inhibition of humoral immunity will be important for the development strategies in overcoming the insect defence system. The studies offer the possibility to create experiments which couple basic research on insect immunity with the practical needs of biological control. Possible using bacterial, synthetic provocators and humoral antibacterial immune response to bacteria inoculation as the criteria estimate of resistance of different insect population are discussed.

Index terms: Lymantria dispar, antibacterial protein, lysozyme, cecropin, insect immunity.

[2436] TWO COLLAGENASES BEING SECRETED BY TERATOCYTES FROM *MICROPLITIS MEDIATOR* (HYMENOPTERA: BRACONIDAE) CULTURED *IN VITRO**

H. Gong & Q. L. Qin, State Key Lab. of Integrated Management of Insects & Rodents, Institute of Zoology, Chinese Academy of Sciences, Beijing, China 100080, E-mail gongh@panda.ioz.ac.cn. *This work is supported by National Natural Sciences Fundation (No 39870099).

Teratocytes, deriving from serosal cells of some parasitoid wasps embryo after the parasitoid egg hatches, have a lot of putative functions that mediate the relationship between host and parasitoid wasp. Their ability of secretion has been investigated extensively, especially in secreting some polypeptides or proteins. However, D.L. Dahlman, and S.B. Vinson, in their comprehensive review concerning teratocytes, suggested that the cells probably released collagenase. Based on this implication, we detected collagenase activity by zymograph analysis in the medium of the teratocytes from *Microplitis mediator* cultured *in vitro*. The enzymes activity also existed in the hemocoel of the host *Pseudaletia separata* during the later period of parasitization. The young teratocytes were obtained from *in vitro* hatching of the embryos, which were dissected from the host 32-hour after the female wasp oviposition. The mature cells (4-day old) were collected from the hemocoel of the host by a modification of T. Tanaka, and H. Wago. The cells were cultured in Sf 900 insect cell culture medium under sterile condition for 12 h (4-day cells) or 24 h (young cells) at 27±0.5□. The supernatant of the cultured medium was analyzed by gelatin zymography. Zymography of the supernatant showed that young teratocytes could secrete a 72 kD gelatinase whose molecular weight equaled to that of gelatinase A (*EC 3.4.24.24*), while a 92 kD gelatinase, whose molecular weight equaled to that of gelatinase B (*EC 3.4.24.35*), was secreted by 4-day teratocytes. Gelatinase A and gelatinase B are two important members of collagenases belonging to matrix metalloproteinases (MMPs) family. They play crucial roles in degradation of extracellular matrix (ECM) and remodeling of tissues of mammals. In an *in vivo* assay, collagenases activity also existed in the hemolymph plasma of the parasitized host, especially in the plasma of 6-day after parasitization, in which time the parasitoid larvae were in their maximum growth rate. This finding suggests that collagenases may play important role in nourishment of the parasitoid larvae.

Index terms: *Pseudaletia separata*, parasitoid wasp, zymography, cell culture, secretion function

[2436] RESPIRATORY CHANGES THROUGHOUT ONTOGENY IN THE AMERICAN LOCUST, *SCHISTOCERCA AMERICANA*

K. J. Greenlee & J. F. Harrison, Dept. of Biology, Arizona State Univ., P. O. Box 871501, Tempe, AZ 85287-1501, USA, E-mail kendra.greenlee@asu.edu.

As grasshoppers age and become larger, leg lengths increase five-fold, thorax width increases six-fold, and body mass can increase by as much as 100 times from hatchling to adult. How do these increases in size affect the function of the insect respiratory system? To explore the relationship between development and gas exchange, we used grasshoppers (the American locust, *Schistocerca americana*) of known age and body size and exposed them to graded hypoxia. We measured ventilatory frequency by counting abdominal pumping and MCO_2 (umol h^{-1}) using flow-through respirometry. In normal air, size had little effect on ventilation frequency. In response to hypoxia, ventilation frequency increased in large but not small grasshoppers. Larger grasshoppers had much lower critical PO_2's (the ambient PO_2 at which MCO_2 became significantly lower than that in normoxia) possibly due to their greater ability to increase abdominal pumping frequency in response to hypoxia. Large grasshoppers were able to maintain constant MCO_2's down to a critical point near 3 kPa PO_2, whereas progressive hypoxia caused logarithmic decreases in MCO_2 in small grasshoppers. These findings support the hypothesis that smaller grasshoppers are more reliant than larger grasshoppers on diffusion for gas exchange when the oxygen delivery system is challenged by hypoxia. However, it is not clear whether such a difference is size-, or simply, age-dependent. Smaller grasshoppers may not yet have developed the neural/signaling mechanisms required for responding to hypoxia. In addition, we studied the effect of within instar development on critical PO_2 for grasshoppers in the first, third, fifth, and adult stadia. *S. americana* substantially increase their body mass and MCO_2 during an instar. Since we suspect insects can make only minimal changes in the structure of the major trachea between moults, we hypothesized that animals near the end of an instar may have decreased oxygen delivery capacity relative to their metabolic needs. Therefore, we predicted that insects near the end of the instar would be more sensitive to hypoxia than insects that had recently moulted. We found that animals nearing the end of the instar did have increased ventilatory frequencies and increased critical PO_2's compared to the younger insects. This decrease in oxygen delivery capacity relative to tissue metabolic needs may constrain growth within an instar for insects in general.

Index terms: grasshopper, gas exchange, ventilation, body size, development

[2438] RESPONSES OF THE TROPICAL BONT TICK *AMBLYOMMA VARIEGATUM* TO ITS AGGREGATION-ATTACHMENT-PHEROMONE AND TO HOST ODOUR ON A SERVOSPHERE

P.M. Guerin & C. McMahon, Institute of Zoology, University of Neuchâtel, Rue Emile-Argand 11, 2007 Neuchâtel, Switzerland, E-mail patrick.guerin@zool.unine.ch

Male *A. variegatum* ticks release a mixture of *o*-nitrophenol (ONP) and methyl salicylate (MS) from dermal glands that develop soon after infesting a host. These products serve to attract conspecifics to the attachment site. The behavioural responses of *A. variegatum* adult males and females were recorded on a servosphere to vapours of both these compounds presented in an air stream. In the absence of the air stream *A. variegatum* adults walk on all eight legs but with long halts. An air stream causes continuous walking and induces a reaching response where the first leg pair is used to actively sample the air. This increases the angular velocity of the displacement and reduces walking speed.

Air-current effects on behaviour are amplified in the presence of vapours of ONP and MS in the air flowing over the ticks. Males and females are equally attracted to low source doses of ONP and MS presented alone. Vapours from a 1:1 binary mixture of ONP and MS attract over the 10^4-fold source dose range of 10ng to 100µg (10^9-10^{14} molecules/ml of air), but attraction to vapours from the binary mix is significantly reduced at source doses over 100µg. Attraction was higher to this 1:1 mixture than to the natural ratio released from the dermal glands of males, where ONP vapour predominates. This indicates that *A. variegatum* adults are sensitive both to the quality and quantity of the odour presented.

Although the response to ONP vapour is variable on its own, it is consistently attractive when delivered with steer hair odour - unattractive on its own. Moreover, no change in angular velocity or speed was observed in the the upwind walk to this combination. This supports the hypothesis that the response to the pheromone is enhanced by host odour.

Index terms: *Amblyomma*, pheromone, host relations, behaviour

[2439] HARDINESS TO LOW OR HIGH TEMPERATURE AND DRYING-OUT IN A WATER STRIDER, *AQUARIUS PALUDUM* AND A SUBSPECIES, *A. P. AMAMIENSIS*

T. Harada, S. Inoue, S. Miyata, S. Ikeda & H. Saiki, Lab. of Environmental Physiology, Fac. of Science, Kochi Univ., Kochi 780-8520, JAPAN, E-mail haratets@cc.kochi-u.ac.jp

100% of the adults survived after they were put on at 0□ for 12h for Kochi (33°N) and Sapporo (42°N) strains. When they were put on at -5□ for 12 h, more than 75% of the adults in the both strains were dead. Diapause adults under 12L-12D tended to show lower fatal retio (76.5 %) than reproductive ones under 16.5L-7.5D (92.9 %), although the difference was not significant. Overwintering adults of *A. paludum* were collected from a water way in Kochi and kept under natural conditions during winter. Supercooling points (SCP) in the middle of December were -9□ on average and significantly higher than that two months later (-14□). SCP became significantly higher in order of Sapporo (-18□), Naha (*A.p.amamiensis*, 26°N: -10□) and Kochi (-7□)at adult emergence. Hybrid between Naha and Kochi strains showed similar SCP (-11□) to that of Naha strain. Photoperiods under nymphal and adult stages had no significant effects on SCP for the three strains. When temperature was increased by 1 or 2 □ every 1 hour from 20□ to 44□, the average lethal temperature of Kochi strain was 42□ and significantly higher than that of Naha strain (41□) . Overwintered adults, direct-breeders and diapause adults were collected in April, August and November, respectively, in Kochi and put in the air at 16.4±2□ with the relative humidity of 70±5□. Diapause adults survived for 40 hrs on average which are double of 22 or 21 hrs by overwintered and direct-breeding adults, respectively. Hardiness to cold temperature and drying out may be linked to reproductive diapause in *Aquarius paludum*. This study was supported by Government Fundation by Ministry of Education, Project No. 1179001 (1999-2002).

Index terms: Semi-aquatic bug, supercooling point, reproductive diapause.

[2440] CASTE-SPECIFIC DIFFERENCES IN ECDYSTEROID TITERS IN EARLY LARVAL STAGES OF THE BUMBLE BEE *BOMBUS TERRESTRIS*

K. Hartfelder[1], J. Cnaani[2,3] & A. Hefetz[2], [1]Depto.Biologia, FFCLRP-Universidade de São Paulo, 14040-901 Ribeirão Preto, SP Brazil, Email: khartfel@rgm.fmrp.usp.br, [2]G.S. Wise Faculty of Life Sciences, Department of Zoology, Tel Aviv University, 69978 Tel Aviv, Israel, [3]Carl Hayden Bee Research Center, USDA-ARS, 2000 E. Allen Road, Tucson, AZ 85719-1596, USA Financial support was provided by the DFG (Ha 1625/3-1) and a CAPES/DAAD visiting-professor fellowship to KH.

Mounting evidence implicates ecdysteroids in queen/worker differentiation during the last larval instars of highly social insects. Since models on social insect polymorphism predict that the expression of morphological caste differences should depend on caste determining signals occurring in earlier larval stages, we now focussed on these instars. *Bombus terrestris* is of particular interest because caste is already determined in the second instar, presumably by a pheromonal signal emitted by the egg-laying queen. Caste differences in the adults, however, are only expressed at the physiological and not at the morphological level, except for the distinctly larger size of the queen. In the present study, we analyzed ecdysteroid titers in queen and worker larvae from the second through to the feeding period of the fourth (last) instar. Pronounced cycles of caste-specifically modulated ecdysteroid titers were apparent in the second and third but were abolished in the fourth instar. In feeding-stage fourth instar larvae we could detect two small ecdysteroid peaks, with the one preceding the cocoon-spinning phase presenting the characteristics of a pupal commitment peak. The synchrony of caste differences in ecdysteroid and juvenile hormone titers suggests a synergistic action of these hormones in caste determination and provides endocrine evidence for separate mechanisms acting in caste determination and caste differentiation in social bees.

index terms: ecdysteroids, caste development, bumble bee, *Bombus terrestris*

[2441] MEMBRANE DYNAMICS OF RAPID FLUID TRANSPORT IN THE MALPIGHIAN TUBULES OF THE HOUSE CRICKET, *ACHETA DOMESTICUS*

S. R. Hazelton, J. H. Spring, B. E. Felgenhauer & V. R. Townsend Jr, Dept. Biology, Univ. of Louisiana at Lafayette, Lafayette, LA 70504-2451, USA, E-mail srr0064@louisiana.edu.

In *Acheta domesticus* the Malpighian tubules (Mt) are composed of three morphologically distinct regions, each consisting of a single cell type. The bulk of the Mt is composed of the mid-tubule which is identifiable at both the light and electron microscopy level. The mid-tubule is 50-70 ;m in diameter and is composed of a single layer of cuboidal epithelial cells joined by septate desmosomes. These cells display the classic architecture of transport epithelia possessing extensive basolateral infoldings and a dense brush border. The mid-tubule is secretory in function and responds to endocrine stimulation. Our research centers on correlating the physiological response of the mid-tubule with the corresponding ultrastructural changes within the cells following the addition of various secretagogues. One of the most striking ultrastructural changes occurs when the Mt are stimulated with the second messenger dibutyryl cAMP. The increase in secretion rate (approximately doubling) is accompanied by notable changes in ultrastructure, the most prominent being membrane re-organization to increase the surface area of the basolateral infolds and vesiculation. The extensive pattern of endomembrane distribution noted in unstimulated tissue disappears following stimulation and the concretions (spherites) begin to dissolve. The area of the cell given over to vesicles/vacuoles more than doubles over 420 s post-stimulation. We followed the membrane dynamics of the mid-tubule using Transmission Electron Microscopy (TEM), Scanning Electron Microscopy (SEM) coupled with freeze-cleaving followed by extraction of the cytosol, and various fluorescent tracers (FM®4-64, ER-Tracker™, $DiOC_6$). The SEM technique was developed in our laboratory to provide a three-dimensional view of membrane structure. Using this technique we were able to observe the increase in basolateral infoldings along with the presence of dilated areas of membrane suggestive of the vesiculation pattern of stimulated tissue previously observed with TEM. Our findings suggest that there is an intricate endomembrane network that vesiculates in response to rapid fluid transport possibly to compartmentalize fluid to prevent dilution of the cytoplasm. Supported by NSF grant IBN-9807948 to JHS and BEF.
Index terms: secretion, ultrastructure, cAMP

[2442] CHARACTERIZATION OF PROTEIN CHANGES IN BUFFALOGRASSES CHALLENGED BY CHINCH BUG FEEDING

T. M. Heng-Moss[1], F. P. Baxendale[1], G. Sarath[2], X. Ni[3], & S. S. Quisenberry[3], [1]Dept. of Entomology, Univ. of Nebraska, 202 Plant Industry, Lincoln, NE 68583-0816, USA, E-mail tiffany@unlserve.unl.edu; [2]Dept. of Biochemistry, Univ. of Nebraska, Lincoln, NE 68588, USA; [3]Dept. of Entomology, Montana State University, Boseman, MT 59717, USA

Buffalograss, *Buchloe dactyloides*, is receiving considerable attention as an alternative turfgrass species because of its low maintenance requirements and relative freedom from disease and arthropod pests. Recently, however, the chinch bug, *Blissus occiduus* has emerged as an important insect pest of this native warm-season prairie grass. The deployment of insect-resistant turfgrasses offers an attractive approach for managing chinch bugs and other insect pests associated with buffalograss because it is economical, sustainable, and fits well with buffalograss' low maintenance reduced pesticide input philosophy. Accordingly, greenhouse experiments were conducted to determine the categories of resistance of 10 buffalograss cultivars/selections ('Cody', 'Tatanka', 'Texoka', '315', '378', '609', NE84-45-3, NE86-120, NE86-61, NE91-118) previously screened for resistance to *B. occiduus*. From these initial greenhouse screenings, Cody, Tatanka, NE91-118 were determined to be resistant to *B. occiduus*, whereas NE84-45-3 and 378 were susceptible. No-choice experiments served to assess the relative levels of tolerance among these buffalograsses. No statistical differences in turfgrass quality were detected between infested and non-infested Cody, Tatanka, and NE91-118 plants. These no-choice experiments also served to develop and evaluate several tolerance indices based on turfgrass quality, chinch bug damage ratings, plant height, and plant biomass. Turfgrass quality and chinch bug damage ratings were identified as the most suitable parameters for assessing buffalograss tolerance to *B. occiduus*. Research designed to investigate plant protein profiles as molecular indicators of buffalograss tolerance to *B. occiduus* is underway. These studies will characterize changes in plant protein profiles of tolerant and susceptible buffalograsses before and after chinch bug feeding and investigate the use of these profile changes as protein-mediated markers to screen for chinch bug resistance in buffalograss. Plant proteins from susceptible and resistant buffalograss were analyzed by native and denaturing gel electrophoresis to obtain information about isozyme patterns and total protein profiles. Native gels were evaluated for esterase, peroxidase, and alcohol dehydrogenase enzyme activity. This research offers a new molecular perspective on plant resistance to insects and will provide a comprehensive model for studying insect-plant interactions.
Index terms: *Buchloe dactyloides*, *Blissus occiduus*, plant resistance, turfgrass

[2443] CLONING AND DEVELOPMENTAL EXPRESSION OF A LYMNOKININ-LIKE RECEPTOR FROM THE CATTLE FEVER TICK, *Boophilus microplus* (ACARI: IXODIDAE)

S.P. Holmes & P.V. Pietrantonio, Dept. of Entomology, Texas A&M University, College Station, TX 77843-2475, USA, E-mail p-pietrantonio@tamu.edu.

The cattle fever tick, *Boophilus microplus*, is the vector for a serious disease of cattle. The tick is distributed worldwide including Mexico, where some populations have recently developed resistance to commonly used pesticides. Reintroduction of resistant ticks to the United States poses a serious threat to the Texas cattle industry. The molecular targets of pesticides are often cell-surface receptors that regulate critical physiological processes in arthropods. Neuropeptide receptors are potential targets for novel pesticide design. Leucokinins are invertebrate neuropeptides that cause hindgut contraction and are involved in regulating diuresis. Little is known about their mode and molecular site of action. Using reverse transcribed cDNA from unfed tick larvae, we have cloned an entire open reading frame that encodes for a leucokinin-like receptor. The deduced amino acid sequence is 45 % identical to the only other leucokinin receptor known, the lymnokinin receptor from the pond snail, *Lymnaea stagnalis*. Semi-quantitative RT-PCR was performed using β-actin as an internal standard to determine when the cloned receptor is expressed. The receptor is expressed in all life stages of the tick, but most strongly in the adult female and larval stages. The neuropeptide receptor that we have cloned could present a target for a novel acaricide useful in controlling populations of *B. microplus*.
Index terms: ticks, leucokinin, neuropeptide receptor, disease vector

[2444] PSEUDOTUMORS IN THE STICK INSECT (*CARAUSIUS MOROSUS*) - A MODEL SYSTEM TO STUDY REGULATION OF THE MAINTENANCE OF TISSUE DIFFERENTIATION

M. Holtmann, P. Hoffmann & A. Dorn, Institute of Zoology, University of Mainz, D-55099 Mainz, Germany.

Aging stick insects develop tumorous-like lesions (pseudotumors) spontaneously at several tissues and organs. Pseudotumors at the midgut region can have severe consequences since, in progressed stages, they lead to gut perforations followed by lethal infections. Pseudotumors can be induced experimentally by interrupting the stomodeal nervous system (stomNS) (*e.g.* removal of hypocerebral ganglion). Spontaneously developed and experimentally induced pseudotumors show the same organization in fine structural analyses. Studies on the evolution of midgut pseudotumors pointed out that the lesions were caused by a defect in the regulatory circuit maintaining the cellular homeostasis of the midgut epithelium. After manipulations at the stomNS more gut cells degenrated than were replaced by differentiation of regeneration cells. Thus, the phenomenon and its experimental induction can be used as a model system to study the regulatory processes underlying maintenance of tissue and organ differentiation. It was shown that denervation of the midgut increases apoptosis of epithelium cells and causes a deorganization of regeneration crypts. The involvement of pharmacological factors from the stomNS into these processes is presently being investigated.
Index terms: Pseudotumors, maintenance of tissue differentiation, stick insect, *Carausius morosus*.

[2445] COMPARATIVE ANALYSIS OF STORAGE PROTEIN GENE OF FALL WEBWORM, *HYPHANTRIA CUNEA*

S. J. Hwang, H.M. Cheon, H. J. kim, K. S. Chae[1], S. J. Seo, Dept. of Biology, Gyeongsang Natl. Univ., Chinju, 660-701, Korea, E-mail: sookjae@gshp.gsnu.ac.kr ; [1]Dept. of Biology, Korea Univ., Seoul 136-701, Korea .

Two kinds of storage protein, Storage protein –1 (SP-1) and Storage protein –2 (SP-2), are found in the hemolymph and fat body of *Hyphantria cunea*. The cDNA for SP-1 (2,259 bp) and SP-2 (2,241 bp) code for 753 and 747 residue proteins showing molecular mass of 88.3 kDa and 88.5 kDa, respectively. The calculated isoelectric points are pI=8.35 and 7.63 for both storage proteins. SP-1 belongs to methionine-rich storage protein group, but SP-2 is neither methionine-rich nor arylphorin group. SP-1 is more closely related to basic juvenile hormone suppressible protein 1 (BJHSP1, 72.7%), while SP-2 is more closely related to basic juvenile hormone suppressible protein 2 (BJHSP2, 74.3%). SP-1 and SP-2 have 38.4% identical residues when compared against each other. A Northern blot of fat body mRNAs reveals big differences in female during developmental stages. In female, SP-2 mRNA of fat body appears in middle last instar larvae, accumulates to a maximum level at the prepupae and 0-day-old pupa, but shows smaller quantity, compared to SP-1 expression. A Northern blot of various tissues shows positive signal from fat body, Malpighian tube, testis, and ovary, using SP-1 probe, while SP-2 probe detects only fat body and Malpighian tube.
Index terms: Storage protein, BJHSP1, BJHSP2, Northern blot

[2446] ISOLATION, cDNA CLONING AND MODIFICATION OF DEFENSIN FROM THE COCONUT RHINOCEROS BEETLE, *ORYCTES RHINOCEROS*

J. Ishibashi, H. Saido-Sakanaka, H. Tanaka, J. Yang & M. Yamakawa, National Institute of Sericultural and Entomological Science, 1-2 Owashi, Tsukuba, Ibaraki 305-8634, Japan, E-mail bishiba@nises.affrc.go.jp.

An antibacterial peptide, defensin, was purified by 4 steps of reversed phase HPLC from hemolymph of *Oryctes rhinoceros* larvae immunized with *Escherichia coli*. *Staphylococcus aureus* was used as an indicator bacteria. *O. rhinoceros* defensin showed antibacterial activity against Gram-positive but not against Gram-negative bacteria. The N-terminal amino acid sequence was determined with an amino acid sequencer. The *O. rhinoceros* defensin cDNA was cloned by 3 steps of polymerase chain reaction using fat body mRNA from immunized larvae. Deduced amino acid sequences from the nucleotide sequences indicated that the defensin contains a 79 amino acid precursor, in which the mature peptide (43 amino acids) is assumed to be produced by cleavage of the signal peptide and propeptide region by furin-like processing enzyme. Defensin from *Allomyrina dichotoma* and that from *O. rhinoceros* shared 86 % identity in the mature peptide region. The expression of *O. rhinoceros* defensin was induced in the fat body, hemocyte and Malpighian tubule after injection of *E. coli*. Expression was also observed in the midgut with and without the injection. This is assumed to be because the food compost always stimulates expression of antibacterial peptides. We synthesized a 9-mer fragment peptide based on *O. rhinoceros* defensin, which corresponds to the active site of *A. dichotoma* defensin. The fragment peptide and its analogues exhibited comparable activities to those of the *A.dichotoma* defensin based analogues. *In vivo* experiments were performed using methicillin resistant *S. aureus* (MRSA) infected mice. More than 50 % of the MRSA infected mice recovered injection of these peptides. These peptides did not stimulate super oxide synthesis from neutrophils nor NO synthesis from macrophages. This indicates the mechanism of recovery for these peptides is different from that of KLKLLLLLKLK-NH_2, which binds to a cell surface receptor and activates the immune response of a neutrophil
Index terms: antibacterial peptide, *Allomyrina dichotoma*, fragment peptide, MRSA

[2447] MOLECULAR CLONING OF NEUROPARSIN PRECURSOR CDNAS IN THE DESERT LOCUST *SCHISTOCERCA GREGARIA*

T. Janssen, I. Claeys, G. Simonet, A. De Loof & J. Vanden Broeck Lab. for Developmental Physiology and Molecular Biology, Zoological Institute K.U.Leuven, Naamsestraat 59, B-3000 Leuven, Belgium.

The pars intercerebralis (PI) is one of the brain regions that contain perikarya of neurosecretory cells. The neurosecretory material is stored in the corpora cardiaca (CC) until it is released into the hemolymph. Peptidic factors originating from the PI and released at the CC are called "parsins". Neuroparsin A (NPA) and neuroparsin B (NPB) are two 8 kDa neurohormones that were initially isolated from the corpora cardiaca (CC) of the migratory locust, *Locusta migratoria* (Girardie et al., 1987). NPA is an 83-residue polypeptide that co-exists with several N-terminally truncated isoforms in CC-extracts. DNA sequencing revealed that both neuroparsins are cleavage products of a 107-aa precursor polypeptide. This precursor consists of a secretory signal peptide and NPA. NPB is the result of a partial metabolic conversion (enzymatic proteolytic cleavage) of NPA. In *Locusta migratoria*, these purified neuroparsins exhibit anti-juvenile, antidiuretic, hyperglycemic, hyperlipemic and neurotropic activities. Recently, Girardie et al. (1998) also determined the amino acid sequence of NPA (NPB) in the desert locust, *Schistocerca gregaria*.. The sequences of *Locusta* and *Schistocerca* neuroparsins are similar. Based on this sequence information, we have cloned the neuroparsin precursor cDNA of *Schistocerca gregaria*. Interestingly, a combined approach of PCR and RACE has led to the identifcation of additional cDNA sequences encoding different neuroparsin-related precursors (NPP). The deduced amino acid sequences of the NPPs range in length between 103 and 111 residues. All *Schistocerca* NPPs share the same secretory signal sequence and contain 11-12 cystein residues at conserved amino acid positions. For each precursor, specific cDNA probes were generated and the tissue- and stage-dependent (larval stages, moulting cycle and reproduction cycle) distribution of the distinct NPP-transcripts was analyzed by northern blot experiments. The results show that some NPP transcripts are exclusively expressed in the brain, whereas others also occur in a variety of other tissues, including the fat body and the testes. Furthermore, the level of NPP-transcripts generally was higher in males than in females.
Index terms: gene expression, gonad, neurohormone, parsin

[2448] CONCENTRATED EXPRESSION OF THE GENES FOR PROTEINS INVOLVED IN CALCIUM SIGNALING IN THE MUSHROOM BODIES OF THE BRAIN OF THE WORKER HONEYBEE *APIS MELLIFERA* L

A. Kamikouchi[1], H. Takeuchi[1], S. Natori[2], K. Sekimizu[1] and T. Kubo[1], [1]Grad. Sch. Pharmaceu. Sci., Univ. of Tokyo, Bunkyo-ku, Tokyo, 113-0033, Japan; and [2]Natori Special Lab., RIKEN, Wako-shi, Saitama, 351-0198, Japan.

The honeybee is a social insect and various exquisite social behaviors are performd by their colony members. To analyze the molecular basis of such social behaviors of the honeybee, we searched for genes that are expressed selectively in the paired mushroom bodies, putative memory and sensory integration centers of the insect brain, of the honeybee. As results, we found that genes for three proteins involved in the intracellular Ca^{2+} signaling pathway, inositol 1,4,5-trisphosphate receptor, Ca^{2+}/calmodulin-dependent protein kinase II (CaMKII) and protein kinase C (PKC), were expressed selectively in the mushroom bodies of the honeybee brains. [1,2]. We also found that specific activities of CaMKII and PKC are higher in the mushroom bodies than in those of the optic and antennal lobes of the worker bee brain[2]. The intracellular Ca^{2+} signaling pathway is reported to be involved in neuronal plasticity in various higher organisms. Taken together, our results suggest that the function of the intracellular Ca^{2+} signaling pathway and thus the synaptic plasticity of the intrinsic neurons of the mushroom bodies (the Kenyon cells) are enhanced in comparison with other neuronal cell types in the honeybee brain.
Index terms: social insect, gene expression, specific activity, synaptic plasticity

[2449] CHEMO AND MECHANO RECEPTORS OF GENUS OLIGONEURIELLA (OLIGONEURIIDAE, EPHEMEROPTERA)

N. Kazanci, Dept. of Biology, Science Faculty, Univ. of Hacettepe, Beytepe, Ankara, Turkey, e-mail kazanci@tr-net.net.tr

Ephemeroptera an important part of benthic fauna of runningwaters. There are many works on their taxonomy and biology but information on their behaviour and sensilla is scarce. The present , scanning electron microscopic study was carried out to describe the external morphology of sensilla of nymphs of genus *Oligoneuriella*. The receptors on the body surface provide information regarding physico-chemical properties of water and flowrate thus guide behaviour in controlling movements of the nymphs. Their structures are also useful to solve some taxonomical problems.

[2450] LOCALIZATION AND CHARACTERIZATION OF A NOVEL RHABDOVIRUS FROM A PARASITIC WASP *DIACHASMIMORPHA LONGICAUDATA*, A PARASITE OF THE CARIBBEAN FRUIT FLY *ANASTREPHA SUSPENSA*

C. C. H. Khoo & P. O. Lawrence, Entomology and Nematology Department, University of Florida, P. O. Box 110620, Bldg. 970, Hull Road, Gainesville, FL. 32611-0620, USA, E-mail khoo@gnv.ifas.ufl.edu.

While polydnaviruses are the best known viruses associated with parasitic wasps of lepidopteran hosts, little is known about viruses of wasps that attack dipterans. A rhabdovirus (DlRhV) was discovered in the braconid wasp *Diachasmimorpha longicaudata*, a parasite of tephritid fruit flies. DlRhV is passed from one wasp generation to the next but its mechanism of inheritance is not known. In the Caribbean fruit fly *Anastrepha suspensa* (host) the virus localizes in vesicles of the larval epidermis and presumably, inhibits vesicle migration required for molting. The objectives of this study are to 1)localize DlRhV in wasp eggs and 2) characterize the viral structural proteins. Transmission electron microscopy for the first time, localized DlRhV in wasp eggs 44-48 h post parasitization (hpp). DlRhV was seen in abundance within vesicles, beneath the vitelline membrane, of the wasp egg, suggesting that it is transovarially transmitted from one generation of the wasp to the next. This is also a likely avenue of transmission from wasp to host. In the integuments of hosts, DlRhV was seen in vesicles of the larval epidermal cells 60-72 hpp. The virus was also seen budding from these vesicles, evidence of viral replication / maturation. These viruses are bacilliform, measuring 215-230 nm long and 50-60 nm wide. Since DlRhV was abundant in integuments 60-72 hpp, samples of the same age were used as a source of the virus for purification by sucrose density gradient centrifugation (SDGC). Negative stain of sucrose bands confirmed the presence of DlRhV at densities of 1.05-1.10 mg/ml. Sodium dodecyl sulfate polyacrilamide gel electrophoretic analysis of the purified sample revealed protein bands of 70 and 78 kDa, which are likely, DlRhV structural proteins. Comparison of the protein profiles of parasitized and unparasitized integuments showed a 29 kDa protein band unique to the parasitized samples. This is the first attempt at characterization of DlRhV structural proteins. Additional studies are in progress to further characterize them.

Index terms: viruses of wasps, braconid wasp, tephritid fruit flies, viral structural proteins.

[2451] EFFECTS OF ONTOGENY ON THE OXYGEN SENSITIVITY OF JUMPING PERFORMANCE IN THE AMERICAN LOCUST (*SCHISTOCERCA AMERICANA*)

S. D. Kirkton, N. Petrie & J. F. Harrison, Dept. of Biology, Arizona State Univ., Tempe, AZ 85287-1501, USA, Email: kirkton@asu.edu

As insects grow, the distance between the spiracle and the tissue increases such that diffusive gas exchange capacity could be reduced. For example, leg length increases five fold and body mass increases 100 fold during development from juvenile to adult in the American locust (*Schistocerca americana*). We tested the hypothesis that older, larger insects have more difficulty supplying oxygen to body tissue during locomotion. We forced second, fourth, and sixth instars and adult *S. americana* to jump in five different oxygen atmospheres (ranging from 5% to 60% oxygen). Each grasshopper experienced only one oxygen concentration (balance nitrogen, normobaric). We measured the initial hop rate, endurance time up to 20 minutes and total hops to exhaustion for each individual. Animals were considered exhausted when 30 seconds passed between jumps. Smaller, younger grasshoppers in normal (21% oxygen) atmospheres jump at higher rates, have greater endurance times, and more jumps to exhaustion. Hyperoxia increased initial hop rate and the number of jumps to exhaustion only in the largest (sixth instar and adult) grasshoppers suggesting oxygen limitation of performance. Hypoxia decreased initial hop rate and the total number of jumps until exhaustion more strongly in larger grasshoppers. These data support the hypothesis that increased body size reduces the tracheal oxygen delivery capacity relative to leg muscle metabolic needs. Body size also changes within an instar, such that grasshoppers approximately double their mass, but do not change the structure of their primary trachea. Therefore, tracheal oxygen delivery capacity relative to leg muscle needs may be reduced within an instar. Also air sac size may decrease during and instar, reducing the internal oxygen stores. To test these possibilities, we compared the jumping performance and oxygen sensitivity of performance of grasshoppers early and late in an instar. Early within an instar, grasshoppers had higher initial hop rates, greater endurance times and more jumps to exhaustion. These results were supported both in early (fourth instars and in late instars (sixth) and adults. These results support the hypothesis older grasshoppers, within a moult, have a reduced capacity to deliver oxygen during locomotion as compared to younger ones. The results are also consistent with the idea that hyperoxia in the Paleozoic Era permitted for the evolution of gigantic insects.

Index terms: gas exchange, body size, grasshopper, age, locomotion

[2452] THE EFFECT OF PLANT INHIBITORS OF INSECT DIGESTIVE ENYZYMES ON GROWTH AND MORTALITY OF MODEL PESTS

F. Kocourek [1], P. Křeček [2], M.Mareš [3], I.Kluh [3], [1]Department of Entomology, Research Institute of Crop Production, Drnovská 507, 16106 Prague, Czech Republic, E.mail kocourek@hb.vurv.cz; [2] Department of Zoology, Faculty of Sciences, Charles University, Prague, Czech Republic; [3] Institute of Organic Chemistry and Biochemistry, Academy of Sciences, Prague, Czech Republic.

The aim of this paper was to determine the effect of various types of inhibitors of insect digestive enzymes on some biological characteristics (growth and mortality rate) of model insect species. Defined constitutive inhibitors were either applied onto the surface of plant leaves that served as food for the model insect species, or were incorporated into synthetic diets. The effects of the amylase inhibitor and of various proteinase inhibitors (E64, BPTI, STI, PDI, PCI) of both plant and synthetic origin were quantified in biological assays. Biological assays conducted with the amylase inhibitor isolated from *Phaseolus vulgaris* confirmed the validity of the results obtained in experiments conducted *in vitro*. The inhibitory effect of the amylase inhibitor on the digestive enzymes of *Tribolium castaneum* and *Tenebrio molitor* larvae and adults resulted in a marked decrease of growth rate of the treated animals.

Biological assays conduct

[2453] HORMONAL REGULATION OF FLIGHT METABOLISM IN A MIGRATORY BUTTERFLY, *VANESSA CARDUI* (LEPIDOPTERA: NYMPHALIDAE)

G.V. Köllisch[1], M.W. Lorenz[1], P.D. Verhaert[2], R. Kellner[3] & K.H. Hoffmann[1], [1]Dept. of Animal Ecology I, Univ. of Bayreuth, 95440 Bayreuth, Germany, E-mail: klaus.hoffmann@uni-bayreuth.de; [2]Inogenetics, 9052 Ghent, Belgium; [3]Biomed Fo/GBT, Merck KGaA, 64271 Darmstadt, Germany.

The nymphalid *V. cardui* exhibits large scale migration in spring from Southern to Middle and Northern Europe for establishing one to several new generations there. In late summer, at least some butterflies return to the South for overwintering in a reproductive diapause. From an energetic point of view, animals utilize lipids to provide energy for the contracting flight muscles during long flights. Lipids, stored in the fat body, are mobilized during flight by the action of small neuropeptides of the AKH/RPCH family. In the haemolymph, AKHs are responsible for an overall increase in the lipid-carrying capacity. Freshly ecdysed females from a laboratory stock culture had some higher haemolymph lipid titers than males whereas the lipid concentrations were equal after 1 weak of adult life. Laboratory reared animals do not fly very well. Nevertheless, during 5 min of lift-generating flight, the level of haemolymph lipids in males increased by about 60% compared to rest, whereas no significant increase was observed in females. After 20 min of rest following a 5 min flight, haemolymph lipid concentration in males further increased to 150% compared to the control, but lipid concentration in females did not change significantly. By use of two different technologies of sequence elucidation (HPLC separation of the peptide followed by Edman degradation and Q-TOF mass spectrometry) we have isolated two AKHs from corpora cardiaca of *V. cardui*: the nonapeptide Mas-AKH, as already found in several moth species, and a novel C-terminally elongated 11mer homolog of the Mas-AKH, named Vac-AKH. Injection of 10 pmol Mas-AKH into decapitated animals increased haemolymph lipids up to 300% vs. Ringer injected controls, whereas haemolymph lipids increased up to ca. 150% after injection of 10 pmol Vac-AKH. The biological activity of both peptides will be discussed with respect to flight performance and reproduction state of the animals.Index terms: *Vanessa cardui*, adipokinetic hormones, flight metabolism, haemolymph lipidsed with proteinase inhibitors confirmed the high inhibitory effect of the E64 inhibitors on *Leptinotarsa decemlineata* larvae demonstrated in *in vitro* experiments. By contrast, no inhibitory effects were demonstrated for Kunitz type of proteinase inhibitors which didn't cause any decrease of growth rates of larvae or increase of their mortality. The assays proved that *L. decemlineata* was able to overcome the effect of inhibitors, probably due to the synthesis of proteinases resistant to inhibitors. Other experiments aimed at induction of the synthesis of protective substances in potato and tomato by means of systemin and systemin-competitor application into the vascular tissues. The application of systemin had no effect on the growth of larvae fed on highly stressed plants (stem cutting, injury by insects). On the other hand application of a systemin-competitor increased the growth rates of *L. decemlineata*, *Manduca sexta* and *Spodoptera littoralis* larvae. This is perhaps the first demonstration of the existence of such effect.

[2454] OXIDATIVE CONJUGATION OF CATECHOLS FOR INSECT CUTICLE SCLEROTIZATION

K. J. Kramer[1], M. R. Kanost[2], T. L. Hopkins[3], H. Jiang[2], R. Suderman[2], R. Xu[3], [1]Grain Marketing and Production Research Center, ARS, USDA, Manhattan, KS 66502, USA, E-mail kramer@usgmrl.ksu.edu; [2]Dept. of Biochemistry and [3]Entomology, Kansas State University, Manhattan, KS 66506, USA

Cuticle sclerotization or tanning is a vital process that occurs during each stage of insect development to harden and stabilize the newly secreted exoskeleton. The structural polymers, protein and chitin, make up the bulk of the cuticle, and chemical interactions between these biopolymers with quinonoid tanning agents are largely responsible for the final properties of the exoskeleton. The main hypothesis for sclerotization involves the formation of cross-links between nucleophilic imidazole nitrogens of histidyl residues in cuticular proteins and electrophilic ring or side chain carbons of ortho-quinones and para-quinone methides derived from two catechols, N-beta-alanyldopamine and 3,4-dihydroxyphenylethanol. C-N and C-O linkages between tanning agents and proteins in a variety of insect cuticles from several orders of insects have been elucidated. cDNAs for both the tyrosinase and laccase types of phenoloxidases that catalyze the cross-linking reactions have been isolated and sequenced. The sequences of laccase cDNAs from two insect species demonstrate that insect laccases are more similar to fungal laccases than to those from plants. These results provide insight into how insects use structural proteins, catechols, and oxidative enzymes to form catechol-amino acid adducts, which help to stabilize their exoskeletons. This research was supported in part by the National Science Foundation.
Index terms: *Manduca sexta*, *Anopheles gambiae*, cross-linking, oxidation, metabolism.

[2455] EXPERIMENTAL STUDY OF HAEMOCYTES AND HEMOPOIETIC TISSUE OF ADULT OF *NAUPHOETA CINEREA OLIV*

M. A. Lange, N. W. Potapina & L. I. Ljutikova, Dept. of Entomology, Biological Faculty, Moscow State University, 119899 Russia; E-mail ald@3.entomol.bio.msu.ru.

The research of haemocytes and hemopoietic tissue of cockroach *N. cinerea* was carried out by autoradiographic labeling (^{3}H-thymidine) of intact adult at age of 2-3 weeks and those, but after preliminary artificial hemopoiesis, when a cockroach with cut off distal part of an antenna subjected to a centrifuging with 300 g during 10 min. On the base of evaluations of cell shape and sizes, them nuclear-cytoplasmic ratios, chromatin character and presence granular inclusions on stained with azure-eosine blood smears 5 main types of blood cells were identified: small and large agranulocytes (7 and 10-12 μm respectively); basophilic and eosinophilic granulocytes; coagulocytes. The analysis of labels appearance among different haemocytes in smears prepared through 3 h, 1 and 3 d. after ^{3}H-thymidine injection into cockroaches allows to conclude, that among agranulocytes there are a part of weak-differentiated cells (2-4 %), and granulocytes, apparently, represent fully differentiated cells. The sources of granulocytes are agranulocytes. The results testify also to existence of a population actively proliferous cells-predecessors, which is localized outside haemolymph, namely - in hemopoietic organs. Autoradiographic method has allowed to reveal emerging a great many weak-differentiated cells (large agranulocytes) in plasma after artificial stimulation of hemopoiesis. It was established by means of light microscopy of serial sections of cockroach thorax (area of pericardial sinus), that hemopoiesis stimulation besides raised activity hemopoietic organs, which consist of islets of young differentiating haemocytes, stroma cells and various intercellular structures, and adjoin to a dorsal vessel and dorsal diaphragm. The increased activity was confirmed by enlarge of haemocytic islets, accompanied by intensive cell proliferation. The data suggest, that the initial type of cockroach haemocytes is large agranulocytes, the part of which is capable to division in a norm. The ability to division was increased considerably in conditions of hemopoiesis. The division of large agranulocytes occurs mainly in hemopoietic organ, from which they migrate in haemolymph, where their maturation is accomplished. We assume, that cockroach hemopoiesis is distinguished by inductive character.
Index terms: cockroach, hemopoiesis, autoradiographic analysis

[2456]ROLE OF ACTIVATORS OF THE ABSORPTION OF AMINO ACIDS BY THE MIDGUT IN *BOMBYX MORI* LARVAL NUTRITION

M.G.Leonardi[1], P.Parenti[2], M.Casartelli[1], M.Forcella[2], L.Fiandra[1] & B.Giordana[1], [1]Dept. of Biology, University of Milan,, Via Celoria 26, 20133 Milan, Italy, e-mail: leonardi@mailserver.unimi.it [2] Dept. of Environmental Sciences, University of Milano-Bicocca, P.za della Scienza 1, 20126 Milan, Italy

Intestinal amino acid absorption is an important step in nitrogen metabolism and affects the biological development of the whole organism. The knowledge of the functional and regulative properties of the amino acid transport systems expressed in the gut epithelium is therefore of primary importance. Amino acid absorption in lepidopteran larval midgut occurs through K^+-dependent secondary active transport mechanisms located in the brush border membrane (BBM) of columnar cells energized by the combined activity of a proton V-ATPase and a $K^+/2H^+$ antiporter in the apical membrane of goblet cells. The different categories of transport proteins involved in the absorption of amino acids have been functionally characterized along *Bombyx mori* larval midgut by measuring the uptake of the radiolabeled amino acids into BBM vesicles and/or in midguts incubated *in vitro*. To date we have identified and characterized at least three different transport systems involved in the absorption of neutral and cationic amino acids. We have now evidences that the K^+-transporter for leucine and neutral amino acids can be activated by a number of hydrophobic, low molecular weight molecules, which bind to the external side of the vesicles (that corresponds to the luminal side of the membrane) and cause a large increase of the turnover number of the transport protein. An increased activity of the same cotransporter can be recorded in silkworms topically treated immediately after the fourth larval ecdysis with fenoxycarb, an IGR that mimics some of juvenile hormone effects, administered in a single dose of 5-10 femtog/larva. Leucine initial uptake rate and its accumulation were increased both in BBM vesicles and in the isolated midgut. Two different mechanisms of action are involved in the effects of the two categories of activators, but both, either fed to silkworm or topically applied, are able to induce a shortening of the lengh of the fifth instar, which confirms that the modulation of midgut amino acid absorption plays a key role in larval nutrition and development.
Index terms: *Bombyx mori*, midgut, amino acid absorption, activators, larval development.

[2457] RELATION BETWEEN WEIGHT AND VOLUME OF *CORNOPS AQUATICUM* (ORTHOPTERA: ACRIDIDAE) IN THE SURROUNDINGS OF RIO CLARO, BRAZIL

M. G. Lhano[1], C. H. S. Penteado[2] & J. Adis[3], [1]Dept.of Biology and Zoology, Univ. Federal of Mato Grosso, Ave. Fernando Correa da Costa s/n, 78060-900, Cuiabá, MT, Brazil, E-mail: acrididae@yahoo.com; [2]Center of Environmental Studies – University of São Paulo State, Ave. 24 A, 1515, 13500-000, Rio Claro, SP, Brazil, E-mail: cea@ms.rc.unesp.br; [3]Max-Planck-Institute for Limnology, Tropical Ecology Working Group, Postfach 165, D-24302 Plön, Germany, E-mail: adis@mpil-ploen.mpg.de.

Cornops aquaticum (Bruner, 1906) is a semi-aquatic acridid (Orthoptera, Tetraeniini) with a wide geographical distribuition, ranging from the South of Mexico (23°N) to Uruguay and the Northeast of Argentine (35°S). These grasshoppers can be found on leaves of the aquatic macrophyte *Eichhornia* spp. where they pass their life cycle. The study site "Sítio das Acácias" was located between the subdistricts of Ferraz and Ajapi (22°16'S, 47°34'W) near Rio Claro-SP, Brazil. Adult specimens were collected during daylight with the help of an entomological net in a flooded area affected by cattle, about 20m from the Corumbataí River. The body mass (g) and volume (ml) were measured in 3 males and 15 females. Relations between body mass (M) and volume (V) were obtained and are expressed by the equations $V_{(male)} = 0,1132 + 0,5543 . M$; $V_{(female)} = 0,0893 + 1,0667 . M$ and $V_{(male\ and\ female)} = -0,0355 + 1,4860 . M$. The correlation coefficients (r) (males = 0,41; females = 0,68; both sexes = 0,89) were significant ($P<0,05$ for males and females, $P<0,01$ for both sexes). The positive relation "body mass *versus* volume" in *C. aquaticum* also showed that the proportion of volume in relation to size does not depend on sex. Data are statistically reliable and calculations allow that body volumes are mathematically inferred from weight data in studies that need these parameters for routine calculations, such as respirometric constants of the Warburg respirometer.

Index terms: grasshopper, size, sex

[2458] RESPIROMETRIC STUDIES OF *CORNOPS AQUATICUM* (ORTHOPTERA: ACRIDIDAE) IN THE SURROUNDINGS OF RIO CLARO, BRAZIL

M. G. Lhano[1], C. H. S. Penteado[2] & J. Adis[3], [1]Dept.of Biology and Zoology, Univ. Federal of Mato Grosso, Ave. Fernando Correa da Costa s/n, 78060-900, Cuiabá, MT, Brazil, E-mail: acrididae@yahoo.com; [2]Center of Environmental Studies – University of São Paulo State, Ave. 24 A, 1515, 13500-000, Rio Claro, SP, Brazil, E-mail: cea@ms.rc.unesp.br; [3]Max-Planck-Institute for Limnology, Tropical Ecology Working Group, Postfach 165, D-24302 Plön, Germany, E-mail: adis@mpil-ploen.mpg.de.

Cornops aquaticum (Bruner, 1906) is a semi-aquatic acridid (Orthoptera, Tetraeniini) with a wide geographical distribution, ranging from the South of Mexico (23°N) to Uruguay and the Northeast of Argentine (35°S). These grasshoppers can be found on leaves of the aquatic macrophyte *Eichhornia* spp., where they pass their life cycle. The study site "Sítio das Acácias", was located between the subdistricts of Ferraz and Ajapi (22°16'S, 47°34'W) near Rio Claro-SP, Brazil. Adult specimens were collected during daylight with the help of an entomological net in a flooded area affected by cattle, about 20m from the Corumbataí River. Experiments about the respiratory metabolism of males and females were carried out with a Warburg respirometer, testing correlations with a possible cycle of daily activity. Bottles of about 35ml were used in the respirometer and temperature during measurements was 25°C. Each experiment lasted one hour with readings made every 15 mins. The respirometric data obtained from adults (32 males and 12 females), showed that the respiratory rate in females did not differ from that in males ($P>0,05$), although the female's corporal size was bigger and heavier (average weight: female = 0,27 ± 0,04g, male = 0,17 ± 0,015; $P<0,05$). The average values of the respiratory rates found were: $VO_{2\ (female)}$= 314,80 ± 114,05 $\mu lO_2.g^{-1}.h^{-1}$ and $VO_{2\ (male)}$= 309,64 ± 140,42 $\mu lO_2.g^{-1}.h^{-1}$ in the morning and $VO_{2\ (female)}$= 276,95 ± 82,91 $\mu lO_2.g^{-1}.h^{-1}$ and $VO_{2\ (male)}$= 284,14 ± 78,49 $\mu lO_2.g^{-1}.h^{-1}$ in the afternoon. Due to the high standard deviation of data, a "size-rule" could not be established. Also, no difference found in the respiratory rates of *C. aquaticum* measured during the morning and afternoon indicate the lack of a daily rhythm, at least with the metodology applied.

Index terms: grasshopper, sex, metabolism, respiration

[2459] EVOLUTION OF TRYPSIN SPECIFICITY IN INSECTS

A.R. Lopes[1], M.A. Juliano[2], L. Juliano[2] & W.R. Terra[1], [1]Dept. of Biochemistry, Inst. of Chemistry, Univ of São Paulo, Av. Lineu Prestes 748, São Paulo, SP 05599-970 Brasil, E-mail: drilopes@quim.iq.usp.br; [2] Dept. Biophysics,Univ. Fed. São Paulo, R. Três de Maio 100, 04044-020, São Paulo, SP, Brasil. Supported by FAPESP, PRONEX and CNPq

Trypsins are serine endopeptidases that hydrolize peptide bonds at the carboxyl side of positively charged residues (Arg, Lys) and are important digestive enzymes in most insects. Differences in trypsin specificity may be the cause of some insects to resist to serine endopeptidase plant inhibitors and to *Bacillus thuringiensis* toxins. *Periplaneta americana* (Dictyoptera), *Tenebrio molitor* (Coleoptera), *Musca domestica* (Diptera) and *Diatraea saccharalis* (Lepidoptera) trypsins were purified by using different chromatographic techniques (anion-exchange chromatographies for *P. americana* and *T. molitor* trypsins and affinity chromatographies for *M. domestica* and *D. saccharalis* trypsins). kcat and Km values were determined for each purified enzyme with a series of peptide substrates displaying a *o*-amino-benzoyl (Abz) as fluorophore and a N-(2,4-dinitrophenyl)-ethylenediamine (EDDNp) as a quencher. The substrates were based on the sequence Abz-AGG*R*GAGQ-EDDnp with the positions P1 (the R position), substituted by K and P2, P3 (at the left of R) and P1' (at the right of R) being replaced by different amino acids residues resulting in 50 peptides. Based on the Km and kcat values determined using these 50 peptides as substrates, we suppose that the peptides that would be best hydrolyzed by each enzyme are: *P. americana*, Abz-AQL*R*MAGQ-EDDNp; *T. molitor*, Abz-AMA*R*IAGQ-EDDNp; *M. domestica*, Abz-AVF*R*GAGQ-EDDNp; *D. saccharalis*, Abz-AAL*K*AAGQ-EDDNp. Trypsins from the mentioned insects have different specificities, including the primary specificity. Thus, *D. saccharalis* trypsin cleaves at Lys more efficiently than at Arg, whereas the contrary is true for the other insects. The data also showed that trypsin subsites tend to become more hydrophobic as the insects are more evolved. Plant proteinase inhibitors are actually slow-hydrolyzing substrates. Many of them are trypsin inhibitors interacting with the enzymes mainly by hydrophobic bonds and having a lysine residue at the P1 position. Thus, these inhibitors are expected to bind and be differentially inactivated by trypsins, explaining their characteristic susceptibility to the inhibitors.

Index terms: Trypsin, specificity, protein digestion, proteinase inhibitors.

[2460] ANTIFEEDANT ACTIVITY AND POST-INGESTIVE EFFECT OF TERPENOIDS ISOLATED FROM *TRICHILIA HAVANENSIS* AND *SCUTELLARIA ALPINA* ON COLORADO POTATO BEETLE LARVAE

J. F. López-Olguín[1,2], F. Ortego[1], M. C. de la Torre[3] & P. Castañera[1], [1] Dpto. de Biología de Plantas, Centro de Investigaciones Biológicas, CSIC, Velázquez 144, 28006 Madrid, Spain. [2] Departamento de Investigación en Ciencias Agrícolas, Instituto de Ciencias, Benemérita Universidad Autónoma de Puebla, 14 Sur 6301, 72570 Puebla, México. [3] Instituto de Química Orgánica, CSIC, Juan de la Cierva 3, 28006 Madrid, Spain.

Acetone extracts from the seed kernels of *Trichilia havanensis* (Meliaceae) and the aerial parts of *Scutellaria alpina* subsp. *javalambrensis* (Labiatae) were evaluated for their antifeedant activity on last instar larvae of Colorado potato beetle (CPB), *Leptinotarsa decemlineata*. The bioassay-guided fractionation of *T. havanensis* extract lead to the identification and purification of three limonoids: azadirone, *O*-acetyltrichilenone, and the mixture 1,7-di-*O*-acetylhavanensin and 3,7-di-*O*-acetylhavanensin (F18), that exhibit strong antifeedant activity against CPB. Likewise, two *neo*-clerodane diterpenes isolated from *S. alpina* extracts: scutalpins B and I, significantly reduced CPB consumption. Nutritional tests, antifeedant simulation assays and post-treatment studies indicated that scutalpin-B acts as an insect feeding deterrent, whereas the antifeedant activity of azadirone and F18 is likely associated with a toxic mode of action. The effect of these compounds on digestive proteases and detoxication enzymes in the larval midgut of CPB were also tested. Azadirone, a toxicant with low mortality action, decreased esterase activity and increased glutathione S-transferase activity during the treatment period, but these detoxication enzymes reached normal levels of activity when the larvae were shifted to untreated leaf disks during the post-treatment period. The mixture of limonoids F18, a strong toxicant that produces high levels of larval mortality, significantly reduced digestive protease and esterase activities and increased glutathione S-transferase and polysubstrate monooxygenases during the treatment period. All enzymatic activities but glutathione S-transferase remained altered during the post-treatment period. Scutalpin-B, with a deterrent mode of action, did not have any significant effect on any of the enzymatic processes. We concluded that, as expected, toxicants display a post-ingestive effect on some biochemical process of CPB larvae, whereas no such effect appear with deterrents.

Index terms: *Leptinotarsa decemlineata*, limonoids, scutalpins, deterrent, toxic

[2461] A HIGH-AFFINITY OCTOPAMINE/TYRAMINE TRANSPORTER CLONED FROM THE INSECT CENTRAL NERVOUS SYSTEM

T. Malutan[1,2], H. McLean[1], S. Cavaney[1] & C. Donly[2], [1] Dept. of Zoology, Univ. Western Ontario, London, ON, Canada N6A 5B7; [2] Southern Crop Protection and Food Research Centre, London, ON, Canada N5V 4T3.

Octopamine (OA) is a phenolamine present in high concentrations in the insect central nervous system and because it plays similar roles to those of norepinephrine in mammalian systems, OA has been called "the insect norepinephrine". As a neurotransmitter, the release of OA initiates a post-synaptic event and it is then rapidly cleared from the synaptic cleft by plasma membrane transporters. This study describes a cDNA encoding a high-affinity Na^+/anion$^-$-dependent octopamine/tyramine transporter (OA/TAT), isolated via an RT-PCR based approach from caterpillars of the cabbage looper, *Trichoplusia ni*. The OA/TAT cDNA has an open reading frame encoding a 670 amino acid protein that bears strong homology to other cloned monoamine transporters. *In situ* localization of OA/TAT mRNA revealed that the transporter is expressed in a subset of neuronal cells associated with the presence of OA. Insect cells infected with OA/TAT expressing baculovirus accumulate both ^{3}H-OA and ^{3}H-dopamine (DA) with the typical saturation kinetics of a high-affinity carrier-mediated process. The uptake of ^{3}H-DA by OA/TAT was strongly inhibited by tyramine, OA, DA and the tricyclic antidepressants desipramine and imipramine. Substitution of other ions for Na^+ and Cl^- in the saline indicated that OA/TAT activity has an absolute requirement for Na^+ and a less stringent requirement for Cl^-. The pharmacological profile of OA/TAT is distinct from those of other monoamine transport systems, making OA/TAT a potential target for neuro-active pest control agents.

Index terms: *Trichoplusia ni*, neurotransmitter, monoamine, membrane transport.

[2462] APYRENE AND EUPYRENE SPERMATOZOA IN THE SEMINAL VESICLE OF *EUPTOIETA HEGESIA* (LEPIDOPTERA: NYMPHALIDAE)

K. C. Mancini & H. Dolder, Depto. de Biologia Celular e Estrutural, Universidade Estadual de Campinas, CP 6109, Campinas, SP, Brazil. E-mail: kmancini@unicamp.br.
Financial support – Fapesp, Capes

As in other invertebrates, the Lepidoptera present two kinds of sperm, wich in this group is very evident. One type, termed the eupyrene spermatozoon is responsible for egg fertilization; the other, called apyrene, participates in other functions, not yet entirely clear. Both kinds undergo morphological and organizational changes in the reproductive tract of the male. Here we describe sperm ultrastructure and their organization in the seminal vesicle of the adult butterfly *Euptoieta hegesia* males. Two methods were used: 1. conventional processing for Transmission Electron Microscopy. 2. Fixation using ruthenium red (RR), specific for carbohydrates. The apyrene spermatozoa swim freely in the lumen and are surrounded by a accessory gland secretion. They are enclosed in several external concentric layers while cross sections show two small, well separate mitochondrial derivatives beside the 9+9+2 axoneme. The concentric layers stained with RR, apparently form a kind of glycocalix. In the final region, the accessory microtubules disappear first, followed by the central ones and the doublets, ending in concentric layers. The eupyrene spermatozoa remain associated in bundles enveloped by RR stained material, suggesting the presence of carbohydrates. The lacinate appendages, loose their testicular organization, contributing to a RR stained material that surround the bundle. Each spermatozoon is covered by dense amorphous coat. The eupyrene flagellum has closely associated mitochondrial derivatives and a 9+9+2 axoneme. The reticular appendage is large in the anterior portion and slender in the tail region. It was strongly marked by the RR, allowing the identification of a region of dense amorphous portion inside the dense coat and linked to the reticulate appendage. The nucleus is long and thin at the extremities, widening in the mid section and invading the axoneme region. The acrossome also stained with the RR, due to the presence of glycoproteins; it is a hollow tubular structure extending laterally throughout the nuclear region. The relative quantities of each kind of spermatozoa varies greatly in different individuals: the apirenes generally are the most common. There are few works using RR to stain spermatozoa of invertebrates. Considering that there is little information on the composition of many spermatozoon structures of Lepidoptera, the present study is a contribution toward elucidating their probable composition.

Index terms: Lepidoptera, ultrastructure, apyrene spermatozoa, eupyrene spermatozoa, seminal vesicle, ruthenium red

[2463] PIONEERS OF INVERTEBRATE CELL CULTURE

K. Maramorosch, Dept. of Entomology, Rutgers University, New Brunswick, NJ 08901, USA.

In 1915 Richard Goldschmidt at Yale University obtained spermatogenesis of Cecropia moth. Subsequent progress was slow until R.W. Glaser became interested in insect cell culture. In 1935 William Trager at Rockefeller Institute grew cells infected with grasserie virus and in 1938 he proved the multiplication of equine encephalitis virus in mosquito cells *in vitro*. Trager systematically developed culture media based on the chemistry of insect hemolymph. Further media improvements were achieved by Silver-Wyatt and Gerry Wyatt in Canada in 1945. In 1957 Zan-Zin Gaw in Wuhan,China established the first insect cell line from *B. mori* and carried it through 22 passages. This breakthrough was overlooked for many years because of China's cultural revolution. It did not influence invertebrate cell culture as did the 1962 work of T.D.C. Grace in Canberra, Australia. Grace's media have been used world-wide ever since. In 1962 C. Vago at Montpellier, France organized the First International Conference on Invertebrate Cell Culture, providing the platform for rapid exchange of information and a stimulus for further developments. Subsequent conferences were organized in Tremezzo, Italy by C. Barigozzi, 1967, D. Blaskovic and J. Rehacek at Smolenice, Slovakia in 1971, E. Kurstak and K. Maramorosch at Mt. Gabriel, Canada in 1975, Kurstak, Maramorosch and A. Dubendorfer at Rigi-Kaltbad, Switzerland in 1979, by Dwight Lynn at St. Augustine, Florida in 1983, by Kuroda, Kurstak and Maramorosch in Ohito, Japan in 1987, by M. Fraser in Anaheim, California in 1991, by Marcia Loeb and K. Maramorosch in Washington, DC in 1996, and by Cynthia Goodman and L. Ellis in San Diego, CA in 2000. Work in France by C. Vago has been continued by M. Bergoin .In 1970 G. Echalier and associates in Paris obtained the first cell culture of *Drosophila*. In Bratislava, J. Rehacek, and in London M.G.R. Varma and M. Pudney pioneered tick cell culture. H. Miltenburger in Germany, Gershenzon and Medvedeva in Ukraina, Gaw in China , Kuroda in Japan and Grace in Australia pioneered invertebrate cell culture in their countries. In the United States Imogene Schneider started tsetse fly, Marion Brooks and E. Marks cockroach, and Sonja Buckley mosquito cell cultures. Carlo Ignoffo, A.H. McIntosh, James Vaughn, R. R. Granados greatly improved mass cultivation and improved culture media. Max Summer and co-workers applied insect cell cultivation to biotechnological uses of baculoviruses. Prominent Japanese pioneers include Y. Kuroda, J. Mitsuhashi and H. Hirumi. Tick cell culture has been perfected by T.H. Kurtti and U.G. Munderloh. Cell and organ culture of *Lepidoptera* has flourished in H. Oberlander's laboratory. Several of the early pioneers remained active and are now in the forefront of invertebrate cell culture research, turning out cadres of younger workers who proudly continue the work started by Goldschmidt, Trager, Gao and Grace.

Index terms: *in vitro*, media

[2464] A NEW CAGE FOR *GRAPHOLITA MOLESTA* FEMALES OVIPOSITION

M. S. Marín, C. C. Sáez & G. S. Mácola. Cat. Zoología Agricola. Fac. Cs. Agrarias. U.N.Cuyo. Alte. Brown 500. (5505) Chacras de Coria. Mendoza. Argentina. E-mail: msmarin@supernet.com.ar.

"Oriental fruit moth", *Grapholita molesta*, is the main pest in peach orchards of Mendoza. Its larvae produces damages in buds and fruits, affecting directly the fruit quality destined for industry or fresh consumption. The succes of this pest culture in laboratory, in experimental or massive scale, depends directly of the fecundity of females and the viability of eggs. This work was done in order to: 1) design an adult cage adjusted to the best behavioral conditions for pest mating and oviposition. 2) evaluate the efficiency of this cage by mean of female fecundity, eggs viability and adults longevity. The essay was made in the rearing laboratory of the Cathedra of Agricultural Zoology since november 1997 to december 1999. Rearing chamber was maintained to 25° C ± 1, 60% ± 20 of relative humidity and 16: 8 hours of light and darkness photoperiod. Eggs coming of the rearing of 9 generations were put on green thinning apples cv. Granny Smith. Larvae, after the end of its development, made its coccoon in a piece of corrugated paperboard. Pupae were extracted at eight or nine days, and they were sexed and weighted. Then, they were transfered to oviposition cages (40 couples by cage). Cages, in cylindrical shape (200 mm of diameter by 220 mm of length), were made of dark grey plastic material (Polyvinyl Chloride). They were provided of glass feeding device with wicks of cotton and waxed paper sheets, exposed to more luminosity, for oviposition. The eggs collected was done daily during all oviposition period, meanwhile its viability was determined after 10 days of laying. Longevity was obtained by daily extraction and dead adults sexed. It was got to rear 20 generations. Fecundity (eggs average by female) took a minimum of: 101 and a maximum of: 210 in the total of generations. Pupae average weight (mg.) by sex took a minimum of: 11,20 – 8,17 and a maximum of: 13,11 – 9,54 for females and males respectively. Females fecundity, eggs viability and adults longevity took values which ones surpassed to those obtained by other authors with the same larvae diet. On the other hand, pupae weight was always lower than ones by other authors. The designed cage permited to get similar values, higher enclosed, to the ones obtained by other authors in the investigated parameters.

[2465] CENTRAL ROLE OF METABOLISM IN ELECTROGENESIS AND EPITHELIAL TRANSPORT IN MALPIGHIAN TUBULES OF THE YELLOW FEVER MOSQUITO *AEDES AEGYPTI*

R. Masia[1], W. Nagel[2] & K. W. Beyenbach[1], [1]Dept. of Biomedical Sciences, Cornell University, VRT 8014, Ithaca, NY 14853, USA, E-mail kwb1@cornell.edu.; [2]Dept. of Physiology, Univ. of Munich, D-80336 Munich, Germany.

As soon as dinitrophenol (DNP) enters the peritubular environment of isolated perfused Malpighian tubules of the yellow fever mosquito, the transepithelial voltage plummets from 52.6 mV (lumen-positive) to 6.6 mV, the apical membrane voltage of principal cells falls from -110.6 mV to -8.9 mV, and the basolateral membrane voltage drops from -58.0 mV to -3.3 mV. In parallel, the transepithelial resistance rises to the highest values measured across the epithelium (Pannabecker et al., Am. J. Physiol. 263, R609, 1992). The collapse of all voltages to values less than 10% of control reflects the inhibition of the active transport pathway of Na^+ and K^+ through principal cells as transepithelial electrolyte and fluid secretion come to a halt. What astonishes is the absence of simple K^+ and Na^+ diffusion potentials across the cell membranes of principal cells in the presence of DNP, which was further explored in principal cells of Malpighian tubules using two-electrode voltage clamp methods (TEVC). DNP, fluoride and cyanide (CN^-) had similar effects, but only the effects of CN^- are presented here. CN^- (0.3 mM) immediately (and reversibly upon washout) depolarized the intracellular voltage of principal cells (V_{pc}) from -84.4 to -9.4 mV and increased cell resistance (R_{pc}) from 408 to 3130 KΩ. **Barium (5 mM), a** blocker of K^+ channels, hyperpolarized V_{pc} from -86.8 to -101.1 mV and increased R_{pc} from 408 to 716 KΩ **(reversibly). Bafilomycin (100 µM), which blocks the proton** channel of the vacuolar H^+-ATPase, depolarized V_{pc} from -86.8 to -14.0 mV and increased R_{pc} **from 344 KΩ to 474 KΩ. Thus, the metabolic blocker** CN^- increases R_{pc} nearly 700%, but conventional blockers of K^+ channels and proton pumps increase R_{pc} only 76% and 37% respectively. The discrepancy points to major ATP-dependent electrogenic transport systems in addition to the vacuolar H^+-ATPase. These ATP-dependent transport systems, channels and electrogenic carriers, may be present in the basolateral and apical membrane of principal cells. (NSF IBN 9604394)

Index terms: metabolic inhibition, principal cells, ATP-dependent transport, cyanide, barium, bafilomycin.

[2466] VOLTAGE POLARIZATION OF THE BASOLATERAL MEMBRANE OF PRINCIPAL CELLS IN MALPIGHIAN TUBULES OF THE YELLOW FEVER MOSQUITO *AEDES AEGYPTI:* ROLE OF THE VACUOLAR H^+-ATPASE AT THE APICAL MEMBRANE

R. Masia & K. W. Beyenbach, Dept. of Biomedical Sciences, Cornell University, VRT 8014, Ithaca, NY 14853, USA, E-mail kro1@cornell.edu.

The mechanisms of K^+ and Na^+ entry from the peritubular bath into principal cells of Malpighian tubules of the yellow fever mosquito was studied in single principal cells with the methods of two-electrode voltage clamp (TEVC). In the presence of normal Ringer solution in the peritubular bath, the intracellular voltage of principal cells (V_{pc}) was -86.9 mV and cell resistance (R_{pc}) was 408 KΩ **(n=23). The addition of 5 mM** Ba^{2+} to the peritubular Ringer significantly increased R_{pc} to 716 KΩ, **indicating entry of** K^+ into the cell via Ba^{2+}-sensitive K^+ channels. However, Ba^{2+}-block of these K^+ channels significantly hyperpolarized V_{pc} to -101.1 mV. This response is opposite to the effect of Ba^{2+} in Malpighian tubules of ants (Weltens, Cell Physiol. Biochem. 2, 101, 1992) and most other eucaryotic cells, where diffusion of K^+ out of the cell is the major source of the membrane voltage, and where the block of K^+ conductance depolarizes the membrane voltage towards zero. With K^+ channels blocked by Ba^{2+}, the addition of di-butyryl cAMP (db-cAMP, 0.1 mM), significantly depolarized V_{pc} to -53.2 mV and significantly decreased R_{pc} to 510 KΩ, **confirming the increase in basolateral membrane** Na^+ conductance (Am. J. Physiol. 248, R339, 1985). This Na^+ conductance derives from apparently basolateral membrane Na^+ channels that have low affinity for amiloride, because amiloride at a concentration of 0.1 mM failed to block the effects of db-cAMP. A 10-fold higher amiloride concentration fully reversed the effects of db-cAMP on R_{pc} (765 KΩ), **and it significantly increased** V_{pc} from -53.2 mV to -71.0 mV (akin to the block of K^+ channels by Ba^{2+}). The hyperpolarization of V_{pc} after block of basolateral membrane K^+ channels indicates that the essential polarizing component of this membrane is not a K^+ diffusion potential, but rather the electrogenic vacuolar H^+-ATPase (proton pump) located in the apical membrane. Active H^+ transport into the tubule lumen polarizes the apical membrane (cell negative) with respect to the luminal fluid to values in excess of 110 mV. Current returning from the lumen to the cytoplasmic side of the proton pump, via the shunt and the basolateral membrane, couples the electrical potential of the apical membrane to the basolateral membrane, where it provides the electromotive force for the entry of K^+ and Na^+ into the cell. (NSF IBN 9604394)

Index terms: vacuolar H^+-ATPase, energizing cell membranes, principal cells, electrical coupling, voltage-driven K^+ and Na^+ entry.

[2467] CELL DIFFERENTIATION OF THE FOLLICULAR EPITHELIUM IN STICK INSECT OVARIOLES

M.Mazzini[1], A.M.Fausto[1] & F. Giorgi [2], [1]Dept. of Environmental Sciences, Tuscia University, 01100 Viterbo, Italy, E.mail mazzini @unitus.it; [2]Dept. of Human Morphology, University of Pisa, 56126 Pisa. Italy.

Panoistic ovarian follicles in insects are comprised of only two cell types: the oocyte itself and an enveloping follicular epithelium. During vitellogenesis, the oocyte incorporates the hematic yolk precursor or vitellogenin (Vg) from the maternal hemolymph by a process of receptor mediated endocytosis. Follicle cells participate in this process by capturing Vg within the intercellular spaces of the follicular epithelium. We have recently demonstrated that a fat body derived protein of 85 kDa is selectively sulphated within the follicle cells and apparently accumulated in the follicular interspaces to interact with Vg prior to endocytic uptake in the oocyte. A number of evidence has demonstrated that the 85 kDa fat body derived protein is sulfoconjugated during transit in the follicular epithelium. To accomplish this goal it has to be taken up endocytically at one end of the follicle cells and be transferred transcytotically at the opposite pole for an exocytic release. Laser confocal analysis has clearly demonstrated that while Vg is restricted to the intercellular spaces of the follicular epithelium, the 85 kDa sulfoconjugated protein can be localized both extra- and intracellularly within the follicle cell cytoplasm. In addition, evidence by high resolution autoradiography and gold immunocytochemistry has clearly shown that endocytic vesicles take up the 85 kDa protein at the apical end of the follicle cells, transfer it to the Golgi apparatus and eventually convey it at the basal pole through exocytic vesicles. To allow transcytotic transfer of sulfoconjugated proteins, follicle cells have to be highly polarized. We have demonstrated this by studying how the cytoskeleton is modified during vitellogenesis. In particular actin filaments are predominantly localized along the basal pole while microtubules are preferentially distributed along the apical pole of the follicle cells. The significance of these observations are discussed in relation to the role receptor mediated endocytosis.

Index terms: *Carausius morosus*, transcytosis, cytoskeleton, confocal laser microscopy

[2468] FLIGHT INDUCED LIPID MOBILIZATION AND ENHANCED REPRODUCTION IN *MELANOPLUS SANGUINIPES*

K.J. Min & M. A. Rankin, Integrative Biology Section, School of Biological Science, Univ. of Texas, Austin, TX 78712, USA, E-mail minkj@mail.utexas.edu.

One way of possible stimulation of the endocrine system by flight in grasshopper, *Melanoplus sanguinipes*, was examined. It is known that long flight accelerates oogenesis in this species. One possible mechanism of accelerated reproduction is via lipid delivery to the ovary during and (or) after flight. Lipid is mobilized by adipokinetic hormone into hemolymph during flight and could be available to ovary. The lipid content of eggs was examined after flight. The lipid content of eggs of long-fliers that flew to voluntary cessation (LF-E), was lower than that of non-fliers (NF) or hoppers flown to one hour (LF-1). The carbohydrate content of eggs was also lower in long fliers than non-fliers and there was no difference in protein content in eggs. This indicates that accelerated oogenesis is not by action of lipid delivery. However, when the number of eggs in each individual first egg pod was examined, that of long-fliers flown to voluntary cessation was higher than that of non-fliers and long-fliers flown to one hour. Because it is known that the grasshopper uses only a small portion of its lipid reserve during flight to voluntary cessation, reduced lipid content in eggs of long duration flier is probably not due to depleted lipid reserve. Instead it seems that more eggs are produced having less nutrient per egg, possibly due to accelerated oogenesis or oviposition after long flight. Thus it seems that accelerated reproduction is unrelated to lipid mobilization, but may be due to other endocrine change during flight. This possibility is under investigation.

Index terms : grasshopper, migration, egg, lipid

[2469] OXYGEN RADICAL METABOLISM IN *DROSOPHILA MELANOGASTER*

F. Missirlis & H. Jäckle, Dep. of Molecular and Developmental Biology, Max-Planck-Institut für biophysikalische Chemie, Am Fassberg 11, Göttingen 37077, Germany, E-mail fmissir@gwdg.de.

Reactive oxygen species (ROS) in cells are formed in response to high oxygen levels. They cause lipid peroxidation, DNA damage and protein modifications, referred to as oxidative stress. Insects, like all aerobic organisms, possess antioxidant enzymes which protect the cells against the toxicity of ROS. We use *Drosophila melanogaster* as a model system to investigate the function of the antioxidant enzymes superoxide dismutase (SOD), catalase (Cat), glutathione peroxidase (Gpx) and glutathione reductase (Gr) in vivo, and we address the role of ROS. We have cloned *Drosophila* homologues of Gpx and Gr. We have examined the expression profile of the enzymes SOD, Cat, Gpx and Gr, which are thought to function in all cells. We found that they are expressed in spatially restricted patterns during embryogenesis. We have also generated transgenic flies, by P-element-mediated transformation, bearing an extra copy of the *gpx1* locus. Homogenates from transgenic flies showed increased Gpx activity. These flies were found to be more resistant to acute oxidative stress (feeding with paraquat; exposure to 100% O_2 levels) than the wild type controls. Similar results were obtained in response to transgene-derived overexpression of Gpx1 from a *gpx1* cDNA that was placed under the control of an inducible promoter. In contrast, Gpx1 overexpression in SOD mutants caused lethality. SOD null mutants are semilethal, i.e. only 20% of the flies hatch from the pupal case. However, if such mutants carry an extra copy of *gpx1*, they fail to hatch. Possible explanations of these phenomena will be discussed.

[2470] INFLUENCE OF DIFFERENT AGES OF FISH PUTREFACTION ON THE POST EMBRIONIC DEVELOPMENT OF *LUCÍLIA CUPRINA* (WIED. 1830) (DIPTERA:CALLIPHORIDAE) UNDER LABORATORY CONDITIONS.

G. E. Moya Borja[1], L. G. Brito[1], M. J. Paes[2], M. P. Castelo Branco[1], A. Chaaban[1] & A. C. Arnaut[1], [1]Dept.of Animal Parasitology, Univ. Fed. Rural of Rio de Janeiro, 23.851-970, RJ, Brazil, E-mail lgatto@ufrrj.br; [2] Dep. of Medicine Veterinary, ESAM, 59.629-900, RN, Brazil, E-mail paesmj@esam.br.

Lucília cuprina it is an important dipteran which has been recognized as a major myiasis blowfly of sheep in Australia In Brazil this insect can act as potential vector of pathogenic microorganisms which cause diseases in animals The objetive of this study was to compare the post-embryonic development of *L.cuprina* reared on sardine exposed for different periods under laboratory conditions. Sixty gm of sardine was exposed at 2, 24, 48, 72 or 96 hours at 25ºC before inoculating with 30 newly first instar larvae. Each treatment was replicated four times. Each mature larvae was weighted and placed in one test tube containig humid vermiculite to stimulate the pupation. After the emergence of the adults they were sexed The data indicated that larval period in the diferent diets was around 7 days. The larval weight from sardine exposed during 72 and 96 hours were significantly lighter than the weight of the larvae reared on sardine exposed to 2, 24 and 48 hours. The sexual ratio was close to 1:1.

Index terms: Sheep blow fly,diet, sardine

[2471] HOMEOSTASIS AND PHYSIOLOGY ON VITAMIN B_2 OF THE SILKWORM, *BOMBYX MORI*

M. Nakamura, Dept. of Sericulture, National Inst. of Sericultural and Entomological Sci., 1-2 Ohwashi Tsukuba Ibaraki 305-8634 Japan, E-mail nakamura@nises.affrc.go.jp.

The effects of lack of vitamin B_2 on the growth and physiology of the silkworm was examined. When silkworm larvae were reared on a vitamin B_2 deficient diet, their growth retarded gradually whereas the total vitamin B_2 content in larval body was decreased rapidly. This decrease was mostly due to the fall of riboflavin content; FAD and FMN, the coenzyme forms of vitamin B_2, changed in content only slightly. There were no changes in activity of xanthine dehydrogenate that requires FAD for coenzyme. A large amount of riboflavin was accumulated in the Malpighian tubules but this almost disappeared when the larvae were reared on a vitamin B_2 deficient diet. When the supply of vitamin B_2 to the larvae is deficient, riboflavin accumulated in the Malpighian tubules may act as a pool for the homeostasis of FAD and FMN. The activity of flavokinase that catalyzes the formation of FMN from riboflavin was found to be high in the Malpighian tubules. This enzyme, therefore, would play a part in the incorporation of riboflavin into the Malpighian tubules. As the activity of flavokinase was also high in the midgut, it may function during the ingestion of vitamin B_2 from diet. When larvae were reared on a vitamin B_2 deficient diet from the beginning of the 3rd instar, the activities of flavokinase in the midgut and Malpighian tubules at the 5th instar were higher than the control. The increased activity possible favors the increased supplement of the coenzymes forms of vitamin B_2. Since there was no changes in flavokinase activity when larvae were reared on a vitamin B_2 deficient diet from the beginning of the 5th instar, so that the coenzyme forms will be supplied from a riboflavin pool by the increased flavokinase activity only in the serious shortage of vitamin B_2.

Index terms: *Bombyx mori*, riboflavin, flavokinase, Malpighian tubules

[2472] JH BIOSYNTHESIS BY CORPORA ALLATA IN *LOCUSTA MIGRATORIA* AND *SCHISTOCERCA GREGARIA* ON ARTIFICIAL DIET

S. Nakamura[1] & T. Okuda[2], [1]International Centre of Insect Physiology and Ecology (ICIPE), P. O. Box 30772, Nairobi, Kenya, E-mail snakamura@icipe.org; [2] National Institute of Sericultural and Entomological Science, 1-2 Ohwashi, Tsukuba, Ibaraki, Japan 305-8634

Ovarian development is arrested for about a month in long day-length and crowded conditions, while short day-length and crowded or long day-length and isolated conditions can prevent reproductive arrest in *L. migratoria* Tsukuba strain (Tanaka et al., 1993). When reared on artificial diet, ovarian maturation was delayed by 5 to 7 days compared with those on fresh leaves in *L. m. migratorioides*, indicating that factors such as photoperiod, population density and diet may modulate rate of reproductive development in *L. migratoria*. Isolated corpora allata (CA) from reproductively inactive females kept in long day-length conditions produced more JH in vitro than those from reproductively active ones maintained in a short day-length environment, and we found that allatostatic factors in the brain were involved in this paradoxical result (Okuda et al, 1996). Similarly, the rate of JH biosynthesis by the CA from reproductively active females on fresh leaves was consistently lower than reproductively less active ones on artificial diet. We found similar CA regulation occurring in *L. m. migratorioides*. It seems that adverse environmental conditions for reproduction or growth of the progeny, i.e. high population density and inferior quality artificial diet decelerated actual JH production by the CA due to allatostatic factors but the potential of the CA to produce JH was substantially enhanced. This is why the relationship between JH biosynthesis by the CA in vitro and ovarian development was negative. We also investigated JH biosynthesis by CA on different diets in *S. gregaria* and found that CA regulation by the brain was different to that in *L. migratoria*.

Index terms: JH biosynthesis, reproduction, *Locusta migratoria*, *Schistocerca gregaria*, artificial diet.

[2473] LIPID CONTENT IN MASS-REARED MEDFLIES

D. Nestel[1] & K. Fisher[2], [1]Institute of Plant Protection, Agricultural Research Organization, Ministry of Agriculture, Israel, E-mail: nestel@netvision.net.il. [2]International Atomic Energy Agency Laboratories, Entomology Unit, Seibersdorf, Austria

The present study investigated the relationship between male Medfly pupal size and lipid content of newly emerged adults, as a first step to evaluate the quantification of lipids as an indicator of quality in mass-produced flies. The study was conducted on a temperature-sensitive-lethal strain (*tsl*) originating from a mass-rearing facility. The results show that adult dry and fresh weights increase linearly with pupal size, although indications for a saturation in weight levels with higher pupal size was inferred from the fitting of the data to quadratic functions. Lipids also increase with pupal size up to a certain level, and then stabilize with higher pupal sizes. The physiological mechanisms leading to such a lipid pattern are discussed. We also conclude that current knowledge does not allow us to speculate on the advantages or disadvantages to the fly of the observed lipid patterns.

[2474] MODALITY-SPECIFIC PROJECTIONS OF ANTENNAL SENSORY AFFERENTS IN THE COCKROACH BRAIN

M. Nishikawa, T. Itoh & F. Yokohari, Div. of Biology, Dept. of Earth System Science, Fac. of Science, Fukuoka Univ., Fukuoka 814-0180, Japan.

The antennae of insects bear a great variety of sensilla, each of which contains one to several sensory neurons. Olfaction, contact chemoreception, mechanoreception, thermoreception and hygroreception are well known modalities for antennal sensilla. Based on the outer structures, the antennal flagellar sensilla are classified into six types in the cockroach, *Periplaneta americana*. The chaetic sensillum is a large bristle, which has mechanosensory or contact chemosensory modalities. The marginal sensillum forms a plate-like depression of the antennal surface without hair-like structure and contains a mechanosensory neuron. The trichoid sensillum has perforations on the distal part and ridges on the base of the cuticular structure, and contains olfactory neurons. The p-basiconic sensillum has pored cuticular structure and contains olfactory neurons. The g-basiconic sensillum has grooved cuticular structure and contains olfactory and thermosensory neurons. The capitular sensillum has a cap-like structure on its tip and no-pore cuticular structure, and contains hygrosensory and thermosensory neurons. These sensory afferents project into the deutocerebrum of the brain, which is the primary processing center for the antennal sensory information, and consists of the antennal lobe and the dorsal lobe. The antennal lobe is a highly compartmentalized neuropil in which there are approximately 125 glomeruli in *Periplaneta*. Each glomerulus contains axon terminals of antennal sensory neurons, branches of local interneurons, dendrites of deutocerebral projection neurons and processes of centrifugal neurons. Studies on antennal sensory neurons and deutocerebral interneurons for the female sex pheromone in some insect species suggest that glomeruli in the antennal lobe are functionally specialized. On the other hand, the dorsal lobe is a non-glomerular neuropil and is thought to be the projection area for mechanosensory neurons of the antennal pedicel and scape so far. However, individual projections of antennal mechanosensory neurons and specific regionalization in the dorsal lobe have not been revealed yet. We examined the central projection of the antennal sensory neurons by using extracellularly filling of dyes from antennal sensilla. Our results suggest that a new partitioning exists in the antennal lobe for the thermo- and hygroreception. We will discuss that the modality specific regionalization in the deutocerebrum as a primary processing center for olfaction, contact chemoreception and mechanoreception.

Index terms: cockroach, antennae, sensilla, insect brain, glomeruli.

[2475] ON THE EVOLUTION OF CASTE DIMORPHISM IN THE EPIPONINE WASPS: A PHYLOGENETIC PERSPECTIVE

F. B. Noll[1,2] & R. Zucchi[1], [1]Departamento de Biologia, Faculdade de Filosofia Ciências e Letras de Ribeirão Preto - Universidade de São Paulo, 14040-901 Ribeirão Preto – SP, Brazil, E-mail: fernnoll@usp.br. [2]Financial support: Fapesp nº. 95/09226-1.

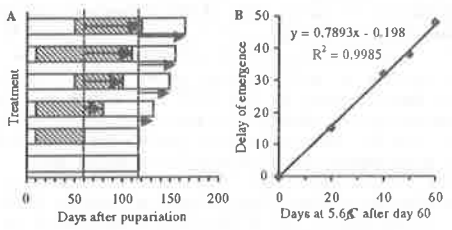
In the social insects, the degree to which castes are specialized behaviorally, physiologically and morphologically is a measure of the level of sociality achieved by a taxon. To study the diversity of such aspects, the swarm-founding polistine wasps are very helpful because the caste differences so far known can be arranged along a spectrum ranging from taxa in which queens and workers are externally similar, to others with quite distinct caste attributes. In the independent-founding polistines, queens tend to be among the larger individuals, but there is no definite evidence of morphological caste differences. Among the swarm-founding wasps, however, there is a continuum, from species in which there is no size or morphological differences between queens and workers to species in which queens show discontinuous size differences in relation to workers. Neotropical swarm founding epiponine wasps are characterized by high variation concerning colony size and morphological differentiation between castes. According to Richards (1978), there are at least three groups of morphological caste differences: 1-Conspicuous size and allometric differences present, with queens larger than workers; 2-Conspicuous dimorphism present, with queens smaller than workers; 3- Morphological differences slight or indistinct and ovary-developed workers can be found. We analyzed the morphological differences between queens and workers in twenty six different species of epiponines using eight measurements of head, thorax, abdomen and wing, associated with analyses of ovary development and insemination. Not just three types of caste differences but five types of syndromes were found in epiponines. These data were used as a data matrix (11 characters and 26 taxa) for a cladistic analysis. Patterns found in the consensus tree are quite similar to previously published phylogenies. The combination of caste difference data and other kinds of data (adult and immature morphology and nest architecture) reinforces the idea that at least five different types of social regulations can be determined and they will preliminary discussed.

Index terms: Hymenoptera, Vespidae, Epiponini, social insects, caste differences

[2476] BIPHASIC EFFECT OF LOW TEMPERATURE ON COMPLETION OF WINTER DIAPAUSE IN THE ONION MAGGOT

M. Nomura & Y. Ishikawa, Lab. of Applied Entomology, Univ. of Tokyo, Tokyo 113-8657, Japan.

The effect of low temperature on completion of winter diapause was investigated in the onion maggot, *Delia antiqua* (Diptera: Anthomyiidae). Diapause was completed under constant diapause-inducing conditions of 15°C and 12L-12D, without any exposure to lower temperature. The pupal period for 50% adult emergence was 117 days. None of the cold treatments at 5.6°C examined in the present study advanced adult emergence; on the contrary, they delayed it. Detailed analyses of the results revealed that diapause development in *D. antiqua* comprises two phases which differ in sensitivity to low temperature, with the phase shift occurring at around day 60 at 15°C and 12L-12D. In the first phase of diapause development, low temperature (5.6°C) had no effect on diapause development. In the latter phase, by contrast, diapause development was retarded in proportion to the duration of cold treatment.



Index terms: *Delia antiqua*, diapause development, diapause completion.

A. Schematic representation of the effect of various cold exposures on the development of diapausing *D. antiqua* pupae. The right end of a bar indicates 50% adult emergence. The hatched area indicates the period of cold exposure. The arrows with thick shafts and those with thin shafts represent the days at 5.6°C after day 60 and the delay of adult emergence, respectively. **B.** Relationship between days at 5.6°C after day 60 and delay of adult emergence.

[2477] REGULATION OF JH LEVELS IN MOSQUITOES

F.G. Noriega[1,2], G.C.Unnithan[3,2], K.Edgar[1,2], R. Feyereisen[3,2], J. A.Veenstra[4] & M.A. Wells[1,2], [1]Dept. of Biochemistry, Univ. of Arizona, BSW 440, Tucson, AZ 857, USA, E-mail fnoriega@u.arizona.edu; [2] Center for Insect Science, Univ. of AZ, [3] Dept of Entomology, Univ. of AZ. [4]Lab. Neuroendocrinologie des Insectes, Univ. Bordeaux 1, Talence, France.

In adult female mosquito JH signals that ecdysis of the adult is complete and reproductive processes should begin, inducing simultaneously changes in the expression of many genes in different tissues. We have shown that JH plays an essential role in the transcriptional activation of the early trypsin gene in the *Aedes aegypti* midgut. The early trypsin gene is a remarkable "molecular marker", its expression is dramatically modified after blood feeding, and it is affected by both hormones and nutrients. We plan to use the expression of the early trypsin gene as a paradigm to investigate the nutritional regulation of JH levels. The ultimate goal of this project is to understand how changes in the nutritional status are assessed, and this information is transduced to coordinate post-feeding physiology. In this presentation we are focussing on the nutritional regulation of juvenile hormone levels. Our hypothesis is that the midgut can detect the nutritional status, and regulates the JH levels by affecting the activity of the corpora allata. This regulation could be mediated directly or indirectly by midgut peptides synthesized by the endocrine cells and released into the hemolymph. In summary, in order to define how JH levels are regulated after a blood meal; we are studying the nutritional control of JH levels, and the regulatory role of the midgut peptides.

Index terms: *Aedes aegypti* , Juvenile Hormone, allatoregulatory peptides

[2478] A NEW COMPONENT OF THE PROPHENOLOXIDASE CASCADE, ß-1,3-GLUCAN RECOGNITION PROTEIN II FROM THE SILKWORM, *BOMBYX MORI*

M. Ochiai & M. Ashida, Biochem. Lab., The Inst. of Low Temp. Sci., Hokkaido Univ., Sapporo 060-0819, Japan. E-mail ochiai@orange.lowtem.hokudai.ac.jp.

Recognition of non-self molecules such as ß-1,3-glucan, peptidoglycan and lipopolysaccharide on the surface of invading microorganisms is important for self-defense. The ß-1,3-glucan recognition protein (ßGRP) of the silkworm is an essential component of the prophenoloxidase cascade that represents an important defense mechanism in invertebrates of many species. The ßGRP specifically binds to ß-1,3-glucan, a component of fungal cell wall, and is considered to be one of pattern-recognition proteins in the innate immunity of insect. We purified a protein homologous to the ßGRP from hemolymph of bacteria-challenged silkworms, cloned the cDNA, and named it ßGRP II. The purified ßGRP II bound to curdlan (insoluble ß-1,3-glucan) and participated in the activation of prophenoloxidase cascade by ß-1,3-glucan. The ßGRP II mRNA is constitutively expressed in the hemocytes, fat body, and epithelial cells of naive silkworm, and furthermore, a bacterial or yeast challenge intensified the expression of the transcription. These results indicate that the ßGRP II is a new component of the prophenoloxidase cascade and is an inducible acute phase protein that is implicated in the immune response of insect. The amino acid sequence that was deduced from the ßGRP II cDNA has a putative signal sequence of 23 amino acid and a mature protein consisting of 466 amino acid residues. The N-terminal region (Tyr^{1} – Asn^{102}) of ßGRP II shows 82.3 % identity and 91.2 % similarity with the binding domain of ßGRP for ß-1,3-glucan. A bacterial ß-1,3-glucanase like region in the central portion of the ßGRP II has a sequence significantly similar to the corresponding parts of ßGRP, gram-negative bacteria binding protein of the silkworm, coelomic cytolytic factor 1 of the earthworm and factor G of the horseshoe crab coagulation cascade. Pattern recognition proteins containing glucanase like region seem to have developed from a common origin and constitute a novel family for the recognition of invading microorganisms in the innate immunity of invertebrate.

Index terms: innate immunity, pattern recognition, ß-1,3-glucan, prophenoloxidase cascade, *Bombyx mori*

[2479] TWO FAMILIES OF CHLORIDE CHANNELS IN APICAL MEMBRANE PATCHES OF STELLATE CELLS OF MALPIGHIAN TUBULES OF THE YELLOW FEVER MOSQUITO *AEDES AEGYPTI*

K. O'Connor & K. W. Beyenbach, Dept. of Biomedical Sciences, Cornell University, VRT 8014, Ithaca, NY 14853, USA, E-mail krol@cornell.edu.

Previous studies have shown that during leucokinin-VIII-stimulated diuresis, Cl^- moves from the hemolymph to the tubule lumen either through paracellular septate junctions in *Aedes* Malpighian tubules (Pannabecker et al., J. Membr. Biol. 132, 63, 1993) or through stellate cells in *Drosophila* Malpighian tubules (O'Donnell et al., Am. J. Physiol. 274, R609, 1998). The apical membrane of Malpighian tubules of the yellow fever mosquito, *Aedes aegypti*, was exposed by hand-dissection, and patches of stellate cells were studied in the excised, inside-out configuration. The most frequently observed Cl^- channel has a conductance of 27 pS and a high open probability and dwell time. This channel is blocked by DPC, 9-AC and niflumic acid from the intracellular (bath) side. SITS and DIDS were not effective blockers. Multiple channels of this type were often observed in the same patch (up to five in pipettes with 10-20 **MΩ resistance), suggesting high channel density.** The second Cl^- channel has a conductance of 5 pS, a low open probability and dwell time and a very high selectivity for chloride. Leucokinin-VIII is thought to open the chloride pathway via Ca^{2+} serving as a second messenger (Cady & Hagedorn, J. Insect Phsyiol. 45, 327, 1999). For this reason, bath Ca^{2+} was eliminated. Yet this maneuver did not appear to have an effect on Cl^- channel activity. Since these channels were highly active in excised patches under control conditions, it is possible that excising the membrane dissociates the channels from their regulatory constituents. Hence it may not be possible to directly link these Cl^- channels to leucokinin-VIII-induced Cl^- secretion using excised membrane patches. Finding a high density of Cl^- channels in apical membrane patches of stellate cells in *Aedes aegypti* supports the O'Donnell view of transcellular Cl^- movement during leucokinin-induced diuresis (Am. J. Physiol. 274, R1039, 1998). But stellate cells must also have Cl^- channels in the basolateral membrane in order to explain transepithelial Cl^- diffusion potentials that are symmetrical for lumen-to-bath and bath-to-lumen Cl^- gradients. In addition, Cl^- concentrations in the cytoplasm must rise and fall with extracellular Cl^- concentration in order to explain a shunt conductance that is dependent on the Cl^- concentration in both luminal and peritubular fluids (Pannabecker et al., J. Membr. Biol. 132, 63, 1993). Thus, it is unlikely, but not impossible, that stellate cells serve as the Cl^- shunt pathway under conditions of diuresis induced by leucokinin. (NSF IBN 9604394)

Index terms: leucokinin, stellate cells, calcium, shunt pathway, septate junctions.

[2480] LEPIDOPTERA ROLLERS AND *BYRSONIMA INTERMEDIA* RELATIONSHIP: THE ROLE OF SECONDARY METABOLITES AND NUTRICIONAL STATUS

Y. Oki[1] & E. M. Varanda[1], [1]Setor de Botânica, Dep. de Biologia, Fac. de Filosofia , Ciências e Letras de Ribeirão Preto, Univ. de São Paulo, Av. Bandeirantes 3900, Ribeirão Preto, SP, CEP 14050-230, Brazil, e-mail yumioki@usp.br, emvarand@usp.br.

The Brazilian Cerrado presents a great variety of Lepidoptera species; however, information concerning their larvae plant hosts lacks. The present work was developed at Área de Relevante Interesse Ecológico (ARIE) – Cerrado Pé-de-Gigante, located in Santa Rita do Passa Quatro, SP, Brazil, where several lepidoptera species can be found, mainly the Oecophoridae, Pyralidae, Riodinidae, Lycaenidae, Notoctuidae, Tortricidae and Gelechiidae families. Various species build shelters using leaves where larvae end their life cycles. One of the objectives of this work was to study the relations between herbivory by lepidoptera leaf rollers and the total contents of nitrogen, water and tannins in the leaves of *Byrsonima intermedia* (Malpighiaceae). The larval food preference and its relation to leaf nutritional quality was determined in bioassays. The research shows that immature leaves inside the rolls present a low concentration of tannins (14% dw) compared to immature leaves totally exposed to sunlight (40% dw), but there were no differences in water or nitrogen content between these leaf groups. The results of the bioassays using *Cerconata achantina* showed that larvae prefer immature leaves (15 to 30 days old) exposed to less than 5% of total light incidence inside roll condition rather than those exposed to total light incidence outside roll condition. The herbivory level in immature leaves inside the rolls was more than 50% while in leaves outside the rolls, it was less than 5%. The results from lepidoptera leaf rollers show that these leaf shelters increase the leaf nutritional quality inside the rolls, which is related to the low content of tannins, compounds considered as defenses against insects since they cause protein precipitation. The rolls can also provide protection against desiccation, predators and parasites.

Index terms: nutritional preference, Oecophoridae, tannin, bioassays, nutritional quality, immature leaves, shelter, Cerrado

[2481] SIGNIFICANCE OF TERATOCYTES AS A SOURCE OF NUTRIENTS□FOR DEVELOPING LARVAE OF 3 SPECIES OF EUPHORINE PARASITOIDS OF THE ADULT HOSTS

T. Okuda[1], B. I. P. Barratt[2] & S. Knutelski[3], [1]National Institute of Sericultural and Entomological Science (NISES), 1-2 Ohwashi, Tsukuba, Ibaraki, Japan 305-8634, [2]AgReserach, Invermay Agricultural Centre, Private Bag 50034, Mosgiel, New Zealand, [3]Institute of zoology, Jagiellonian University, Ingardena 6, 30-060 Krakow, Poland

Teratocytes of euphorine parasitoid, *Dinocampus coccinellae* synthesize a major polypeptide with molecular weight of 540 kD and play an important role in supplying nutrients for developing parasitoid larvae in the adult host, *Coccinella septempunctata* (Okuda and Kadono-Okuda, 1995). The hypertrophied teratocytes may provide safe nutrition to parasitoid larvae because not only tissues but also hemolymph of the host coccinellids contain toxic alkaloids. The hypertrophy of teratocytes may also be related to the fact that larvae and adults store nutrients in different ways. Insect larvae store protein reserves in the hemolymph, so that parasitoid larvae in larval host should have easy access to protein nutrients. However, adult hosts store nutrients in fat body and consequently *Dinocampus* parasitoid larvae rely on the teratocyte-specific protein accumulated in the teratocytes. This hypothesis was tested with 2 species of euphorine parasitoids, *Microctonus aethiopoides* and *Microctonus hyperodae* which attack adult weevil hosts. We investigated changes in protein content in the tetatocytes and in parasitoid larvae during parasitism, and characterization of the teratocyte proteins. In both *Microctonus* wasps teratocytes accumulated nutritive proteins and became hypertrophic. The parasiotid larvae consumed the teratocyes resulting in an abrupt increase in growth in the last instar.
Index terms: host-parasitoid relationship, *Dinocampus*, *Microctonus*

[2482] PHYSIOLOGICAL RESPONSES OF COLORADO POTATO BEETLE AND BEET ARMYWORM LARVAE TO ANTISENSE-MEDIATED DEPLETION OF WOUND-INDUCIBLE PROTEINASE INHIBITORS IN POTATO

F. Ortego[1], C. Novillo[1,2], J. Sánchez-Serrano[3] & P. Castañera[1], [1] Dpto. de Biología de Plantas, Centro de Investigaciones Biológicas, CSIC, Velázquez 144, 28006 Madrid, Spain. [2] Monsanto España, S.A. División Agricultura, Avda. Burgos 17, 10[4], 28036 Madrid, Spain. [3] Dpto. de Genética Molecular de Plantas, Centro Nacional de Biotecnología, CSIC, Campus Cantoblanco Universidad Autónoma de Madrid, 28049 Madrid, Spain.

In a previous study, we have shown that larvae of Colorado potato beetle (CPB), *Leptinotarsa decemlineata*, and beet armyworm (BAW), *Spodoptera exigua*, reared on potato plants in which wound-inducible proteinase inhibitors were largely reduced through antisense-mediated depletion of a specific lipoxygenase (LOX H3) had significantly larger weight gain than those fed on non-transformed plants. As such, in continuation of our study, we report here on the differences in the digestive physiology of CBP and BAW larvae feeding on antisense-mediated LOX-H3-deficient potato plants or on its corresponding isogenic plants (var. Desiree). Midgut extracts from CBP larvae fed on non-transformed potato had significantly higher levels of proteolytic activities than those feeding on LOX-H3-deficient plants. However, apart from a putative cysteine-like proteinase that is only present in midgut extracts from CPB larvae feeding on antisense plants, no other qualitative changes in gelatin-containing SDS-PAGE gels were detected. Furthermore, none of the most important endo and exoproteolytic activities in CPB larvae were inhibited by leaf extracts from transgenic and isogenic potato plants, independently of the plant that they fed on. Taken together, these data suggest that CPB, a leaf-feeding specialist of solaneceous plants, is adapted to the inducible proteinase inhibitors in potato, but the metabolic cost associated with the hiperproduction of digestive proteases may be responsible of the 12-30% lower weight gain of larvae fed on wild-type plants. On the contrary, BAW larvae fed on non-transformed potato showed a significant reduction in the endoproteolytic activities and an increase of leucine aminopeptidase- and carboxypeptidase A-like activities compared to those of insects fed on LOX-H3-deficient plants. In addition, most digestive proteases of BAW larvae fed on both transgenic and isogenic plants were susceptible to inhibition by leaf extracts from wild type plants, whereas a smaller inhibition was obtained with extracts from LOX-H3-deficient plants. These results suggest that the poorer performance of BAW larvae fed on non-transformed plants (57% lower weight gain) might be due to its high susceptibility to the inducible chemical weaponry of potato. Indeed, despite the induction of exopeptidases, the larvae of this generalist herbivore were unable to overcome the accumulation of proteinase inhibitors that may interfere with digestibility of the ingested food
Index terms: *Leptinotarsa decemlineata*, *Spodoptera exigua*, LOX-H3, proteases

[2483] THE DESIGN AND APPLICATION OF AN ACTIGRAPH TO STUDY THE CIRCADIAN RHYTHM OF THE DUMP FLY, *HYDROTAEA AENESCENS*

G. S. Paulson, M. Marisic, M. Kauffman, N. Bossart, C. Kanesiger, A. Smith, T. Schaefer, A. Armstrong[1], Dept. of Biology; Dept. of Physics[1]; Shippensburg Univer.; Shippensburg, PA, 17257, USA

The circadian rhythm of the dump fly was recorded using an actigraph that we produced and developed. The actigraph records insect activity by using a trigger mark system consisting of seven infrared emitters with lenses and their corresponding receptors. The receptors are connected to a Mac SE Macadios Analog to Digital converter computer. The computer records each time one of the receptors is blocked due to movement of a test organism. The data was compiled and summarized through the use of programs we developed and analyzed using Igor Pro. The endogenous cycle of the dump fly is described as are the results of entraining experiments.
Index terms: Zeitgeber, Entrainment, Free-running rhythm, Behavior

[2484] EVIDENCE FOR A CATECHOL-β-ALANYL LIGASE IN INSECTS

M. Pérez, P. Wappner & L. A. Quesada-Allué, Instituto de Investigaciones Bioquímicas, (Fundación Campomar, CONICET and University of Buenos Aires), Patricias Argentinas 435, Bs Aires (1405), Argentina. E-mail: lualque@iib.uba.ar.

The presence of sclerotization precursors in the cuticle, namely N-β-alanyldopamine (NBAD), N-acetyldopamine (NADA) and N-β-alanylnorepinephrine (NBANE) has been described in a number of insects. We recently studied the biosynthesis of N-β-alanyldopanine (NBAD) by insect integument. This is the main catecholamine conjugate involved in the brown tanning of *Ceratitis capitata* puparium. We have analyzed the properties of the enzyme responsible of NBAD synthesis, NBAD synthase and found that it is difficult to characterize due to unstability at temperatures higher than –65 ^{0}C. We demonstrate here that the same insect epidermis preparations containing the NBAD synthase was able to synthesize NBANE when incubated with Norepinephrine (NE) and β-alanine. From different kind of evidences like kinetics data, heat-denaturation assays and absence of both activities in the melanic mutants *Ceratitis capitata niger* and *Drosophila melanogaster ebony*, it seems that the same protein might be responsible for the synthesis of both substances NBAD and NBANE. Thus pointing to the possibility of an enzyme of broad specificity, that we should call catecholamine-β-alanine-ligase (CBAL), being capable of processing alternative substrates. Other enzymes of the catecholamine pathway like the aromatic aminoacid decarboxylase and the catechol N-acetyltransferase show similar unspecificity. The only reported enzyme having catalytic characteristics related to CBAL is the mammalian carnosine synthase, that conjugates β-alanine with histidine. We tested our insect extracts aiming at synthesizing carnosine (β-alanine-histidine) and so far negative results were obtained in several conditions. Moreover, preliminary results show that the CBAL activity might be present in neural tissue where the unknown physiological role of the synthesized products must be completely different from the one in cuticle sclerotization .
Index terms: *Ceratitis capitata*, metamorphosis,catecholamines, sclerotization

[2485] QUANTIFICATION AND UTILISATION OF INSECT GROWTH IN BIOASSAY OF INSECT GROWTH INHIBITOR

A. D. Permana, Department of Biology, Institut Teknologi Bandung, Ganesa 10, Bandung 40132, Indonesia. e-mail : agus@bi.itb.ac.id

Studies of the effect of allelochemicals or other insect growth regulator on the development of insect are difficult using parameter currently employed. By measuring the effect growth-inhibiting of seed crude extract of : *Annona muricata*; *Azadirachta indica*; and leaf crude extract of *Lantana camara* on the *Heliothis armigera* larvae, growth index (GI) and relative growth index (RGI) calculation are demonstrated in this paper.
Index term: Growth Index, Relative Growth Index, *Annona muricata*, *Azadirachta indica*, *Lantana camara*, *Heliothis armigera*.

[2486] CLONING AND LOCALIZATION OF AQUAPORIN AND G PROTEIN-COUPLED RECEPTORS FROM THE MOSQUITO *Aedes aegypti* (DIPTERA) MALPIGHIAN TUBULE

P. V. Pietrantonio & C. Jagge, Dept. of Entomology, Texas A&M University, College Station, TX 77843-2475, USA, E-mail p-pietrantonio@tamu.edu.

In insects, homeostatic maintenance of the internal milieu depends on the control of excretion, mainly performed by the Malpighian tubules, hindgut and rectum. Adults of the yellow fever mosquito (*Aedes aegypti*, Diptera, Culicidae) have five structurally similar and functionally homogeneous Malpighian tubules, about 3.5 mm in length. The Malpighian tubule is composed of two cell types, the "principal" and "stellate" cells, respectively. Numerous hormone G protein-coupled receptors controlling diuresis are believed to be present in Malpighian tubules. The long-term goal of this research is to understand how various tissues communicate in the female mosquito to produce a diuretic response after/during a blood meal.
Water transport in highly permeable membranes occurs through water channels composed of proteins called aquaporins. Each water channel is composed of four aquaporin subunits. Little is known at the molecular level about how female mosquitoes achieve high rates of water movement in diverse tissues such as the salivary gland and the Malpighian tubule. No aquaporins have been yet reported from the mosquito *A. aegypti*. In order to investigate water movement in *A. aegypti*, we cloned an aquaporin from a female Malpighian tubule cDNA library and localized its mRNA by *in situ* hybridization. The aquaporin mRNA was not present in the Malpighian tubule epithelium, but instead was present in the tracheolar cells closely associated with the tubules. This finding suggests that the function of this aquaporin may be the removal of water from tracheolar ends to facilitate oxygen supply to the highly active epithelium of the Malpighian tubules.
Serotonin and leucokinins influence the rate of fluid secretion in Malpighian tubules. A full length-cDNA clone encoding a serotonin receptor and a partial cDNA fragment from a neuropeptide receptor were obtained from *Aedes* Malpighian tubule. Anti-peptide antibodies against the neuropeptide receptor fragment localized the protein in Malpighian tubules and hindgut by western blot. It is speculated that the neuropeptide receptor identified is the elusive mosquito leucokinin receptor. To our knowledge these are the first hormone G protein-coupled receptors identified from any mosquito species.
Index terms: serotonin, leucokinin, antibody, excretion, tracheoles

[2487] PARTIAL CHARACTERIZATION OF DIGESTIVE PROTEINASES FROM COFFEE BERRY BORER ADULTS (*HYPOTHENEMUS HAMPEI*)

D.P.R. Preciado [1] & A.J. Valencia [2], [1]Centro Nal. de Investigaciones de Café, Cenicafé, A.A 2427, Manizales, Colombia; [2]Depto. de Química, Univ. de Caldas, Calle 65# 26-10, Manizales-Colombia. A.A 275, E-mail: arnubio@emtelsa.multi.net.co.

The digestive tract of insects contains proteolytic enzymes, which participate in the digestive process. A detailed knowledge on the activity of these enzymes will enable the selection and assessment of different inhibitors that may be used in the design and development of strategies allowing the control of *Hypothenemus hampei*. In order to determine, the pH and optimum temperature of endogenous proteolytic activity, the isoenzymatic profile and the type of proteinase present in the digestive tract of this insect, 0.05g of freeze dried extract of adult borer were prepared with 500µl of different extraction solutions: water, 1% NaCl and buffer solutions 0.05M pH (3.0 - 6.0). The determination of the optimum pH was carried out by using buffing solutions of pH (1.5 – 4.5) 0.2M. The optimum activity temperature was assayed between 30° and 70°C. The type of digestive proteinase was determined by using Pepstatin A synthetic inhibitor in concentrations of 1µM, 5µM and 10µM. In all cases; the enzymatic activity was determined spectrophotometricaly at 280nm. The isoenzymatic profile was done in native gels of 16%. The results showed that the best extraction solution is buffer citrate pH 3.0, the optimum temperature is between 30° and 40°C. The proteinase found in the digestive tract was identified as an aspartic type Catepsin. In the zymogram, at least 3 well-defined bands of proteolytic activity were found two of which are present borer adults and in the intestines.
Index terms: Coffee berry borer, *Hypothenemus hampei*, enzymes, proteases

[2488] MASS SPECTROMETRIC MORPHOLOGY - DISTRIBUTION OF FXPRLAMIDES IN NERVES AND NEUROHAEMAL ORGANS OF THE AMERICAN COCKROACH

R. Predel & M. Eckert, Inst. für Allg. Zoologie und Tierphysiol., Univ. Jena, Erbertstr. 1, 07743 Jena, Germany; E-mail: b6prre@pan.zoo.uni-jena.de

FXPRLamides are members of a peptide family which includes neuropeptides with diverse functions and which is widely distributed in insects. Pheromone-biosynthesis activation, egg diapause induction, melanization and regulation of the motility of insect visceral muscles have been recorded. We recently identified six FXPRLamides (pyrokinins) from different neurohaemal organs of the American cockroach. Five pyrokinins (PK-1 to -4, PK-6) were isolated from the retrocerebral complex, two pyrokinins (PK-5 and -6) were found in extracts of the abdominal perisympathetic organs. The differential distribution of the various FXPRLamides was subsequently confirmed using immunocytochemical and mass spectrometric methods. In this study, we describe the distribution of FXPRLamides in major neurohaemal organs and nerves supplying these organs with putative neurohormones. For that, we analyzed the neuropeptide pattern of single organs and nerves using a MALDI-TOF mass spectrometer. In the retrocerebral complex, PK-1 to -4 and PK-6 were found in the storage lobe of the corpora cardiaca, and, highly abundant, in the region of the nervi corporis allati-1 (NCA-1). Spectra of single corpora allata revealed the occurrence of these five FXPRLamides too. In the storage lobes of the corpora cardiaca, FXPRLamides were always accompanied by other known neuropeptides such as corazonin, sulfakinins and leucomyosuppressin. No other known neuropeptides were found, however, in the corpora allata. The NCA-2, NCC-1, and NCC-3 all contained PK-1 to -4, and PK-6. Neurons, supplying these nerves with FXPRLamides, were revealed using immunocytochemical methods. Spectra from thoracic perisympathetic organs did not contain mass peaks of the known FXPRLamides. In abdominal perisympathetic organs, however, two FXPRLamides were detected, namely PK-5 and, with a lower abundancy, PK-6. PK-5 was found in spectra of anterior median nerves and transverse nerves of each abdominal ganglion. PK-6 was not detected in nerves innervating the abdominal perisympathetic organs, most likely due to the very low amount of this peptide in these tissues. The pattern of FXPRLamides in different neurohaemal organs seems to be unchanged during the development, no relevant differences were obtained in males, females and larvae of the American cockroach.
Index terms: *Periplaneta americana*, pyrokinin, insect neuropeptide, MALDI-TOF.

[2489] CELLULAR CIRCADIAN RHYTHMS IN THE FLY'S VISUAL SYSTEM

E. Pyza[1], [1]Zoological Museum, Inst. of Zoology, Jagiellonian Univ., R. Ingardena 6, 30-060 Kraków, Poland. E-mail: pyza@zuk.iz.uj.edu.pl

The visual system of the flies *Musca domestica* and *Drosopihla melanogaster* shows circadian rhythms in the structure of its cells and their subcellular organization. These rhythms have been detected in the first optic neuropile, the lamina, in the number of synaptic contacts and the vertical migration of screening pigment in photoreceptor terminals, and in size and shape changes in two of their interneurons, L1 and L2. These are regulated by the lamina's neurotransmitters and controlled by so-called "clock genes", such as the *per* gene. Circadian information from "clock neurons" is transmitted by the neuropeptide pigment dispersing factor (PDF) the effect of which on L1 and L2 also depends on serotonin. Lesioning the optic lobe in *Musca* disrupts L1 and L2's circadian size changes but weak daily oscillations in these cells persist. The input from the clock alone is not sufficient, however, for expression of the lamina's structural circadian rhythms. In the arrhythmic *Drosophila* mutant per^{01} insertion of A 7.2: 9 kb fragment of *per* which induces PER expression in the clock neurons and photoreceptors cannot completely rescue rhythms in L1 and L2. This indicates that there are cells in the lamina which participate in L1 and L2's rhythmic changes, for which the lamina epithelial glia are good candidates. These change their sizes too, but in a reversed pattern to L1 and L2, swelling during the night in the housefly's lamina. In *Drosophila* they express PER and changes in their metabolism affect the sizes of L1 and L2. Moreover, closing gap junctions between glia stops rhythmic swelling and shrinking in L1 and L2. The glial cells may generate and/or synchronize the lamina's rhythms or mediate between PDF neurons and cells which show structural circadian rhythms. If the size of L1 and L2 depends on the epithelial glia a mechanism of this process is unknown. Recently, we have detected in the brain of *Musca* and *Drosophila* a proton V-ATPase which is expressed in glia and shows daily oscillations in immunostaining. Blocking the V-ATPase by bafilomycin affects L1 and L2 in *Musca* only when applied during the night when the glial cells are more active than neurons. This suggests that the glial cell proton VATP-ase may participate in the mechanism of L1 and L2's shrinkage during the night.

Index terms: *Musca domestica*, *Drosophila melanogaster*, neuronal plasticity, glial cells.

[2490] APHIDS AND APHID PROTEASES AS NON-CONVENTIONAL TARGETS FOR PROTEASE INHIBITOR TRANSGENES USED FOR CONTROLLING PHLOEM-FDEEDING INSECTS

Y. Rahbé[1], C. Deraison[3], L. Duportets [3], L. Quillien [2], P. Cristofoletti [4], W.R. Terra [4] & L. Jouanin [3], [1] Biologie Fonctionnelle, Insectes et Interactions, UMR INRA-INSA, Bat.406, 69621 Villeurbanne, France, E-mail: rahbe@jouy.inra.fr; [2]INRA Nantes, France; [3] INRA Versailles, France; [4] USP, Dep. Bioquimica, Saõ Paulo, Brazil.

Aphids constitute an important group of insect pests, and though, a limited number of genes encoding aphid-efficient toxins are available. The two pioneering gene families used to control the major insect pests have no efficient aphid-specific representatives: no *Bacillus thuringiensis* toxin with adequate aphid toxicity has been described, and no protease inhibitor (PI) with convincing aphid toxicity have been used yet in transgenic plants for aphid control. Since aphids feed on a low-protein diet (phloem sap), and do not rely on protein digestion for their nitrogen nutrition, the general absence of activity of PIs in early screening tests was not a surprise. However, several results obtained *in vitro* highlighted the interest of some members of this wide peptide class: First, one PI member of the plant cysteine protease inhibitors, oryzacystatin (gene OC I), showed a low but significant growth inhibition activity on many aphid species tested *in vitro*. Furthermore, transgenic oilseed rape plants expressing OC I in their phloem sap affected similarly the larval growth of *Myzus persicae*, and induced significant reductions in aphid fecundity. Finally, tissue and enzyme targets of OC I were successfully identified by immunolocalization and enzymatic assays on OC I-fed aphids; cysteine-type proteases were shown to form the major endoproteolytic system in the aphid digestive tract, and were analyzed. Although the digestive function of these proteases is still under question, the aphid mesenteron is definitely not devoid of protease activity. Second, a pea seed Bowman-Birk trypsin/chymotrypsin inhibitor was shown to induce significant *in vitro* toxicity towards the pea aphid *Acyrthosiphon pisum*. Testing isoforms and species variants of this bi-functional inhibitor indicated that toxicity was probably harbored by the anti-chymotrypsin active site ; this was confirmed by testing the effect of synthetic active-site peptides, which demonstrated that an active 15 amino acid anti-chymotrypsin loop was responsible for the acute toxicity observed on *A. pisum*. In conclusion, our work points out to the interest of some protease inhibitors for controlling insect groups initially not ideally suited to this type of activity. These results could be extended to other insect groups feeding on low-protein diets, such as other phloem or xylem-feeding Hemiptera.

Index terms: *Aphididae, Myzus persicae, Acyrthosiphon pisum*, Protease inhibitors, Bowman-Birk chymotrypsin inhibitor, Oryzacystatin, Cysteine proteases, Transgenic plants, Host-Plant Resistance.

[2491] OOCYTE RECEPTORS FOR THE SPECIFIC ACCUMULATION OF YOLK PROTEINS

A. S. Raikhel[1], S. J. Seo[2], H. M. Cheon[2], J. Sun[1], K. H. Cho[1], & C. Y. Yun[1], [1]Dept. Entomology, Michigan State Univ., East Lansing MI, USA, E-mail: araikhel@pilot.msu.edu; [2]Dept. Biology, Gyeonsang Natl. Univ., Chinju Gyeongnam, South Korea

Our ultimate goal is the elucidation of the molecular mechanisms underlying the specific accumulation of yolk protein precursors (YPP) in mosquito oocytes. We have previously characterized the vitellogenin receptor (VgR) as being responsible for specific internalization of the major yolk protein, vitellogenin (Vg). The mosquito VgR has been identified as a 205-kDa protein. Cloning of the cDNA encoding VgR has shown that it is a member of the low-density lipoprotein receptor (LDLR) family, sharing significant homology with the *Drosophila* yolk protein receptor. Insect Vg/YP receptors are unique in that they are twice as big as vertebrate VgR or VLDLR, carrying two clusters of cysteine-rich complement-type repeats (implicated in ligand recognition) instead of one as found in vertebrate VgR and LDLR. In the mosquito *Aedes aegypti*, several other YPP are syn

[2492] JUVENILE HORMONE BIOSYNTHESIS AND REGULATION OF VITELLOGENESIS IN THE FALL ARMYWORM, *SPODOPTERA FRUGIPERDA* (LEPIDOPTERA: NOCTUIDAE)

S. Range[1], U. Oeh[1], D. Sorge[1,2], M.W. Lorenz[1], R. Nauen[2] & K.H. Hoffmann[1], [1]Dept. of Animal Ecology I, Univ. of Bayreuth, 95440 Bayreuth, Germany, E-mail: klaus.hoffmann@uni-bayreuth.de: [2]Bayer AG, Agrochemicals Division, Research Insecticides, 51368 Leverkusen, Germany

The first objective of this study was to investigate the qualities and quantities of juvenile hormones (JH) released by isolated CC-CA complexes from female adults of the noctuid *S. frugiperda* as a basis for further research on how moths control vitellogenesis. In female moths, JH release was high compared to that in 5th and 6th instar larvae. JH release was shown to be age-dependent with a peak value on day 2 of adult life. By a combination of RP- and NP-HPLC, two major labelled products were found. One compound co-migrated with chemically synthesized JH II diol, the second compound with JH III diol. Double labelling experiments using ^{3}H-methionine and ^{14}C-acetate confirmed their *de novo* synthesis in CC-CA complexes of female moths. In the haemolymph of female moths, a single female-specific protein, likely to be the vitellogenin (Vg), appeared at 5h after adult eclosion. The relative molecular mass of the designated Vg was determined as 164.5 ± 2.5 kDa. Vitellogenic oocytes became visible 36 - 48h after emergence and egg deposition began on day 3 of adult life. Vg could not be detected in the haemolymph of females decapitated directly after eclosion. When decapitated females were injected with the JH-mimic methoprene, the level of Vg was comparable to that in non-decapitated moths, although the number of vitellogenic oocytes was somewhat lower. Injection of 20-hydroxyecdysone (20E) promoted Vg production to a similar extent, but treatment with 20E never resulted in the production of vitellogenic oocytes. *In vitro* cultured ovaries of adult females dissected directly after eclosion produced lower amounts of ecdysteroids than those isolated on day 1 after emergence. The relevance of this findings to pest control strategies, based on disruption of the insect endocrine system, will be discussed.

Index terms: *Spodoptera frugiperda*, juvenile hormones, ecdysteroids, vitellogenesis, pest control.

Thesized in addition to Vg, in the vitellogenic fat body which are specifically accumulated by oocytes and deposited in mature yolk granules. These include two pro-enzymes, vitellogenic carboxypeptidase (VCP) and vitellogenic cathepsin B (VCB), and lipophorin (Lp). In this paper, we present data indicating that a specific Lp receptor (LpR) exists in the mosquito oocytes which is distinct from the Vg receptor and is homologous to the *Locusta* fat body LpR and to the vertebrate VLDL receptor. The cDNA encoding a putative ovarian mosquito lipophorin receptor (LpR) was cloned by a combination of PCR and cDNA library cloning. The deduced amino acid sequence has 64.3% homology with the locust fat body LpR and the structure of a receptor belonging to the LDL receptor family. The protein receptor consists of a typical cysteine-rich complement domain containing eight modules, an EGF homologous domain, a transmembrane domain and a cytoplasmic tail with a tyrosine internalization motif. Northern blot analysis revealed that the 4.1-kb transcript for this ovarian receptor is expressed at the previtellogenic and vitellogenic stages. To determine the localization of the ovarian LpR mRNA, *in situ* hybridization was performed. LpR mRNA was present in the nurse cells and oocyte of developing primary follicles starting from early previtellogenic stages. We are presently investigating whether this newly discovered oocyte receptor is responsible for internalization of only Lp or if it serves as a multifunctional receptor binding, VCP and VCB as well.

Index terms: *Aedes aegypti*, vitellogenin receptor, lipophorin receptor, LDL receptor family.

[2493] IDENTIFICATION AND CHARACTERIZATION OF A LIPOPHORIN RECEPTOR FROM THE□TERATOCYTES OF *DINOCAMPUS COCCINELLAE*

G. Ravikumar & T. Okuda, National Institute of Sericultural and Entomological Science, Owashi 1-2, Tsukuba, Ibaraki 305 8634, Japan,□E **mail** : grkumar@nises.affrc.go.jp ; oku@nises.affrc.go.jp

Teratocytes of *Dinocampus coccinellae* synthesize a teratocyte-specific polypeptide of 540 kDa. The teratocytes exhibited a lipophorin binding site at the cell surface. It was demonstrated using avidin biotin system. The receptor protein has an apparent molecular weight of 94 kDa in SDS-PAGE under non-reducing conditions and was sensitive to treatment with EDTA and Suramin. The importance of the lipophorin receptor and its role in relation to its host, Coccinellid is discussed.
Index terms:Teratocyte-specific protein,lipid uptake, host-parasitoid relationship, *Coccinella septumpunctata*.

[2494] INFLUENCE OF WATER AND NUTRITIONAL STATUS OF *BACCHARIS DRACUNCULIFOLIA* ON THE ABUNDANCE AND RICHNESS OF ENDOPHYTES

Ribeiro-Mendes, H. N[1]. & G. W. Fernandes[1], C. A. Rosa[2], [1]Ecologia Evolutiva de Herbívoros Tropicais, Dep. Biol. Geral, ICB/UFMG. CP 486, 30161-970, Belo Horizonte, MG, Brazil, E-mail gwilson@icb.ufmg.br; [2]Laboratório de Fermentação, Dep. de Microbiologia ICB/UFMG.

We studied the influence of irrigation and fertilization on the abundance and richness of endophytes associated with a perennial dioecious shrub, *Baccharis dracunculifolia* (Asteraceae) in southeastern Brazil. 100 individuals of *B. dracunculifolia* (50 individuals of each sex) were distributed into 5 treatments in the field: watered plants, fertilized, fertilized + watered, stressed, and control. Endophytes were isolated and cultured on corn meal agar under controlled temperature and humidity. Plants and endophytes were monitored during two consecutive years. 15 endophyte morphospecies were found. Endophyte morphospecies sp1 and morphospecies sp2 were the most abundant species during the study. Endophyte richness was higher on watered, fertilized, and fertilized + watered treatment plants than on stressed, and control treatments. Nevertheless, the effect of precipitation was stronger on endophyte abundance. We found no consistent effect of plant gender on endophyte richness and abundance during the study period.
Index terms: Endophytes, *Baccharis*, irrigation, fertilization, plant ecology

[2495] DOWNREGULATION OF ULTRASPIRACLE BUT NOT ECDYSONE RECEPTOR DURING PUPAL DIAPAUSE IN *SARCOPHAGA CRASSIPALPIS*

J. P. Rinehart, and T. L. Craig, D. L. Denlinger. Dept. of Entomology, Ohio State Univ., 1735 Neil Ave., Columbus, OH 43210-1220, USA, E-mail denlinger.1@osu.edu.

The establishment and maintenance of diapause is under neuroendocrine control. In species that undergo pupal diapause, such as the flesh fly *Sarcophaga crassipalpis*, this control is characterized by the lack of ecdysteroids. While the role of ecdysteroids during pupal diapause is well defined, the expression of ecdysteroid receptors remains unclear. To resolve this issue, we first used rt-PCR to develop partial clones of ecdysone receptor (EcR) and its dimerization partner ultraspiracle (USP) from *S. crassipalpis*. These clones were then used as probes for northern blotting and *in situ* hybridization to analyze gene expression during diapause and diapause termination. Northern blot hybridization revealed that transcripts of EcR remain present throughout diapause, with levels further increasing upon termination. Expression is not uniform during diapause, but shows considerable individual variation. Conversely, transcripts of USP gradually decrease when diapause is initiated and are undetectable 20 days after the onset of diapause. Late in diapause USP transcripts are again evident, and at diapause termination USP is quickly upregulated. Data from *in situ* hybridization have defined specific expression patterns in the brain throughout diapause and at the onset of adult development. The implications of these results will be discussed, including the possibility that the late diapause upregulation of USP suggests its involvement in preparation for diapause termination.
Index terms: Sarcophaga crassipalpis, in situ, diapause, ecdysone receptor, ultraspiracle

[2496] NUTRITIONAL STATUS AND THE BEHAVIOURAL ECOLOGY OF PARASITOIDS

A. Rivero[1,2], D. Giron[1] & J. Casas[1] , [1]Institute de Recherche sur la Biologie de l'Insecte (CNRS ESA 6035), Faculté des Sciences, Université de Tours, 37200-Tours, France; [2]Institute of Cell, Animal and Population Biology, University of Edinburgh, Kings Buildings, Edinburgh EH9 3JT, UK (current address). Email: Ana.Rivero@ed.ac.uk

The way in which nutritional resources are allocated to egg production and survival has important consequences for the predictions of many models of parasitoid behaviour and population dynamics, as well as for the outcome of biological control efforts. Using radioactively labelled amino acids, we quantified the incorporation of nutritional resources into the eggs of the host feeding parasitoid *Dinarmus basalis*. Our experiments show that although 40% of the nutrients acquired from a single adult meal are invested into egg production within 4 days, the rest are stored and used gradually throughout the life of the parasitoid. We also present information, obtained using a double marking technique, about the way in which parasitoids invest the resources accumulated during their larval development. We show conclusively that larval reserves constitute a significant nutritional resource for egg production in parasitoids, which is managed separately from the nutrients obtained from the adult. We discuss the relative importance of larval vs adult food sources in the light of differences in life history parameters.
Index terms: *Dinarmus basalis*, synovigenic parasitoids, egg production, radioactive labelling, larval reserves

[2497] TRIACYLGLYCEROL LIPASE FROM THE MIDGUT OF LARVAL *MANDUCA SEXTA*: PROPERTIES AND PARTIAL CHARACTERIZATION

E.R. Rubiolo [1,2], L.E. Canavoso[1] & M.A. Wells[1], [1]Dept. of Biochemistry and Center for Insect Science, University of Arizona, Tucson, AZ 85721-0088, USA, E-mail:erubiolo@u.arizona.edu; [2]Fac. Ciencias Químicas, Univ. Nacional de Córdoba, 5000-Córdoba, Argentina.

Among lipids, triacylglycerol (TAG) is a major component of the insect diet and the midgut is the main site for its digestion, absorption and processing. We have shown that in larval *Manduca sexta*, which is widely used as insect model, dietary TAG is hydrolyzed in the lumen to fatty acids (FAs) and glycerol. FAs are absorbed efficiently and once into the midgut cell, they are transformed to diacylglycerol (DAG) by the phosphatidic acid pathway. We have also shown that in the enterocyte, DAG is converted to TAG, which ultimately serves as a reservoir from which *sn*-1,2-DAG are exported to the hemolymph. In order to elucidate the events of lipolysis that take place in the midgut, we have partially characterized a triacylglycerol lipase from the midgut of larval *M. sexta*. Activity of the lipase from the midgut of larval *M. sexta* (L-Mg) was identified and measured using [^{3}H]-trioleoylglycerol as a substrate. The enzyme showed a cytosolic subcellular localization and catalyzed the hydrolysis of TAG, DAG and monoacylglycerol (MAG), but showed highest affinity for TAG and DAG. L-Mg exhibited an optimum activity at pH of 8.3 and was not affected by high concentrations of NaCl. The stereospecific analysis of the end products of TAG hydrolysis were assayed using trioleoyl-[^{3}H]-glycerol and two NaCl concentrations, 150 and 500 mM. Unlike the *in vitro* activity of fat body lipase, which led to accumulation of MAG, in the both conditions assayed the DAG isomers, *sn*-1,2(2,3)DAG and *sn*-1,3-DAG represented approximately 45 % and 25 % respectively of total acylglycerols products. The enzyme was effectively inhibited by the serine protease inhibitors such as PMS and DPF, indicating the presence of an active site serine in its structure. The L-Mg activity was not inhibited for Ca^{+2}, Mg^{+2}, EGTA and Protamine-$SO_4^=$. The results herein reported make the lipase from the midgut of larval *M.sexta* a strong candidate for hydrolysis of the midgut-TAG pool, which serves as reservoir for the hemolymph-DAG. *Supported by NIH grant 50008.*

Index terms: dietary lipids, lipolysis, tissue

[2498] MASKING OF CIRCADIAN ACTIVITY RHYTHM IN BUMBLE BEES: A NOVEL ADAPTATION MECHANISM TO HIGH-LATITUDE CONDITION

M. Sasaki[1,3], N. Monden[1] M. Mitsuhata[2] and M. Ono[1], [1] Laboratory of Entomology, Faculty of Agriculture, Tamagawa University, Machida, Tokyo, 194-8610 Japan. [2] Agro-Ecology Dept., Tomen Corporation, 2-14-27, Akasaka, Minato-ku, Tokyo, 107-8677, Japan [3]E-mail sasaki@agr.tamagawa.ac.jp

Bumble bees are well-known to be adapted to the northern climate. We showed their dual photoreceptive pathways and masking of the circadian rhythmicity which enable the arctic, long-day life of the bees.1) Individual worker, queen and male of *Bombus terrestris* were confined in infrared LED actograph from right after emergence, and the locomotor activity was recorded. Under LD 12:12, worker and male became active shortly before light-on and ceased their activity after light-off. The strong activity continued throughout the photophase and no peak was detected.
2) Under changing LD, active phase (□□) was constant ca 14 h, irrespective of daylength. In long day with more than 14 h photophase, activity started immediately after light-on. The rhythm was entrained by dusk signal. 3) Under constant darkness (DD), clear free-running rhythm with the average period (□□) was 23.5 h in workers. Under LL, however, endless activity was observed as far as illumination continued. This masking effect on the rhythmicity occurred only under strong illumination, i.e., more than ca 700 lx by white fluorescent bulb. 4) Surgical removal of compound eyes and/or ocelli showed that the photoreceptor for driving circadian oscillator is extraretinal and most probably in the brain. On the other hand, the compound eye-ectomized bees revealed no more masking, thus the photoreceptor for the masking (direct drive of the activity by illumination) should be compoun d eye. 5) We confirmed the function of this masking allowing foraging under midnight sun in natural mid summer condition in arctic Norway. It should be a co-adaptation between pollinator insects and flowers to utilize the extraordinary long day in short summer effectively.

Index terms: *Bombus terrestris*, circadian rhythm, photoperiodism, extraretinal photoreception.

[2499] INSECT ANTENNAE AS BIOSENSORS

S. Schütz[1], B. Weißbecker[1], P. Schroth[2] & M.J. Schöning[2], [1] Inst. of Phytopathology and Applied Zoology, Univ. Giessen, Ludwigstr. 21b, D-35390 Giessen, Germany. E-mail: stefan.schuetz@agrar.uni-giessen.de.; [2] Inst. of Thin Film Ionics, FZ Juelich GmbH, D-52425 Juelich, Germany.

Insect antenna are morphologically and physiologically highly specialised organs for odour perception. Their sensitivity, selectivity, and response time cannot be matched by any technical method of trace analysis. Utilisation of these unique abilities of insects for trace analytical purposes demands a thorough adaptation of technical devices to the special needs of insect antennae. Former approaches using electroantennogram (EAG) techniques are highly sophisticated yet (Koch et al., 1997), however, insect antenna have to be damaged limiting lifetime of the preparations. Using a field effect transistor directly coupled to an undamaged insect antenna proved to solve some of the problems (Schroth et al., 1999). Therefore, practical applications of biosensors on the basis of intact insect antennae as a sensitive odour detecting device become more feasible. Besides sex pheromones, insect antenna are able to detect a broad range of odours specific to their habitat. The Colorado beetle (*Leptinotarsa decemlineata*) shows a high sensitivity to damage induced volatiles released by potato plants (Schütz et al., 1997), the Steelblue jewel beetle (*Phaenops cyanea*) detects stressed and burned trees, and the Black jewel beetle (*Melanophila acuminata*) shows a very high sensitivity to wood-fire specific volatiles (Schütz et al., 1999). First practical applications of the biosensor in plant protection and stored food protection will be presented and further possible applications in food quality assessment and fire early warning will be discussed.

Index terms: *L. decemlineata, Ph. cyanea, M. acuminata*, odour detection

Koch, U.T., Lüder, W., Clemenz, L., & Cichon, I. (1997). Pheromone measurements by field EAG in apple orchards. In: Technology Transfer in Mating Disruption, IOBC wprs Bulletin, 20: 181-190.
Schroth, P., Schöning, M.J., Kordos, P., Lüth, H., Schütz, S., Weißbecker, B., & Hummel, H.E. (1999). Insect-based BioFETs with improved signal characteristics. Biosensors & Bioelectronics, 14: 303-308.
Schütz, S., Weißbecker, B., Klein, A., & Hummel, H.E. (1997). Host plant selection of the Colorado potato beetle as influenced by damage induced volatiles of the potato plant. Naturwissenschaften, 84: 212-217.
Schütz, S., Weißbecker, B., Hummel, H.E., Apel, K.-H., Schmitz, H., & Bleckmann, H. (1999). Insect antennae as a smoke detector. Nature, 398: 298-299.

[2500] NEW STRIDULATORY STRUCTURES IN A TIGER BEETLE (COLEOPTERA, CICINDELIDAE): MORPHOLOGY AND SOUND CHARACTERIZATION

A. R. M. Serrano, A. C. Diogo, E. Viçoso & P. J. Fonseca, Depto. Zoologia e Antropologia and Centro de Biologia Ambiental, Fac. Ciências de Lisboa, Campo Grande, Lisboa, Portugal, E-mail aserrano@fc.ul.pt, adiogo@fc.ul.pt, fonseca@fc.ul.pt

Numerous species of Cicindelini tiger beetles generate sounds using a stridulatory mechanism. A *pars stridens* on the dorsal side of the costal and subcostal veins of the metathoracic wings is acted by a *plectrum* at the ventral apical area of the elytra. A tympanic organ lies at the dorsal side of the metathoracic and first abdominal segments. Besides responding to the conspecific sounds, this organ acts as a high frequency detector probably related to predator avoidance. The behavioral significance of the sounds, however, is not established. The Neotropical tiger beetle *Oxycheila tristis*, which belongs to the tribe Megacephalini, has different stridulatory structures. Here the *pars stridens* on the elytral epipleura is rubbed by the sclerotized internal edge of the hind femura (*plectrum*) in both sexes. The hind legs usually alternate and sound is mostly generated during the backward movement. Video recordings revealed that although the striated file occupies most of the epipleura (8-10 mm) the region acted by the plectrum is restricted to about 5.5 and 3.5 mm in females and males respectively. Accordingly, the sound generated during a leg cycle (syllable) lasts longer in females (120-200 ms) than in males (80-130 ms). In addition, loading experiments showed that the free elytral apex plays a significant role in sound radiation. This is a likely reason for the observed steady increase in sound amplitude along the syllables, as well as for the amplitude modulations caused by movements of the tip of the abdomen. The file ridges get closer posteriorly while the leg movement becomes faster resulting in an increase of sound frequency towards the end of the syllables. Hence, this effect explains the frequency modulations associated to the syllables. The signals are characterized by broad band spectra (2 to 35 kHz, -20 dB relative to peak) with most energy within 3 to 10 kHz in females and extending upper in frequency in the males (15 kHz). The same stridulatory structures were also found in three other species of *Oxycheila* (*O. nigroaenea, O. gracillima, O. weyrauchi*), but a behavioral meaning for this acoustic apparatus is still lacking.

Index terms: *Oxycheila tristis*, sound production.

[2501] DISTRIBUTION OF FMRF-AMIDE LIKE IMMUNOREACTIVITY IN THE BRAIN OF *TRIATOMA INFESTANS*

B.P. Settembrini[1], L. Compagnucci[1], & M.J. Villar [2], [1]Museo Argentino de Ciencias Naturales, División Entomología, Avda Angel Gallardo 470, 1405, Buenos Aires, E-mail: bsettem@muanbe.gov.ar; [2]Facultad de Ciencias Biomédicas, Universidad Austral, Pte Perón 1500, 1629, Pilar

A polyclonal antiserum against FMRFamide (a) was used to investigate the presence and distribution of this peptide in the brain of adult *Triatoma infestans*. Immunocytochemistry was performed using the sensitive avidin-biotin peroxidase method together with nickel salt intensification of the reaction product. FMRFa-like immunorreactivity (LI) was widely distributed in cells and fibers of the brain. In the protocerebrum, FMRFa-immunorreactive (ir) cell bodies were observed in both, the optic and protocerebral lobes. In the optic lobes, several positive cell bodies were seen in the lateroexternal soma rind and at the base of the lobula. FMRFa-ir cells of the protocerebral lobes were observed near the median furrow, above the calyces of the mushroom bodies, in the lateral and caudal soma rind. Two large positive cells were seen near the entry of the ocellar nerve. High density of positive fibers were seen in the median bundle, the protocerebral bridge, the calyces, the central body and the anterolateral PC. FMRFa-ir cells were also observed around the sensory glomeruli of the deutocerebrum in the lateroexternal and anteroventral soma rind. The glomeruli harboured positive fibers while the central core was totally devoid of immunoreactivity. Positive cells and fibers were found in the tritocerebrum. A high density or immunorreactive fibers were seen surrounding the esophageal canal, mainly in its posterior part. Several experiments are currently under progress to establish the coexistence of FMRFa with other neuroactive molecules.
Index terms: *Triatoma infestans*, FMRFamide, insect brain.

[2502] THE DISTRIBUTION OF NPY AND NPY-Y1 RECEPTOR LIKE IMMUNOREACTIVITIES IN THE BRAIN OF *TRIATOMA INFESTANS*

B.P. Settembrini[1], T. Hökfelt[2] & M.J. Villar[3], [1]Museo Argentino de Ciencias Naturales, Avda Angel Gallardo 470, 1405, Buenos Aires, E-mail bsettem@muanbe.gov.ar; [2]Department of Neuroscience, Karolinska Institutet, S-17 177, Stockholm, Sweden; [3]Facultad de Ciencias Biomédicas, Universidad Austral, Pte Perón 1500, 1629, Pilar.

The distribution of NPY and its Y1 receptor were studied in the brain of *Triatoma infestans* using immunohistochemistry. In the protocerebrum (PC) NPY-immunoreactive (-ir) cell bodies were found around the neuropilar areas of the optic lobes, at both the interno and externolateral margins. In the PC lobes, positive cell bodies were seen above the calyces of the mushroom bodies (MB), in the anteromedial and caudolateral soma rind. In the deutocerebrum (DC), NPY-ir cell bodies were seeen in the lateroexternal edge of the sensory glomeruli and in the caudal part of the antennal motor center. Some glomeruli showed positive fibers. The subesophageal ganglion (SOG) harboured NPY-ir cell bodies in the maxillary and labial neuromeres. Y1–ir cell bodies were seen in the lamina ganglionaris of the optic lobe. Several positive cell groups were detected in the soma rind of the antero and posteromedial PC lobes. In the DC, numerous positive somata surrounded the glomeruli and the lateral and posterior parts of the antennal motor center. The sensory glomeruli showed high intensity and density of Y1-ir processes. Numerous cells were seen at the posterior part of the esophageal canal while some cells were observed at the root of the mandibular and the maxillary nerves. When assessed by immunoblotting, incubation of neural tissue with Y1 antibodies resulted in a single prominent band of approximately 46kDa. These results suggest that NPY and its Y1 receptor are expressed in cells that integrate messages from sensory receptors.
Index terms: *Triatoma infestans*-NPY-Y1 receptor-insect brain

[2503] JUVENILE HORMONE ESTERASE BINDING PROTEINS IN *MANDUCA SEXTA*

M. Shanmugavelu[1], A. R. Baytan[2], J. D. Chesnut[2] & B. C. Bonning[1], [1]Dept. Entomology, Iowa State Univ., 418 Science II, Ames, IA 50011, USA E-mail bbonning@iastate.edu; [2]Invitrogen, 1600 Faraday Ave., Carlsbad, CA 92008, USA

Juvenile hormone esterase (JHE) hydrolyses juvenile hormone, which acts in conjunction with ecdysteroids to control gene expression in insects. Circulating JHE is synthesized by the fat body and epidermis, and removed from hemolymph by pericardial cells for lysosomal degradation. For analyses of binding proteins in the tobacco hornworm *Manduca sexta* L., baculovirus expressed, recombinant JHE was purified by ion exchange chromatography and biotinylated, for use in ligand blot. Five putative JHE binding proteins of 29, 50, 75, 125 and 240 kDa were identified in both fat body and pericardial cell tissues. All binding proteins were present from second through fifth instar larvae of *M. sexta*. On narrow-range isoelectric focusing, the 29 kDa binding protein separated into three species with isoelectric points of 6.48, 6.63 and 6.80. In order to identify proteins involved in the degradation of JHE, a pericardial cell cDNA phage display library derived from *M. sexta* was constructed and screened for proteins that bind JHE. A 732 bp cDNA encoding a novel 29 kDa protein, P29, was isolated. Western and northern analyses indicate that P29 is present in both pericardial cell and fat body tissue and is present in each larval instar. In immunoprecipitation experiments, P29 bound injected recombinant JHE taken up by pericardial cells, and also native *M. sexta* JHE in fat body tissue. P29 bound JHE more strongly that it did a mutant form of the enzyme JHE-KK, with mutations that perturb lysosomal targeting. Future research will address the roles of JHE binding proteins in synthesis and export and/or uptake and degradation of JHE by the pericardial cells and fat body of *M. sexta*.
Index terms: protein trafficking, lysosome, pericardial cells, fat body.

[2504] THE GENOME ORGANIZATION OF *BUCHNERA*, AN INTRACELLULAR BACTERIAL SYMBIONT OF APHIDS

S. Shigenobu[1], H. Watanabe[2], M. Hattori[2], Y. Sakaki[3] & H. Ishikawa[1], [1]Dept. of Biol. Sci., Grad. Sch. of Sci., Univ. of Tokyo, Hongo, Bunkyo-ku, Tokyo 113-0033, Japan, E-mail iskw@biol.s.u-tokyo.ac.jp; [2]RIKEN Genomic Sci. Center, Kitasato, Sagamihara, Kanagawa 228-8555, Japan; [3]Human Genomic Sci. Center, Inst. of Med.Sci., Univ. of Tokyo, Shirokanedai, Minato-ku, Tokyo 108-8639, Japan.

A considerable number of insect species harbor intracellular symbionts that are vertically transmitted through host generations. One typical example of these associations is seen in aphids (Aphididae, Homoptera). Most aphid species have huge cells called bacteriocytes, by which round-shaped bacteria, *Buchnera*, are harbored. These bacteria are maternally transmitted through host generations, and the intracellular symbiosis between *Buchnera* and aphids probably dates back as far as 250 million years ago. This represents one of the most intimate interactions between a bacterium and the eukaryotic cell, and the mutualism between them is so obligate that neither of them can no longer reproduce independently. While *Buchnera* is a close relative of *Escherichia coli*, it contains more than 100 genomic copies per cell, and its genome size is only a seventh of the *E. coli*. Our recent genome analysis of *Buchnera* from pea aphids *Acyrthosiphon pisum* demonstrated that its chromosome was composed of 640,681 base pairs (bp), representing the smallest of the complete genomes sequenced to date except for that of *Mycoplasma genitalium*, which is of 580, 070 bp DNA and regarded as a genome of the minimal gene set. The 583 predicted ORFs were compared against a non-redundant protein database and their biological roles were assigned. It turned out that the *Buchnera* genome was quite different from those of endocellular and epicellular bacterial parasites that were sequenced to date. There were genes for biosyntheses of essential amino acids of animals in the genome, while those for nonessential amino acids were all missing, suggesting the complementarity and syntrophy between the host insect and *Buchnera*. Furthermore, *Buchnera* lacked genes for cell surface components, including those for biosyntheses of lipopolysaccharides and phospholipids and those involved in defense of the cell. All these results clearly indicate that *Buchnera* is completely symbiotic and viable only in its limited niche, bacteriocyte of aphids. In this context, *Buchnera* is similar to, not parasites, but cell organelles, such as mitochondria and plastids, which also require endocellular environment of the host cells and make a contribution to the host.
Index terms: endocellular symbiosis, aphids, Buchnera, genome, organelle.

[2505] CHARACTERIZATION OF A RECOMBINANT INSECT CHITINASE AND A BACULOVIRUS CHITINASE

T. Shinoda[1], J. Kobayashi[2], M. Matsui[1] & Y. Chinzei [3], [1]National Research Inst. of Vegetables, Ornamental Plants and Tea, Ano, Mie, 514-2392, Japan, E-mail shinoda@nivot.affrc.go.jp; [2]Faculty of Engineering, Mie Univ. Tsu, Mie, 514, Japan; [3]Dept. of Medical Zoology, School of Medicine, Mie Univ. Tsu, Mie, 514, Japan.

Insect chitinase is an attractive target for selective insect regulators and also is indicated to be a good source for insect-resistant plants and efficient entomopathogens via genetic-engineering. It is thus important to gain more knowledge on this enzyme. We have isolated a chitinase cDNA (*Slchi*) from the common cutworm, *Spodoptera litura*, and characterized its recombinant protein. The *Slchi* cDNA encodes 552 amino-acid residues (aa) including a 19 aa putative signal peptide, with the calculated molecular mass of the putative mature protein 60,152 Da. The predicted amino acid sequence is highly similar to other insect and prawn chitinases. A major transcript of *Slchi* about 2.8 kb was detected in the epidermis only during molting suggesting that its digestive role of old cuticle at this period. To evaluate the chitinolytic activity of Slchi protein, we produced a recombinant Slchi protein using a *Hyphantria cunea* NPV (*Hycu*NPV)-based protein expression system. The genome of *Hycu*NPV also encodes a chitinase gene (*chiA*), which is similar to *Ac*MNPV *chiA*, but shares only 15% amino acid residues with Slchi. To distinguish the chitinase activity derived from *Slchi* and *chiA*, we construct a recombinant *Hycu*NPV, which expresses *Slchi* under the polyhedrin promoter and whose viral chitinase gene was knocked out. The recombinant Slchi protein produced from this virus exhibited high chitinolytic activity against 4MU-$(GlcNAc)_3$ > 4MU-$(GlcNAc)_2$ > 4MU-$(GlcNAc)_4$, in this order. The viral chitinase also showed comparable chitinolytic activity, but in a different order, 4MU-$(GlcNAc)_2$ > 4MU-$(GlcNAc)_3$ = 4MU-$(GlcNAc)_4$. No enzymatic activity was found against 4MU-$(GlcNAc)_1$ in either chitinase. Interestingly, the Slchi protein was secreted rapidly into the culture medium from the infected cells, whereas the viral chitinase was retained predominantly in the infected cells. The differences in substrate specificity and the secretion properties suggest that the *Slchi* introduced into a baculovirus may enhance its insecticidal activity. Moreover, the recombinant Slchi protein can be used for screening of chitinase inhibitors and a supplement for entomopathogens.

Index terms: *Spodoptera litura*, *Hyphantria cunea*, NPV, chitinase, recombinant protein.

[2506] OCCURRENCE OF α-GLUCOSIDASE AS A BIOCHEMICAL MARKER FOR PERIMICROVILLAR MEMBRANES IN HEMIPTERA AND THYSANOPTERA

Carlos P. Silva[1], Walter R. Terra[2], Marilvia Dansa- Petretski[1], José R. Silva[1], Fábio V. Fonseca[1], [1]Centro de Biociências e Biotecnologia-LQFPP-UENF, Campos dos Goytacazes/RJ; [2]Depto. Bioquímica-IQ-USP, São Paulo/SP. Supported by CNPq, FAPERJ, FAPESP, FENORTE and PRONEX.

The insects of the order Hemiptera are characterized by the absence of a peritrophic membrane, a chitin-protein structure that envelopes the food bolus in the majority of insects. However, the microvillar membranes of intestinal cells from hemipterans are not in direct contact with the food bolus, due to the existence of a plasmatic membrane, the so-called perimicrovillar membrane (PMM), which covers the microvilli from their bases up to the tips and extending into the gut lumen. It has been demonstrated that α-glucosidase is a biochemical marker for PMM in the seed sucker bug *Dysdercus peruvianus* (Heteroptera: Pyrrhocoridae). In this communication we report that adults of the major Infraorders among hemipterans also have a major membrane bound α-glucosidase, which has many properties similar to those found for the enzyme from *D. peruvianus*. By using *in gel* assay with a fluorogenic substrate following SDS-PAGE, we observed that α-glucosidases from the other insects tested showed electrophoretic migration very similar to that of the *D. peruvianus* enzyme. The relative molecular weights ranged from 50,000-60,000. The similarity between the α-glucosidase of *D. peruvianus* and the other hemipterans was reinforced by the observation that a polyclonal antibody raised against the enzyme of the phytophagous bug recognized the other enzymes present in the perimicrovillar membranes. The same antibody was also able to recognize perimicrovillar α-glucosidase from thrips, suggesting that this enzyme is widespread among the insects of the order Hemiptera and the related order Thysanoptera.

[2507] HEME GENERATION AND PROCESSING IN THE MIDGUT LUMEN AND ITS STORAGE IN THE EPITHELIAL CELLS OF THE *Rhodnius prolixus* (HEMIPTERA: REDUVIIDAE)

J. R Silva[1], C. P. Silva[1], G. C. Atella[2], P. L. Oliveira[2], M. F. Oliveira[2], H. Masuda[2] and M. Dansa-Petretski[1], [1] Lab. de Química e Função de Proteínas e Peptídeos, CBB, UENF, Av. Alberto Lamego, 2000, Campos, RJ, Brasil, Cep: 28015-620, [2] Depto. de Bioquímica Médica, ICB, CCS, UFRJ, Rio de Janeiro, RJ, Brasil. Supported by: FENORTE, CNPq, and FAPERJ.

Rhodnius prolixus is a hematophagous insect which ingests large volumes of blood during a single feeding session. During digestion, high concentrations of heme, iron-protoporphyrin IX, are generated as a result of hemoglobin digestion. In the current literature there are no studies of the fate of heme in hematophagous insects. In this work we are interested in heme generation in the *Rhodnius* midgut, and its processing in the luminal compartment and intracellular structures involved in the heme storage (or transport) in the midgut epithelial cells. The profile of changes in protein content is similar to that seen for heme levels in the anterior midgut. The decrease of proteins in the anterior midgut was coincident with the increase of heme levels in the posterior midgut. In the posterior midgut heme reaches highest levels 7days after feeding. This heme is processed to hemozoin, a insoluble polymer of heme. In the same midgut segment we observed an intense heme association with the perimicrovillar membranes. This association could present an additional protective mechanism against heme hazard due to this association and further excretion. In addition, the perimicrovillar membranes could be involved in heme polymerization, probably due to their association with heme in the luminal content. In the midgut epithelial cells, electrodense structures were also seen, where we detected peroxidasic activity using transmission electron microscopy. These structures could be involved in the heme transport through the midgut epithelial cells. Furthermore, these electrodense structures could be involved in a cellular protection mechanism against the heme hazard. In this moment, we are searching for more information about the heme association with the perimicrovillar membranes and the cellular heme storage process as an additional protective mechanism against heme hazard.

Index terms: heme transport, storage, blood digestion, heme polymerization, perimicrovillar membranes

[2508] MORPHOLOGICAL CHARACTERIZATION OF LARVAL HAEMOCYTES FROM *ANTICARSIA GEMMATALIS*

E. B. Silveira [1, 2], B. M. Ribeiro[2] & S. N. Báo[2], [1]Depto. de Biologia Celular, IB, UNICAMP, C.P. 6109, Campinas, SP 13.083-970, Brasil, E-mail enis@obelix.unicamp.br; [2]Depto. de Biologia Celular, IB, UnB, Brasília, DF 70919-970, Brasil. CAPES/CNPq/PRONEX/FAPDF

The soybean caterpillar *Anticarsia gemmatalis* is an important pest, representing approximately 50% of the chemical pesticides applications in soybean crops from Brazil. A nucleopolyhedrovirus associated to this caterpillar, Anticarsia gemmatalis nucleopolyhedrovirus (AgMNPV), has been used to control this pest and studies about this virus and its relationships with its host have been carried out. The haemocytes are, generally, targets of infection by baculoviruses so; they constitute an interesting model for virus/host cells interactions studies. In this work, a first description of the larval haemocytes from *A. gemmatalis* was carried out. The haemolymph, collected from 3rd instar larvae, was directly observed at interferential/diferential contrast microscopy (DIC) and processed for transmission and scanning electron microscopy (TEM and SEM). The cells were fixed in glutaraldehyde/paraformaldehyde buffered in sodium cacodylate buffer, post-fixed in OsO_4 and dehydrated in acetone. For TEM, the cells were embedded in Spurr resin and sectioned in an ultramicrotome. For SEM, they were critical point dried in CO_2 and coated with gold in a sputter coater. Six types of haemocytes, already described for other lepidoptera, were observed. They were Prohaemocytes, Plasmatocytes, Granular haemocytes type 1, Spherulocytes, Oenocytoids and putative Adipohaemocytes. Prohaemocytes were the smallest cells detected, presenting a high nucleus/cytoplasm ratio and moderately developed organeles. Plasmatocytes were variable in shape and when in contact with glass became fully spread. They were rich in organeles, phagocytic vacuoles, cytoplasmic projections and pseudopodia. Granular haemocytes type 1 were spherical and presented typical microtubular structured, unstructured and dense granules. The cytoplasm was dense and the rough endoplasmic reticulum was well developed, with enlarged cisternae filled with electron-dense material. In contact with glass these cells presented numerous filopodia. Spherulocytes had typical spherules that occupied most of the cytoplasm area and were filled with a material arranged in concentric layers. Oenocytoids were large cells, with a small nucleus and a homogeneous cytoplasm that was poor in membranous organeles and rich in free ribosomes. Putative Adipohaemocytes were rich in electron-dense inclusions, apparently not surrounded by a membrane, whose possible lipidic nature can be confirmed by cytochemistry. Ultrastructural studies were shown to be efficient to identify and classify these cells, making easier further analysis by light microcopy.

Index terms: Lepidoptera, haemolymph, morphology, cytology.

[2509] THE 4-KDA PROTEASE INHIBITOR FAMILY IN THE DESERT LOCUST *SCHISTOCERCA GREGARIA*: MOLECULAR CLONING AND ANALYSIS OF TISSUE- AND STAGE-DEPENDENT EXPRESSION

G. Simonet, I. Claeys, R. Maes, T. Janssen, A. De Loof & J. Vanden Broeck Lab. for Developmental Physiology and Molecular Biology, Zoological Institute K.U.Leuven, Naamsestraat 59, B-3000 Leuven, Belgium

Serine proteases and their corresponding inhibitors play a crucial role in the regulation of a large variety of physiological processes, such as food digestion, blood clotting, embryogenesis, tissue reorganization, defense mechanisms and immune responses. Based on their structural characteristics, serine protease inhibitors were initially classified in twelve distinct families (Laskowski and Kato, 1980). Recently, members of a novel peptide family (the 4-kDa protease inhibitor family) were discovered in invertebrates. Boigegrain et al. (1992) and Nakakura et al. (1992) independently reported the identification of two serine protease inhibitors (PMP-D_2 and PMP-C) from the migratory locust, *Locusta migratoria*. Kromer et al. (1994) showed that both peptides were derived from a single precursor polypeptide. A third related peptide (HI) was identified by Kellenberger et al. (1995) and by means of NMR spectroscopy the solution structures of PMP-D_2 and PMP-C were analyzed (Mer et al. 1994, 1996). More recently, five additional members, designated as SGPI-1-5, were isolated (Hamdaoui et al., 1998) from another locust species, namely *Schistocerca gregaria*. Although they were initially isolated from the ovaries, further studies revealed the presence of these peptides in different tissues (fat body and gonads). In addition, the cDNAs encoding the precursors for SGPI-1-3 have been cloned and stage- and hormone-dependence of gene expression has been studied in different locust tissues (Vanden Broeck et al., 1998). Based on the available sequence data we have also determined the complete cDNA sequence of the precursors for SGPI-4 and SGPI-5. Interestingly, these two precursors contain three additional peptides that display significant sequence similarities to the other 4-kDa inhibitors. Furthermore, northern blot analysis revealed important tissue-dependent differences in the expression of both precursors.

Index terms: gene expression, ovary, peptide, serine protease

[2510] RECORDING OF SPIRACULAR FUNCTIONS BY ARTIFICIALLY GENERATED PRESSURE PULSES

K. Sláma, Inst. of Entomology, Czech Academy of Sciences, Drnovská 507, 16100 Praha 6, Czech Republic; E-mail: slama@entu.cas.cz.

After invention of special methods for recording changes in haemocoelic pressure in 1976, I also attempted to record endotracheal pressures through the spiracles. Unfortunately, these recordings never produced practically useful results. The obstacle was due to mutual interconnections of all spiracles. The cannulated spiracle became soon recognized by the nervous system and it was opened within some 10-15 min. Since then, the barographs recorded only the trivial changes in overall haemocoelic pressure. In 1984, I invented a new, micro-anemometric technique for simultaneous recording of inspirations from multiple spiracles. The advantage of this method was that it permitted recording of air passage through absolutely unrestrained spiracles. It also enabled recording of coordinated pulsations of different spiracular valves during the extracardiac haemocoelic pulsations. These results indicated that insects could actively regulated breathing by means of an autonomic, cholinergic nervous system (coelopulse) localized in thoracic ganglia of the ventral nerve cord. In contrast to the perfectly synchronised pulsation of spiracular valves during extracardiac pulsations, spiracular behaviour during the resting period remains still rather obscure. The results of previous anemometric recordings suggested that spiracles might be during this period closed, with exception of one or a few alternating valves that were incompletely constricted or flashed briefly once in a few min. (passive suction inspiration). In order to obtain more informations in this respect, I tried to develop another method, which was based on physical proportions between the volume, internal pressure and external surface of insect body. I knew from some earlier observations that a relatively small abdominal compression could cause a large positive peak in haemocoelic pressure, provided that all spiracles had been tightly closed. Alternatively, when certain spiracles were open, the same abdominal compression produced only a bulk flow of air through the spiracles without profound impact on haemocoelic (internal) pressure of the body (effect as of a punctured ball). The described isometric-anisobaric physical principle has been now used for recording of spiracular openings. Artificially generated pressure pulse has been externally applied to insect body, whose abdominal movements were monitored by a strain-gauge sensor positioned at the tip of abdomen. The closure, constriction or opening of spiracles could be easily discerned on the records by sudden appearance, modulation or disappearance of the pulse, respectively. The results of these recordings will be presented, with special emphasis on functions of the spiracular valves during the passive suction inspiration, extracardiac haemocoelic pulsation, or during spiracular outpuffs of CO_2. The measurements were mainly performed on pupae of several species of Coleoptera, Lepidoptera and Diptera.

Index terms: Spiracular functions, Spiracular pulsations, CO_2 outpuffs.

[2511] EXCRETION IN THE HOUSE CRICKET, *ACHETA DOMESTICUS*: EFFECTS OF SECRETAGOGUES ON MALPIGHIAN TUBULE ELECTROPHYSIOLOGY AND SECRETION RATE

J.H. Spring[1], M.J. O'Donnell[2] & S.R. Hazelton[1]. [1]Dept. Biology, Univ. of Louisiana at Lafayette, Lafayette, LA 70504-2451, USA, E-mail jhs0431@louisiana.edu; [2]Dept. Biology, McMaster Univ., 1280 Main St. West, Hamilton, Ont., Canada L8S 4K1.

The Malpighian tubules of *A. domesticus* are comprised of three regions, distal, mid and proximal, each consisting of a single cell type. The mid-tubule is the largest segment (≈75% of the total length) and its secretory activity is controlled by a suite of neuropeptides. Basolateral membrane (V_{bl}) and transepithelial potentials (TEP) were determined using microelectrodes, while secretion rates were measured using Ramsay-type preparations. Altering the concentrations of specific ions in the bathing saline suggests that the basal membrane is predominantly permeable to K^+, which provides about 70% of V_{bl}. Dibutyryl cAMP (1 mM) and *Manduca sexta* diuretic peptide 1 (Mas-DP1; 5 nM) both acted to increase TEP but not V_{bl}, indicating that they act on the apical membrane. We had previously suggested that cAMP and the diuretic peptides might act by increasing the permeability of the basolateral membrane to Na^+, however, these data and the reduction in secretion rate by bumetanide (0.1 mM) indicated that basolateral Na^+ entry is restricted to the Na:K:2 Cl cotransporter. Whether cAMP and Mas-DP1 act to stimulate the apical V-ATPase, as is the case in *Drosophila*, or the Na^+/H^+ and K^+/H^+ antiporters, as is the case in *Aedes*, has not been determined. The myokinins, achetakinin 1 and 2 (AK-1, AK-2; 5 nM) decreased TEP by up to 73% without affecting V_{bl}. The chloride channel blocker NPPB reduced the effect of AK-1 on TEP by 75%, indicating that these peptides also act on the apical membrane and not via a paracellular pathway. It appears that the kinins act at quite different sites in different species, e.g. on the stellate cells in *Drosophila*, on a paracellular pathway in *Aedes*, and possibly on apical ion channels in *A.domesticus*. Supported by NSF grant IBN-9807948 to JHS.

Index terms: diuretic peptide, achetakinin, cAMP

[2512] PALATABILITY OF BAIT MATRICES AND MATRIX/TOXICANT COMBINATIONS TO *IRIDOMYRMEX PURPUREUS* AND *I.RUFONIGER* GP SP. (HYMENOPTERA: FORMICIDAE)

M. M. Stevens[1], D. G. James[1,2] & L. J. Schiller[1], [1]Yanco Agricultural Inst., NSW Agriculture, Private Mail Bag, Yanco NSW 2703 Australia. [2]current address: Irrigated Agriculture and Extension Center, Washington State Univ., 24106 N. Bunn Rd, Prosser WA 99350-9687 USA. E-mail: mark.stevens@agric.nsw.gov.au.

Iridomyrmex purpureus and *I.rufoniger* gp sp. disrupt the biological control of honeydew-producing Homoptera in Australian citrus groves primarily through depletion of predator communities in the tree canopies. Baiting has the potential to control *Iridomyrmex* spp. without prejudicing other IPM programs in citrus that have a strong reliance on biological control. Bait matrix preference tests were conducted at nest entrances of both *Iridomyrmex* species. Ground dry dog food and ground insect matrices (with or without added sugar) were equally attractive to *I.rufoniger* gp sp., whilst *I.purpureus* preferred the dog food and ground insect (no sugar) matrices. The dog food matrix was chosen for further studies because of its palatability and ease of manufacture, and impregnated with either technical pyriproxyfen, fenoxycarb, or fipronil, or formulated fenoxycarb (Insegar®) at rates of 0.05 to 1% active (w/w). In preference tests conducted at nest entrances of *I.rufoniger* gp sp. pyriproxyfen and technical fenoxycarb did not affect palatability, however fipronil at >0.05% and all rates of formulated fenoxycarb were repellent. For *I.purpureus*, fenoxycarb (technical and formulated) and pyriproxyfen were repellent at all rates tested, however fipronil showed no statistically significant repellency. Choice and no-choice laboratory tests on worker colonies of both species were conducted with the dog food/fipronil bait at rates of 0.05, 0.1 and 0.2% active (w/w). In the no-choice tests (bait and water only) all rates provided 51-60% mortality (corrected) of *I.rufoniger* gp sp. over 10 days, however when food choices were provided (bait, untreated matrix, sugar solution) 10 day mortality did not exceed 27%. With *I.purpureus*, mortality exceeded 88% in all treatments in both the choice and no-choice experiments. 0.05% fipronil in a dog food matrix is likely to be an effective bait for *I.purpureus* under field conditions, however alternative toxicants may be required for *I.rufoniger*. This study demonstrates that short-term bait preference studies conducted at nest entrances can give a good indication of relative bait palatability to ants, however longer-term studies using laboratory colonies and alternative food choices are a more sensitive test of bait acceptance.

Index terms: ants, citrus, integrated pest management

[2513] ACTIVATION OF PHOSPHOLIPASE A_2 IN COCKROACH (PERIPLANETA AMERICANA) FAT BODY BY HYPERTREHALOSEMIC HORMONE

D. Sun[1] & J. E. Steele[1], [1]Dept. of Zoology, The University of Western Ontario, London, ON, Canada N6A 5B7.

Injection of either of the naturally occurring corpus cardiacum peptides, HTH-I or HTH-II, into the hemocoel of the cockroach causes the concentration of hemolymph trehalose to increase by as much as 100 percent or more. This increase in trehalose occurs at the expense of glycogen stored in the fat body. A comparable effect of HTH-I or HTH-II can also be obtained using dispersed trophocytes prepared from the fat body and incubated in vitro. Although the hypertrehalosemic response primarily depends on activation of glycogen phosphorylase, recent work in our laboratory has shown that inhibitors of phospholipase A_2 (PLA_2) can also block completely the hypertrehalosemic effect of HTH-I and HTH-II. Treating the trophocytes in vitro with HTH-I or HTH-II increases the activity of PLA_2 by more than 30 percent. Our studies show that activation of PLA_2 is Ca^{2+} dependent and appears to be related to an increase in the intracellular concentration of the ion in the intact cell. The change in the activity of PLA_2 is related to the activity of the enzyme associated with the plasma membrane fraction. Coincident with the increase in the activity of membrane bound PLA_2 there is a corresponding decrease in the cytosolic activity of the enzyme. This suggests that the action of the hormone is to promote relocation of the PLA_2 from the cytosol to the plasma membrane where it can become associated with its substrate. Although the transfer of PLA_2 from the cytosol to the plasma membrane is Ca^{2+} dependent, elevation of $[Ca^{2+}]i$ with the sesquiterpene lactone thapsigargin caused only a partial increase in the activity of the PLA_2 associated with the membrane fraction. However, addition of 1-oleoyl-2-acetyl-sn-glycerol (OAG), an activator of protein kinase C, together with thapsigargin, caused a concentration dependent increase in the activity of PLA_2 with respect to OAG. Furthermore, the stimulatory effect of HTH on PLA2 activity is significantly diminished by the protein kinase C inhibitor sphingosine. These results provide evidence that protein kinase C is part of the activation mechanism for PLA_2 in the fat body and this is linked to the formation of trehalose under the influence of HTH.

Index terms: Ca^{2+}, 1-oleoyl-2-acetyl-sn-glycerol, thapsigargin, trehalose, protein kinase C

[2514] STRUCTURE AND FUNCTION OF SPECIFIC PEPTIDES PRODUCED THROUGHOUT DIAPAUSE OF PHARATE FIRST-INSTAR LARVAE AND ADULTS

K. Suzuki, Dept. of Bioscience and Technology, Faculty of Agriculture, Iwate Univ, Morioka 020-8550, Japan, E-mail koichi@iwate-u.ac.jp.

Throughout the periods of obligatory diapause, we have been expecting the production of novel peptides in pharate first-instar larvae of the wild silkmoth *Antheraea yamamai* and in adults of the leaf beetle *Gastrophysa atrocyanea*. In the wild silkmoth, we have predicted the presence of a repressive factor (RF) and a maturation factor (MF). As for MF, it was already reported that peptide-like factor induces some characters occurred in post-diapause development. Recently, we were fortunately successful in the isolation of RF and it's structure has no homology with known peptides. When this antibody was injected into diapausing pharate first-instar larvae, it could break the diapause. The injection of the isolated RF into the individuals destined to break the diapause by an imidazole compound, also expanded days necessary to diapause terminationin. These results suggest that RF acts to maintain the diapause incident in pharate first-instar larvae. From diapausing adults of the leaf beetle, we isolated a novel and diapause-specific peptide, and determined the amino acid sequence. The injection of this antibody into diapausing individuals had no function to break the adult diapause and the isolated peptide also did not inhibit diapause termination which was destined by the continuous application of a juvenile hormone analogue. These evidence indicates that the diapause-specific peptide may be involved with hard environmental tolerance such as temperature and humidity or antibiotic system.

Index term: *Antheraea yamamai*, *Gastrophysa atrocyanea*, RF, MF, diapause-specific

[2515] cDNA AND CHARACTERIZATION OF A SPECIFIC PEPTIDE PRODUCED THROUGHOUT ADULT DIAPAUSE IN THE LEAF BEETLE, *GASTROPHYSA ATROCYANEA*

H. Tanaka[1], K. Sato[2] & K. Suzuki[1], [1]Dept. of Bioscience and Technology, Faculty of Agriculture, Iwate University, Ueda 3-18-8, Morioka 020-8550, Japan, E-mail denny@iwate-u.ac.jp; [2]Iwate Biotechnology Research Center, Narita 22-174-4, Kitakami 024-0003, Japan.

The amino acid sequence has been determined for specific peptide produced throughout adult diapause in the leaf beetle, *Gastrophysa atrocyanea* (Tanaka et al., 1998). This peptide is cysteine-rich and has no homology with known proteins. In an attempt to analyze the physiological role of the diapause-specific peptide, we decided cDNA sequence of the peptide by RACE (358 bp) that includes the leader peptide (23 amino acid residues) and mature peptide (41 amino acid residues). It was found that the peptide mRNA is highly expressed in the fat body being the major source of this secretary peptide in the diapausing adult. By reason that the distribution of cysteine residues and their sequence motif are similar to conotoxins, we examined Ca^{2+} channel-blocking activity in primary culture of mouse nerve cells, but the peptide did not inhibit Ca^{2+} influx. On the other hand, we found an interesting alignment between the diapause-specific peptide and the polypeptides encoded in some insect baculovirus according to computer search (BLAST and FASTA). We also determined a disulfide bound within 6 cysteine residues. These results do not lead to the understanding of diapause mechanism in adult insects, but cDNA sequence of the diapause-specific peptide will be available to analyze the regulation of gene expression involved with diapause, and co-evolutional relation with the insect and baculovirus.

Index terms: cysteine-rich, conotoxin, baculovirus

[2516] CDNA CLONING AND EXPRESSION ANALYSIS OF REL PROTEINS FROM *BOMBYX MORI*

H. Tanaka[1], H. Nakazawa[2], S. Furukawa[2], J. Ishibashi[2], M. Hirokawa[1], A. Shimazaki[1] □ M. Yamakawa[2] [1] Lab. of Genetic Resources, Natl. Inst. Seric. Entomol. Sci., Kobuchisawa, Kitakoma, Yamanashi, 408-0044, Japan, E-mail htanaka1@nises.affrc.go.jp; [2] Lab. of Biol. Defense, Natl. Inst. Seric. Entomol. Sci., Tsukuba, Ibaraki, 305-8634, Japan.

In *Drosophila*, insect kappa B element is involved in transcriptional activation of immune genes and transcription factors which bind to this element have been identified as members of the REL family. Also, in *Bombyx mori*, this element locates on the 5' upstream region of antibacterial protein genes, suggesting an important role in gene activation. In order to elucidate the transcriptional activation mechanism of these genes in *Bombyx mori*, we have focused on the kappa B element. EMSA analysis revealed that factors which bind to the kappa B element of the attacin gene and cecropin B gene exist in the LPS treated fat body nuclear extract. *In vivo* footprinting suggested that these factors bind to the kappa B element. As a candidate for these binding factors, we cloned a full length cDNA which encodes the REL protein (BmREL A) by RT-PCR, 5', and 3' RACE. The length of the cDNA was 2.2 kb, including a 572 amino acid ORF. The REL homology domain in the N-terminal region was about 55% homologous with Dorsal. This ORF also has a proline rich domain which may be a transcriptional activation domain, and leucine zipper motif. These domains are not found in *Drosophila* REL proteins. Furthermore, we obtained two other cDNAs whose 5' region were different (BmREL B,C). Next, we performed Northern analysis using common regions as probes to observe the effect of LPS on these transcripts in fat body tissue. BmREL mRNA existed without LPS treatment, but the amount of this mRNA increased up to 2 hr after treatment, then decreased. We also performed RT-PCR analysis to quantify each transcript. We found these two transcripts had different tissue specific expression patterns, indicating, different promoters regulate their transcription.

Index term: antibacterial protein gene, BmREL,. kappa B element.

[2517] INVOLVEMENT OF BOTH GRANULAR CELLS AND PLASMATOCYTES IN PHAGOCYTIC REACTION IN THE GREATER WAX MOTH, *GALLERIA MELLONELLA*.

Sumio Tojo, and S. Yokoo, Dept. of Appl. Biol. Sci. , Fac. of Agricul. , Saga Univ. , Saga 840-8502, Japan., E-mail tojos@cc.saga-u.ac.jp

Although it has been shown by most authors that only plasmatocytes are involved in phagocytosis of non-self in the greater wax moth, *Galleria mellonella*, we demonstrate in vitro that both granular cells and plasmatocytes are involved in the reaction, using monolayers of these haemocytes prepared from larval haemolymph by a differential cell fractionation method. The adhesion to glassware and phagocytosis of FITC-labelled silica beads in granular cells are greatly reduced by the presence of p-NPGB, a serine proteinase inhibitor, which is known to inhibit the activation of the prophenoloxidase cascade, but the reactions are only partly influenced by PTU, an inhibitor of phenoloxidase. These results suggest that an enhancing factor for both reactions is phenoloxidase itself or component induced during the couse of activation of prophenoloxidase cascade, but not the melanized substance produced by the action of this reaction.
For plasmatocytes, attachment to non-self is totally blocked by the absence of $CaCl_2$ or by the presence of EDTA over 20 mM and the phagocytosis is greatly enhanced by $CaCl_2$, but suppressed by EDTA. These results suggest that Ca ion is a factor required for adhesion of plasmatocytes, and that it also functions to enhance their phagocytic action.
Index terms: cellular defense, phagocytosis, adhesion, phenoloxidase, calcium

[2518] NEURAL DEVELOPMENT DURING EMBRYONIC AND METAMORPHIC DEVELOPMENT IN INSECTS

L. P. Tolbert, ARL Division of Neurobiology, Univ. of Arizona, P.O. Box 210077, Tucson, AZ 85721-0077, USA, e-mail tolbert@neurobio.arizona.edu.
Why study the development of insect nervous systems? Beyond satisfying sheer curiosity, knowledge of insect neural development holds the hope of revealing novel and specific paths for biologically sensitive intervention to protect or to control specific populations of insects. Furthermore, for developmental biologists, insects offer a rich source of material. The development of the nervous system in insects follows different paths, depending on the life history of the species, yet many of the cellular and molecular mechanisms underlying neural development appear to be common across disparate insect species, and even common between insects and mammals (see Arendt & Nubler-Jung 1999). Individual species variations confer particular experimental advantages to the investigator using insects. For all of these reasons, recent years have seen a huge research effort to understand neural development in insects. Unable to review all of insect nervous system development in a one-hour presentation, I will provide a very selective review. I will focus on the growing understanding of the importance and nature of cellular interactions in insect neural development. The nervous systems of certain insects have been excellent systems in which to study these interactions. *Drosophila melanogaster*, a superb organism for genetic studies, has been used to great advantage to reveal the cellular and molecular bases for developmental influences in the peripheral and central nervous systems. Large holometabolous insects, such as the hawkmoth *Manduca sexta*, have different advantages; for instance, developing sensory and central neural structures are readily accessible throughout a major postembryonic wave of development (during the metamorphosis of the larva to the adult), when the animal is large and hardy, readily amenable to surgical manipulations. *Manduca*, besides being useful for cellular studies, also has been especially useful for studies of the molecular bases of hormone action, a special type of long-range cellular interaction, in neural development (Levine et al. 1995). Insect nervous systems develop along widely differing timetables, depending on the life stages of the species. In this review, I will provide background on embryonic development and metamorphosis of the nervous system, but will focus mostly on intercellular interactions that play key roles no matter what the timetable, no matter what the extent of postembryonic reorganization, of the developing nervous system. I will go into most depth on intercellular interactions during development of the antennal system in *Manduca*.

[2519] METABOLISM OF GLYCOGEN DURING THE METAMORPHOSIS OF THE MEDFLY, *CERATITIS CAPITATA*

D. S. Tolmasky, A. Rabossi, C. R. Krisman & L. A. Quesada-Allué, Instituto de Investigaciones Bioquímicas (Fundación Campomar,CONICET and. University of Buenos Aires),Patricias Argentinas 435, (1405) Bs. Aires, Argentina. E-mail: dtolma.fc@iib.uba.ar.

In insects, most of the studies related to glycogen focused on the catabolic pathway associated with the energetic requirement in flight muscles. As far as we know there are no biochemical studies analyzing the role of this important storage polysaccharide during dipteran metamorphosis. Moreover, main enzymes of this pathway such as the initiator and branching enzymes have never been studied in invertebrates. We show results on the stage-dependent level and on the biosynthesis of glycogen during the transition from larva to adult in *C. capitata*. The amount of glycogen cummulated during larval stage decreased to reach the lowest levels during apolysis (20 h after puparium formation, apf). Simultaneously, the degradation index increased starting at the time of larval jumping (8 h before puparium formation, bpf). In agreement with these results, □-amylase increased its activity from the start of metamorphosis to reach the highest activity during prepupa to pupa transition (40 h apf). At this time, histological preparations of muscles and fat body stained negatively with PAS, in contrast with strong PAS+ images in third larva tissues. Glycogen biosynthetic enzymes (initiator, synthase and branching) were measured during metamorphosis and partially purified. The initiator enzyme (called "glycogenin"in mammals) was measured for the first time in insects. Two radiolabelled protein bands showing mobility corresponding to 42 and 38 KDa were visualized by SDS-PAGE. This is similar to the described MW of mammal glycogenin. However an antiserum against rabbit brain enzyme was apparently unable to recognize the insect homologue. After pulse-chase experiments the apparent size of these species increased to 45 and 42 KDa respectively, thus demonstrating an increase in the length of the nascent glycogen chain.
Furthermore, digestion with □-amylase demonstrated that the product synthesized by the insect enzyme is an □□1,4 polysaccharide. We have correlated these results with other biochemical markers and anatomical landmarks to understand the use of storage carbohydrates during the sequence of metamorphosis events starting with larval tissue histolysis and leading to pharate adult tissue histogenesis.
Index terms: glycogen synthase, glycogenin, branching enzyme, histolysis

[2520] ECESIS OF ENCYRTIDAE (HYMENOPTERA: CHALCIDOIDEA) INTO MÉXICO

V.A. Trjapitzin[1,2] & E. Ruíz-Cancino[1], [1]UAM Agronomía y Ciencias, UAT. Cd. Victoria, Tam. 87149, México, [2]Zoological Institute, St. Petersburg, Russia.

Encyrtidae is one of the most important families in biocontrol. According to unpublished data on August 1999, there are 3,607 known species from 461 genera in the world. In México, 100 genera are recorded (22% of the total). The main hosts of these parasitoids are species of Coccoidea, especially mealybugs. The native fauna of Mexican Encyrtidae is badly studied, but it is clear now that at least 12 important species entered by ecesis, i.e. fortuitously with their hosts from other regions or countries. These are: *Anagyrus saccharicola* (parasitoid of the mealybug *Saccharicoccus sacchari* on sugarcane; probably from East Asia), *A. shahidi* (probably parasitoid of the mealybug *Antonina graminis*; from India), *Anicetus annulatus* (parasitoid of soft scales; from East Asia, probably via California), *Aphycomorpha araucariae* (probably from the Southern Hemisphere), *Arrhenophagus chionaspidis* (parasitoid of armoured scales; probably from Europe), *Chrysoplatycerus splendens* (parasitoid of mealybugs; from California), *Coccidoxenoides peregrinus* (parasitoid of mealybugs; probably from California), *Diversinervus elegans* (parasitoid of black scale *Saissetia oleae*; from Africa, probably via California), *Leptomastidea abnormis* (parasitoid of mealybugs; from the Mediterranean Region of Europe, probably via California or directly from Spain), *Metaphycus lounsburyi* (parasitoid of black scale *Saissetia oleae*; from Africa via USA), *Microterys nietneri* (parasitoid of soft scales; from the Oriental Region, via USA or directly), and *Psyllaephagus pilosus* (parasitoid of psyllids on eucalyptus; from Australia and New Zealand, probably via California). We could not find published data about introduction of these species into México, where their role in pest suppression can be significant. Ecesis is also very important in the formation of faunas of Encyrtidae of New Zealand, Hawaii, Bermuda and some other islands.
Index terms: Beneficial wasps, geographic distribution

[2521] MELANIZATION AND ENCAPSULATION IN *HELICOVERPA ZEA* LARVAE INFECTED WITH *AUTOGRAPHA CALIFORNICA* M NUCLEOPOLYHEDROVIRUS

D. Trudeau, J. Washburn & L. Volkman, Department of Plant and Microbial Biology, Univ. of California-Berkeley, Berkeley, CA 94720-3102, USA.

Insects possess an effective immune system that protects them against pathogens and parasites that gain entry into the hemocoel. Although much is known about insect antibacterial defenses, comparatively little is known of the mechanisms involved in systemic resistance to pathogenic viruses. *Autographa californica* M nucleopolyhedrovirus (AcMNPV) is the most widely investigated and best characterized virus which infect insects. AcMNPV has a wide host range and infects at least 32 lepidopteran species within 12 families. Its infection cycle is mediated by two phenotypically different viral particles: the occlusion-derived virus (ODV) and the budded virus (BV). The ODV is responsible for primary infection of the larval midgut whereas BV transmits the infection from cell to cell systemically within the host. Significant inter- and intra-specific variation exists in host susceptibility to fatal infection by AcMNPV. In hosts that exhibit systemic resistance, like *Helicoverpa zea*, disease progression is blocked after intial infection of midgut cells by ODV. Resistance is also observed in these hosts with intrahemocoelic injections of BV. *H. zea* is a 1000 fold more resistant to fatal infection by AcMNPV than *Heliothis virescens*, a susceptible host. Early events in pathogenesis are nearly identical between the two species but disease progression, in *H. zea*, is severely compromised when the virus interfaces with the host's hemocoel. To determine the basis of systemic resistance in this host, comparative *in vivo* and *in vitro* studies of AcMNPV pathogenesis were conducted. These studies revealed the presence of melanization in association with viral-infected tracheal elements in *H. zea*. Encapsulation of melanized tissue by host hemocytes was also observed in this species. Most importantly, *H. zea*'s hemocytes took up AcMNPV BV and transported the nucleocapsids to the nucleus, but no viral gene expression ensued. Hence, *H. zea* hemocytes served to remove BV from the hemolymph. Together, these results suggest a role for cell-specific resistance and the humoral and cellular branches of the insect immune system in systemic resistance. The significance of these results to our understanding of insect antiviral defenses will be discussed.

[2522] POSSIBLE MOLECULAR STRATEGIES THAT UNDERLIE THE EVOLUTION OF METAMORPHIC DEVELOPMENT

J.W. Truman, M. Schubiger, D. Champlin, & L.M.Riddiford, Dept. of Zoology, Univ. of Washington, Box 351800, Seattle, WA 98195-1800, USA, E-mail jwt@u.washington.edu.

Insects show a wide range life history patterns ranging from insects that lack metamorphosis or undergo only partial metamorphosis (hemimetabolous insects) to those that show complete metamorphosis (the Holometabola). The three life stages that are seen in ancestral insect species -- pronymph, nymph and adult -- are proposed to be equivalent to the larva, pupa, and adult stages of insects with complete metamorphosis. This transition from hemimetabolous to holometabolous development has been accompanied by changes in the endocrine patterns underlying growth and metamorphosis and in the way that tissues respond to these hormonal cues. A key change in endocrine secretion has been a heterochronic advancement in the appearance of juvenile hormone (JH) during embryogenesis. This has been associated with the transformation of the transitional pronymphal stage of hemimetabolous insects into the holometabolous larval stage (Truman & Riddiford, 1999, *Nature* 410,447). The talk will explore implications of the changing pattern of endocrine secretion for postembryonic growth and development of imaginal tissues. An important outcome of metamorphosis has been the shift of the growth and differentiation of the adult form into the postembryonic period. This shift in the timing of imaginal growth is manifest in the formation of imaginal discs in the larva. In the ancestral condition, the formation and growth of imaginal discs appears to have been delayed until the end of larval life. A number of groups, however, now show a derived pattern in which imaginal disc formation and growth has been shifted into the early larval stages. The eye imaginal disc of the moth *Manduca sexta* is an example of an imaginal disc that shows the ancestral pattern of formation because it is delayed until the last larval stage. This delay is due to a tonic inhibition of eye disc formation by JH. Hence, the hormone that maintains the larval form also acts to suppress imaginal growth. In the derived condition, JH still acts to maintain the larval form but its ability to suppress the formation of particular imaginal discs is apparently lost so that they can form and proliferate in the presence of JH. The mechanism of this loss is yet to be determined. Another outcome of metamorphosis is that the patterning processes required for making the adult form have been moved out of the embryonic period into post-embryonic life. In the latter situation, these events have come under the control of ecdysteroids. We will discuss the insights that we have gained from molecular studies in *Drosophila* about how these embryonic patterning systems may have been "captured" by the ecdysone signaling pathway.

Index items: *Manduca sexta*, juvenile hormone, ecdysteroids, evolution of metamorphosis

[2523] THE USE OF *DROSOPHILA* TO STUDY THE CONTROL PATHWAYS FOR EXOGENOUS AND ENDOGENOUS COMPONENTS OF THE ECDYSIS RHYTHM

J. W. Truman, O. Shafer & S. McNabb, Dept. of Zoology, Univ. of Washington, Box 351800, Seattle, WA 98195-1800, USA, E-mail jwt@u.washington.edu.

The rhythm of adult eclosion in *Drosophila* is one of the most extensively studied rhythms in insects. The final form of the ecdysis rhythm, however, is a product of endogenous time-keeping via the circadian clock and responses to exogenous cues such as the lights-on signal. The latter results in a pronounced skewing of the ecdysis peak just following lights-on. Recent studies in both *Drosophila* and the moth *Manduca* have shown that ecdysis is controlled through a complex hormonal cascade that includes the steroid hormone, 20 hydroxyecdysone (20E), and a series of peptide hormones: eclosion hormone (EH), ecdysis-triggering hormone (ETH), and crustacean cardioactive peptide (CCAP). We have been interested in how endogenous and exogenous timing factors impinge on this endocrine control pathway. Through a series of mutations and genetically engineered flies, we have found that endogenous and exogenous factors act through different portions of the control cascade. Removal of the EH neurons renders the ecdysis system incapable of responding to the lights-on signal. Although we originally though that the lights-on signal acted to induce EH release in *Drosophila*, we now have evidence that this stimulus acts to shorten the delay between EH release and the subsequent release of CCAP. In contrast to the lights-on response, the circadian control of ecdysis in *Drosophila* does not require the EH neurons. Nor does it apparently require ETH. We think that there is a parallel pathway that can also activate the CCAP neurons -- a prerequisite for ecdysis. This pathway likely involves a circadian control over the timing of the 20E decline at the end of metamorphosis. Evidence for this pathway will be discussed.

Index items: *Drosophila melanogaster*, circadian rhythms, photoreception

[2524] EXTREME HIGH-LEVEL OF AMINO ACID POLYMORPHISM IN A MALE REPRODUCTIVE PROTEIN GENE, *ACP26AA*, IN *DROSOPHILA MAURITIANA*

S. C. Tsaur[1], C. T. Ting [2] & C. I Wu[2], [1] Inst. of Zool., Academia Sinica, Taipei, Taiwan 115, E-mail zosctsau@ccvax.sinica.edu.tw; [2]Dept. Ecol & Evol., Univ. of Chicago, Chicago, IL 60637, USA.

Many genes pertaining to male reproductive functions have been shown to evolve rapidly between species, and mounting evidence suggests the influence of positive Darwinian selection. The accessory gland protein gene, *Acp26Aa* of *Drosophila*, is one such an example. In order to understand the mechanism of selection, it is often helpful to examine the pattern of polymorphism. We here report that the level of amino acid polymorphism in the N-terminal quarter of *Acp26Aa* is relatively high and unprecedented in *D. mauritiana* within *D. melanogaster* species subgroup. We postulated that I) this N-terminal segment may play a role in sperm competition, and ii) *D. mauritiana* may have been under much more intense sexual selection than other species.

[2525] PURIFICATION AND PROPERTIES OF TWO CAROTENOIDS BINDING PROTEINS FROM SILK GLAND OF *BOMBYX MORI*

K. Tsuchida, H. Tabunoki, K. Okada, & H. Maekawa, Div. of Radiological Protection, National Inst. Infectious Diseases, Shinjuku, Tokyo 162-8640, Japan, Email kozo@nih.go.jp

We purified two carotenoid binding proteins with a molecular mass of 33 kDa and 72 kDa from silk gland of *Bombyx mori*. Silk glands were homogenized in saline and applied ion exchange column, gel filtration column and isoelectric forcusing column. Final fractions containing these proteins were judged by SDS -PAGE and it showed as single band. The 33 kDa protein appeared in the midgut and silk gland, and the 72 kDa appeared exclusively in the silk gland. Immunoblotting analysis showed that anti-33 kDa protein antibody can not recognised the 72 kDa protein and versa visa. The silkworm who make a yellow cocoon has both 72 kDa and 33 kDa proteins in silk gland, the mutant which does not accumulate carotenoids to silkgland did not have 72 kDa protein in silkgland. We do not know any relation between the gene and these proteins, however, these proteins may have a important function to transfer carotenoids in silk gland.
Index terms: yellow cocoon, lutein, lipophorin, western blotting, novel protein

[2526] EFFECTS OF PHOTOPERIOD, TEMPERATURE AND HORMONES ON GLYCEROL CONTENT AND ENDOGENOUS ICE NUCLEUS PRODUCTION IN LARVAE OF THE RICE STEM BORER, *CHILO SUPPRESSALIS* WALKER (LEPIDOPTERA: PYRALIDAE)

H. Tsumuki, Research Institute for Bioresources, Okayama Univ., Kurashiki 710-0046, Japan, E-mail: htsumuki@rib.okayama-u.ac.jp

Overwintering larvae of the rice stem borer, *Chilo suppressalis*, are freeze-tolerant (Tsumuki, 1990). Although overwintering larvae of this species produced high content of glycerol, the crystallization temperature was maintained at around –14°C by the production of ice nuclei (Tsumuki and Konno, 1991; Hirai and Tsumuki, 1995). Since enhancement of insect low temperature tolerance is a seasonal phenomenon, photoperiod and low temperature may be responsible for the production of glycerol and ice nuclei. To determine the effects of photoperiod and temperature on the production of glycerol and ice nuclei, mature larvae reared at 25°C under short (10L: 14D) and long (16L: 8D) photoperiods were acclimated to low temperatures. Glycerol content in the haemolymph and the crystallization temperature of the muscle and epidermis increased in diapausing larvae reared under short photoperiod, but not in non-diapausing mature larvae reared under long photoperiod. Furthermore, non-diapausing mature and over-wintering (diapausing) larvae were treated with juvenile hormone (JH)-I and 20-hydroxy-ecdysone (20-HE) which regulate larval diapause. When JH-I was applied, glycerol synthesis was activated and the crystallization temperature of the muscle and epidermis rose in non-diapausing mature larvae. However, injection of 20-HE lowered glycerol content and crystallization temperature in overwintering larvae. These results show that glycerol content and ice nucleus production in larvae of the rice stem borer are related to short photoperiod (diapause) and low temperature exposure.
Index terms: Crystallization temperature, freeze-tolerant, diapause

[2527] DIGESTIVE α-AMYLASES FROM COFFEE BERRY BORER (*HYPOTHENEMUS HAMPEI*) AND THEIR INHIBITION BY AMYLASE INHIBITORS FROM PLANTS

A.J. Valencia[1], A.E.P. Bustillo [2], G.A.O. Ossa[2] & M. J. Chrispeels[3], [1]Depto. de Química, Univ. de Caldas, Calle 65# 26-10, Manizales-Colombia. A.A 275, E-mail: arnubio@emtelsa.multi.net.co; [2]Centro Nal. de Investigaciones de Café, Cenicafé, A.A 2427, Manizales, Colombia; [3]Dept. of Biology, Univ. of California-San Diego, La Jolla, CA 92093-0116, USA

Animals depend on digestive amylases to break down and utilize the starch in their food sources, and insect larvae that develop in starch-containing seeds require these digestive amylases for their development and survival. An excellent illustration of this principle comes from the work on the genetic engineering of peas and azuki beans with the amylase inhibitor α-AI-1 from the common bean, *Phaseolus vulgaris*. The adult coffee berry borer (*Hypothenemus hampei*), a major insect pest of coffee, has two major digestive α-amylases that can be separated by isoelectrofocusing. The α-amylase activity has a broad pH optimum between pH 4.0 and 7.0. Using pH indicators, the pH of the midgut was determined to be between pH 4.5 and 5.2. At pH 5.0, the coffee berry borer α-amylase activity is inhibited substantially (80%) by relatively low levels of the amylase inhibitor (αAI-1) from the common bean, *Phaseolus vulgaris*, and much less so by the amylase inhibitor from *Amaranthus*. We used an in-gel zymogram assay to demonstrate that seed extracts can be screened to find suitable inhibitors of amylases. The prospect of using the genes that encode these inhibitors to make coffee resistant to the coffee berry borer via genetic engineering is discussed.
Index terms: α-amylase, amylase inhibitor, coffee berry borer, *Hypothenemus hampei*.

[2528] INSECT G PROTEIN-COUPLED RECEPTORS AND SIGNAL TRANSDUCTION

J. Vanden Broeck, H. Torfs, W. Van Poyer, J. Poels, G. Simonet, I. Claeys, T. Janssen & A. De Loof Lab. for Developmental Physiology and Molecular Biology, Zoological Institute K.U.Leuven, Naamsestraat 59, B-3000 Leuven, Belgium.

In biological systems, physiological responses to extracellular signals (physical and chemical ones) are elicited by activation of specific receptor proteins (signal transduction). Interestingly, the important classes of signal transducing receptor proteins [ligand-gated ion channels, single-transmembrane receptors, seven-transmembrane or G protein-coupled receptors (7TM-receptors or GPCRs) and nuclear receptors] are present in many metazoan Phyla. G protein-coupled receptors (GPCRs) are membrane proteins that transduce extracellular messages into cellular physiological responses through the activation of heterotrimeric G proteins (αβγ subunits). GPCRs are putative seven-transmembrane proteins (7-TM). Their general properties are remarkably well conserved during Evolution. Despite of this general resemblance, a large variety of different signals are mediated via this kind of proteins. There are specific GPCRs for ligands, such as chromophores (visual perception), amino acids (e.g. L-Glu, GABA), acetylcholine (muscarinic), biogenic amines, neuropeptides (many small peptides), glycoprotein hormones, prostaglandins, nucleotides, olfactory and taste substances, extracellular Ca^{2+}, thrombin, etc... Many GPCRs are targets for pharmaca (medical applications). In insects, GPCRs for visual and chemical signals and for L-Glu, acetylcholine, biogenic amines and peptide ligands have been discovered. Several GPCR-(sub)families probably have an ancient origin that is situated before the divergence of Protostomian and Deuterostomian animals. Nevertheless, an enormous diversification has occurred since then. This implies that, if one wishes to investigate the molecular and cellular basis of signal transduction in insects, it is necessary to study insect receptors. The availability of novel sequence information is expected to grow very rapidly as a result of molecular cloning experiments and of metazoan genome (*C. elegans*, *D. melanogaster*, *H. sapiens*) and EST (expressed sequence tags) sequencing projects. The *Drosophila* Genome Sequencing Project (Berkeley *Drosophila* Genome Project, BDGP, unpublished data) will certainly have an important impact on the future of insect signal transduction and receptor research. In parallel, convenient expression systems and functional assay procedures will be needed for studying receptor properties and to monitor the effects of natural and artificial ligands. The study of evolutionary aspects of G protein-coupled receptors and of their signaling pathways will probably reveal insect-specific features. More insight in these features can result in novel methods and practical applications.
Index terms: amine, evolution, pathway, peptide, pest control

[2529] INSECT G PROTEIN-COUPLED RECEPTORS AND SIGNAL TRANSDUCTION

J. Vanden Broeck, H. Torfs, W. Van Poyer, J. Poels, G. Simonet, L Claeys, T. Janssen & A. De Loof Lab. for Developmental Physiology and Molecular Biology, Zoological Institute K.U.Leuven, Naamsestraat 59, B-3000 Leuven, Belgium.

In biological systems, physiological responses to extracellular signals (physical and chemical ones) are elicited by activation of specific receptor proteins (signal transduction). Interestingly, the important classes of signal transducing receptor proteins [ligand-gated ion channels, single-transmembrane receptors, seven-transmembrane or G protein-coupled receptors (7TM-receptors or GPCRs) and nuclear receptors] are present in many metazoan Phyla. G protein-coupled receptors (GPCRs) are membrane proteins that transduce extracellular messages into cellular physiological responses through the activation of heterotrimeric G proteins ($\alpha\beta\gamma$ subunits). GPCRs are putative seven-transmembrane proteins (7-TM). Their general properties are remarkably well conserved during Evolution. Despite of this general resemblance, a large variety of different signals are mediated via this kind of proteins. There are specific GPCRs for ligands, such as chromophores (visual perception), amino acids (e.g. L-Glu, GABA), acetylcholine (muscarinic), biogenic amines, neuropeptides (many small peptides), glycoprotein hormones, prostaglandins, nucleotides, olfactory and taste substances, extracellular Ca^{2+}, thrombin, etc... Many GPCRs are targets for pharmaca (medical applications). In insects, GPCRs for visual and chemical signals and for L-Glu, acetylcholine, biogenic amines and peptide ligands have been discovered. Several GPCR-(sub)families probably have an ancient origin that is situated before the divergence of Protostomian and Deuterostomian animals. Nevertheless, an enormous diversification has occurred since then. This implies that, if one wishes to investigate the molecular and cellular basis of signal transduction in insects, it is necessary to study insect receptors. The availability of novel sequence information is expected to grow very rapidly as a result of molecular cloning experiments and of metazoan genome (*C. elegans*, *D. melanogaster*, *H. sapiens*) and EST (expressed sequence tags) sequencing projects. The *Drosophila* Genome Sequencing Project (Berkeley *Drosophila* Genome Project, BDGP, unpublished data) will certainly have an important impact on the future of insect signal transduction and receptor research. In parallel, convenient expression systems and functional assay procedures will be needed for studying receptor properties and to monitor the effects of natural and artificial ligands. The study of evolutionary aspects of G protein-coupled receptors and of their signaling pathways will probably reveal insect-specific features. More insight in these features can result in novel methods and practical applications.

Index terms: amine, evolution, pathway, peptide, pest control

[2530] TASTE ENHANCING EFFECT OF GLYCINE ON THE SWEETNESS OF GLUCOSE: A GUSTATORY TRICK FOR THE SYMBIOSIS BETWEEN THE ANT, *CAMPONOTUS JAPONICUS* AND THE LARVAE OF THE LYCAENID BUTTERFLY, *NIPHANDA FUSCA*

A.Wada[1], Y. Isobe[2], R. Yamaoka[3] & M. Ozaki[3], [1]Venture Laboratory, Kyoto Institute of Technology, Kyoto, 606-8585 Japan; [2]Dept. of Biology, Faculty of Science, Nara Women's University, Nara, 630-8506 Japan; [3]Lab. of Chemical Ecology, Kyoto Institute of Technology, Kyoto, 606-8585 Japan, E-mail mamiko@ipc.kit.ac.jp

Various species of lycaenid butterfly grow up with ants during the larval and pupal periods (Atstatt, 1981; Henning, 1983; Pierce, 1987; Holdobler, 1991; Fiedler et al., 1996). One of the representative species in Japan is *Niphanda fusca* (Nomura et al., 1992). The 3 rd instars larvae of *Niphanda fusca* start to produce a sweet secretion from the Newcomer's gland (Newcomer, 1912). The ants, *Camponotus japonicus*, carry them to the nest in early summer and take care of them over wintertime. The Newcomer's gland secretion given as the reward to the ants should especially be attractive for the ants. Actually, the ants have strong interest in the larvae and their secretion. The secretion of *Niphanda fusca* has been once analyzed and found that the secretion included 160mM glucose (75% of the total sugar) and 43mM glycine (76% of the total amino acid (Nomura et al., 1992). In this study, few behavioral observations have been followed by experimental support with sensory physiological approaches. In behavioral experiments, we showed that the ants improved their taste preference to glucose in the presence of glycine, even if the concentration of glycine was too low to induce the feeding behavior of the ants by itself. In electrophysiological experiments on the taste sensilla of the ant, we also showed that the response to glucose was enhanced by glycine. Thus, the taste of "glycine-flavored glucose" could be a probable motivation by which the ants assiduously feed the larvae to get their secretion.

Key words: Newcomer's gland secretion, taste synergism, taste sensilla

[2531] GLUTAMATE RECEPTORS ON THE SOMATA OF DORSAL UNPAIRED MEDIAN NEURONS IN COCKROACH, *PERIPLANETA AMERICANA*, THORACIC GANGLIA.

H.Washio, Dept.Biotech. Ishinomaki Senshu Univ. Ishinomaki, Miyagi, 986-8580 Japan.

L-glutamate has been established as the major excitatory neurotransmitter not only in the vertebrate CNS of the most arthropods. To characterize the somal response to allow comparison with the pharmacology of the mammalian CNS, the glutamate receptor type on the dorsal unpaired median (DUM) neuronal somata was investigated, using glutamate receptor agonists. The ionotropic glutamate receptor (iGluR) agonists, kainate, AMPA and quisqualate, depolarized the membrane accompanied by an increase in membrane conductance. The order of potency of the different agonists of iGluRs was kainate > AMPA > quisqualate. NMDA had no appreciable changes in membrane potentials at 1mM, but accelerated the spike frequency. The metabotropic glutamate receptor (mGluR) agonists, L-CCG-1, trans-ACPD and L-AP4, also depolarized or hyperpolarized the membrane. The order of potency of different agonists of mGluRs was L-CCG-I > trans-ACPD > L-AP4. Application of trans-ACPD at 1mM resulted in membrane hyperpolarization. These results indicate that, in addition to iGluRs, mGluRs are also present on the somata of DUM neurons in cockroach thoracic ganglia.

Keywords: *Periplaneta Americana*, glutamate receptor, dorsal unpaired median neuron

HORMONAL CONTROL OF PHYSIOLOGICAL TRAITS ASSOCIATED WITH DIAPAUSE AND COLD HARDINESS IN A LEAF BEETLE, *AULACOPHORA NIGRIPENNIS*

M. Watanabe[1], K. Tanaka[2], [1]Dept. of Insect Physiology and Behavior, National Institute of Sericultural and Entomological Science, Ohwashi 1-2, Tsukuba, Ibaraki 305-8634, Japan, E-mail masahiko@nises.affrc.go.jp; [2]Laboratory of Ecology, Miyagi Gakuin Women's College, Sendai, Miyagi 981-8557, Japan.

Diapause and cold hardiness are both essential components of winter survival for most insects living in the temperate regions. In many cases, however, the relationships between these two are not well understood. Our previous study has demonstrated that topical application of JH analog (JHA) terminates reproductive diapause of *Aulacophora nigripennis* (Watanabe & Tanaka, 1998). At present, however, it is yet unknown whether JH also regulates cold hardiness and the related physiological traits. In the present study, we examine the hormonal control of cold hardiness and the related physiological (respiration rate) and biochemical (lipids, glycogen and polyol contents) aspects by applying pyriproxyfen (PPF), a JHA, topically to diapause adults of *A. nigripennis*, and discuss the results in relation to the diapause program. The diapause adults that were swarming in October before overwintering had a relatively low level of chilling tolerance at 0°C and low *myo*-inositol content, although they contained a large amount of lipids and glycogen. Topical application of PPF at high doses (□0.05 μg/individual) caused such adults not only to respire more and mate earlier but also to suppress enhancement of chilling tolerance and accumulation of *myo*-inositol. On the other hand, the treatment at a lower dose of PPF (0.01 μg) did not cause such changes, suggesting that the amount of PPF between 0.01 and 0.05 μg is a critical dose to break diapause and to inhibit cold hardening. PPF-treated post-diapause adults also lost triacylglycerols (TG) more rapidly than the acetone-treated controls, while no significant difference was found in the rate of glycogen loss. TG may be the main energy resource for both post-diapause and diapause adults, but are consumed more rapidly by the former due to their higher metabolic rate. On the other hand, post-diapause beetles use glycogen for post-diapause development, while the autumn beetles convert it into *myo*-inositol, a possible cryoprotectant. The present results suggest that various physiological and biochemical traits related to cold hardiness in this beetle may be in part under the control of JH, or regulated indirectly by this hormone through the diapause program.

Index terms: *Aulacophora nigripennis*, diapause, cold hardiness, chilling tolerance, juvenile hormone analog, pyriproxyfen, respiration rate, energy reserves, *myo*-inositol

[2532] HORMONAL CONTROL OF BODY-COLOR POLYMORPHISM IN LOCUSTS.

Seiji Tanaka ,Dept. of Insect Physiology and Behavior, National Institute of Sericultural and Entomological Science, Tsukuba, Ibaraki 305-8634, Japan.

The body-color polymorphism in locusts is controlled by various factors. While the environmental relations are well understood, our knowledge on the hormonal relations is limited, in spite of the intensive studies with two major plague locusts, *Locusta migratoria* and *Schistocerca gregaria* during the past half century. In the last 8 years, our laboratory focused mainly on the hormonal control of body-color polymorphism in locusts. The present paper will review our main results showing that this phenomenon may be explained by two hormones in *L. migratoria*.
An establishment of an albino mutant strain of *L. migratoria* was the beginning of our study on this subject. Implantation of corpora cardiaca (CC) or brain from normal (pigmented) locusts into albino nymphs caused the latter to develop a dark color. Methanol extracts of CC or brains also induced darkening in albino nymphs when the dried extracts were mixed with oil and injected. A similar phenomenon was also found in *S. gregaria*. Recently, a collaborative study with Belgium and Israel succeeded to isolate the dark-color inducing factors from the two species, and revealed that they are the same peptide, [His^7]-corazonin. By varying the dose and the timing of the injection into albino nymphs, it was found that this peptide induced black, brown, gray and reddish body colors, often manifested by solitary nymphs in the field. Interestingly, the gregarious coloration with black patterns and orange background color was also expressed in albino nymphs when the peptide was injected in the middle of the previous instar. In this case, crowding was not required, and injection of the peptide induced the gregarious coloration even in field-collected solitary nymphs. Injection of juvenile hormone (JH) caused albino nymphs to turn green, as expected from other studies, but they looked different from normal solitary green locusts in which the ventral side of the body and some portions of legs are brown or variously pigmented. Body coloration looking like the latter was obtained when albino nymphs were injected with both JH and [His^7]-corazonin. Therefore, these two hormones appear to control the body-color polymorphism in *L. migratoria*.
We discovered that the CC or brain from other insect species such as cockroaches, crickets, katydids, cicadas, dragonflies, moths and butterflies also contain a factor(s) that can induce dark color in locusts. Recently, we isolated another peptide, [Arg^7]-corazonin from a cricket, *Gryllus bimaculatus* and a silkworm, *Bombyx mori*. This peptide is as potent as [His^7]-corazonin in terms of the dark-color inducing action in locusts, but its function in the cricket and silkworm is unknown.
Index terms: *Locusta migratoria, Schistocerca gregaria*, corazonins, JH, body color.

[2533] COMPARISON OF ACCLIMATORY AND EVOLUTIONARY CHANGES IN PHYSIOLOGY OF WATER-STRESSED LARVAL *MANDUCA SEXTA*

H. A. Woods & J. F. Harrison, Dept. of Biology, Arizona State Univ., Tempe, AZ 85287-1501, USA. Email: art.woods@asu.edu.

An important goal of physiological ecology is to understand the relationship between acclimatory responses of organisms to short-term environmental perturbation and evolutionary responses of populations to persistent, long-term differences in environmental conditions. We examined physiological responses of caterpillars to water stress over both individual lifetimes and longer, micro-evolutionary time scales. To examine acclimatory responses, we reared larval *Manduca sexta* (Lepidoptera: Sphingidae) from the early first instar on either high-water (80% water) or low-water (68%) artificial diets. When they reached the fifth instar, we transferred them to the same or opposite diet and measured growth rate and the complete water budget during the subsequent 24 h. Larvae switched acutely from high- to low-water diet showed rapid, two-fold increases in the rate of water recovery by the rectum but did not show changes in evaporative water loss. In contrast, larvae exposed from hatching to low-water diet did not show additional increases in rectal water absorption but did have 33% lower rates of evaporative water loss, probably reflecting alteration of the cuticle. To examine evolutionary responses of populations, we collected *M. sexta* from four different geographic regions spanning a xeric-to-mesic environmental gradient across North America. Larvae from field-collected eggs were reared on *Datura wrightii* (Solanaceae) from hatching in a laboratory common garden and their offspring were then reared on the high-water artificial diet. When challenged with very dry (55% water) artificial diet, F1 fifth-instar larvae derived from the two xeric sites produced slightly but significantly drier fecal pellets (53%) than did those derived from the mesic sites (56%). However, the geographic pattern was different with respect to evaporative water loss: F1 larvae from one xeric and one mesic site had low rates of water loss (9 mg g^{-1} h^{-1}), whereas those from the other population in each zone had high rates of water loss (11 mg g^{-1} h^{-1}), suggesting that rectal water absorption and cuticular waterproofing have not evolved in concert across the environmental cline. These data together indicate that caterpillars counter water stress primarily by making acclimatory adjustments, but that small evolved differences between populations may also facilitate the broad hydric range of *M. sexta*.
Index terms: *Manduca sexta*, water balance, acclimation, micro-evolution

[2534] ONCE AGAIN ABOUT INVESTIGATION IMPORTANCE ON PECULIARITIES OF NUTRITION OF PREIMAGINAL STAGES OF ENTOMOPHAGES DEVELOPMENT

I.G.Yazlovetsky, Institute of Plant Protection, 58 blvd Dachia, Kishinev, Moldova 2060 , E-mail slipbp@cc.acad.md.

Providing full value nutrition of preimaginal development stages of predators and parasitoids is one of the key problems in development of up-to-date systems and technologies for their mass rearing *in vitro*. Certain achievements obtained during recent 20 years in development of artificial nutritional diets for larvae of many predator and parasitoid species confirm utility and in some cases necessity to accumulate authentic information on nutrition peculiarities of preimaginal development stages of this group of insects. The importance of detail study of the nutrition mechanism for larval predators and parasitoids while developing techniques of their *in vitro* rearing has been realized by some researchers dealing with the rearing of entomophages for biological control purposes. With this reference the poster considers current development status of artificial nutritional diets for rearing of entomophages from three families, i.e. *Chrysopidae , Pentatomidae* and *Trichogrammatidae*. Though dozens of different artificial nutritional diets have been tested for many predator and parasitoid species belonging to these families, development of efficient technologies for their mass rearing *in vitro* is still far from being completed. In our opinion to proceed with the success it is necessary to deepen investigations in the following three trends, i.e. 1. Evaluation of the role on extraintestinal (extra - oral) food digestion in feeding of *Chrysopidae* larvae; 2. Investigation of peculiarities of protein digestion by predaceous *Pentatomidae*, conditioned by the presence of cathepsin-like digestion enzymes; 3. Study of the influence of *Trichogrammatidae* female secretion on the host embryo and clarification of the role of teratocytes in nutrition of larvae of these parasitoids. Implementation of the above mentioned works will allow to develop artificial nutritional diets of more full value as compared to known ones for entomophages of the above families and to improve base indicators for their *in vitro* rearing.
Index terms: nutrition, *Chrysopidae, Pentatomidae, Trichogrammatidae, in vitro*

[2535] LEUCOKININ INCREASES SHUNT CONDUCTANCE AND ANION SELECTIVITY IN MALPIGHIAN TUBULES OF THE YELLOW FEVER MOSQUITO *AEDES AEGYPTI*

M.-J. YU & K. W. Beyenbach, Dept. of Biomedical Sciences, Cornell University, VRT 8014, Ithaca, NY 14853, USA, E-mail my43@cornell.edu.

In Malpighian tubules of the yellow fever mosquito, leucokinin-VIII (LK-VIII) opens a transepithelial Cl^- conductance located outside principal cells. The parallel drop of the transepithelial voltage and resistance to values less than 10% of control (self short-circuit), symmetrical transepithelial Cl^- diffusion potentials, and the dependence of the shunt conductance on the Cl^- concentration in the extracellular solutions (both sides), all suggest that leucokinin increases the Cl^- conductance of the paracellular pathway delineated by septate junctions (Pannabecker et al., J. Membr. Biol. 132, 63, 1993). The present study was undertaken to investigate the properties of this septate junctional pathway. In vitro microperfusion techniques were utilized to determine the halide selectivity sequence of the shunt conductance by measuring transepithelial bi-ionic diffusion potentials. Relative permeability ratios (P_X/P_{Cl}) were estimated using the Goldmann constant-field equation. Under control conditions, P_X/P_{Cl} for iodide and bromide were 1.59 and 1.23 respectively, revealing Eisenman halide seletivity sequence I ($I^->Br^->Cl^->F^-$). The same selectivity sequence was more clearly observed after inhibiting active transcellular transport with dinitrophenol (DNP). LK-VIII significantly decreased transepithelial voltage from 40.8 mV (control) to 2.7 mV, and transepithelial resistance from 12.8 KΩcm to 2.1 KΩcm (the self short-circuit). In parallel, the shunt anion selectivity sequence shifted to Eisenman series III ($Br^->Cl^->I^->F^-$), in the absence or presence of DNP. P_X/P_{Cl} now were 1.13, 0.35 and 0.22 for Br^-, I^- and F^- respectively. High concentrations of F^- (142.5 mM) in the peritubular Ringer bath duplicated the effects of LK-VIII on shunt resistance and selectivity sequence, suggesting a role of G-protein in mediating the effects of LK-VIII. The shunt pathway induced by LK-VIII (or F^-) was blocked by I^- and F^- itself. Since under control conditions selectivity sequence I is the mobility of the four halides in free solution, we conclude that the shunt pathway has a low electrical field strength, that selects halides on the basis on their hydrated size. In contrast, LK-VIII (or F^-) induces a shunt pathway with moderate electrical field strength such that coulombic interactions between the shunt and halides exceed halide hydration energies, thereby selecting small, dehydrated halides for passage. Thus leucokinin increases the shunt conductance while optimizing the Cl^- filter. Coulombic interactions between shunt and halides may be strong enough to cause binding, as indicated by the block of the shunt Cl^- conductance by I^- and F^-. (NSF IBN 9604394). Index terms: leucokinin, shunt pathway, halide selectivity

[2536] THE MECHANISM OF ACTION OF LEUCOKININ IN MALPIGHIAN TUBULES OF THE YELLOW FEVER MOSQUITO *AEDES AEGYPTI:* REQUIREMENT OF INTRA- AND EXTRACELLULAR CALCIUM

M.-J. YU, R. Masia & K. W. Beyenbach, Dept. of Biomedical Sciences, Cornell University, VRT 8014, Ithaca, NY 14853, USA, E-mail my43@cornell.edu.

The insect diuretic neuropeptide leucokinin-VIII (LK-VIII) increases rates of transepithelial electrolyte and fluid secretion in Malpighian tubules of *Aedes aegypti* by increasing the Cl^- conductance of the shunt pathway (Pannabecker et al., J. Membr. Biol. 132, 63, 1993). Upon the addition of 1 µM LK-VIII to the Ca^{2+}-containing peritubular Ringer of isolated perfused Malpighian tubules, the transepithelial voltage (V_t) immediately depolarized from 65.4 mV to 1.6 mV in parallel with the drop of the transepithelial resistance (R_t) from 13.5 KΩcm to 2.4 KΩcm. These voltage and resistance changes reflect the 'self-inflicted' short-circuit that stems from the large increase in the Cl^- conductance of apparently septate junctions. V_t and R_t remained low as long as LK-VIII and Ca^{2+} (1.7 mM) were present in the peritubular Ringer. In Ca^{2+}-free peritubular Ringer (0 mM Ca^{2+} and 1 mM EGTA), LK-VIII lowered V_t and R_t only transiently. Thereafter, V_t and R_t oscillated in parallel at a frequency of 3 oscillations/min between short-circuited and open-circuited states. Adding Ca^{2+} to the peritubular medium in quantities that exceed the buffer capacity of EGTA, restored the full short-circuit effect of LK-VIII, i.e. permanent low values of V_t and R_t. These results suggest that intracellular Ca^{2+} stores serve as the immediate Ca^{2+} source for the initial, transient drop of V_t and R_t that is triggered by LK-VIII in Ca^{2+}-free media, while extracellular Ca^{2+} serves the sustained, steady state opening of the shunt Cl^- conductance. In parallel studies using two electrode voltage clamp methods in principal cells, the addition of the Ca^{2+} channel blocker verapamil (2 µM) to the peritubular Ca^{2+}-containing Ringer bath increased the cell input resistance by 20%, suggesting the presence of Ca^{2+} channels in the basolateral membrane of principal cells. However, verapamil did not block the effects of LK-VIII, for which blocker concentrations higher than 2 µM may be required. In summary, these studies support the widely held view that the effects of leucokinin in Malpighian tubules are mediated via G-protein, phospholipase C, inositol tri-phosphate and Ca^{2+} (Veenstra, 1994; O'Donnell et al., Am. J. Physiol. 274, R609, 1998; Clark et al., J. Exp. Biol. 201, 1753, 1998), to which our study adds a role of both intra- and extracellular calcium. (NSF IBN 9604394)

Index terms: leucokinin, calcium, EGTA, IP3, G-protein, verapamil.

[2537] CALYX CELLS AND POLYDNAVIRUS (PDV) PRODUCTION IN THE OVARY OF *COTESIA FLAVIPES* (HYMENOPTERA, BRACONIDAE)

A. A. Zacaro[1,3], H. Conte[2] & C. Cruz-Landim[1], [1]Departamento de Biologia, Instituto de Biociências, UNESP, Rio Claro, SP, Caixa Postal 199, Brasil, E-mail aazacaro@rc.unesp.br; [2]Departamento de Biologia Celular e Genética, UEM, Maringá, PR, CEP: 87020-900, Brasil; [3]Financial support: CNPQ.

The parasitoid braconid *Cotesia flavipes* is a gregarious wasp used as a biocontrol agent against the sugarcane borer *Diatraea saccharalis* (Lepidoptera, Pyralidae). Some species of Braconidae and Ichneumonidae endoparasitic wasps harbor viruses belonging to the family Polydnaviridae, which are produced in specialized ovarian cells (Calyx Cells, CC). The virus particles are released inside the lumen of the oviducts forming the major part of the calyx fluid. During the oviposition, egg and calyx fluid are injected into the host haemocoel. The genomic virus information is apparently integrated in the wasp's genome as proviruses; it is a mutualistic relationship playing an important role during the endoparasitoid life history. Basically, polydnavirus (PDV) avoids egg encapsulation by the immune system of the host. Morphologically, each PDV particle produced in the calyx cells of *C. flavipes* is formed by several electron-dense nucleocapsids embedded in a less electron-dense matrix and enclosed by a single plasmic membrane. Female and adult *C. flavipes* specimens were dissected in fixative solution (0.1M cacodylate buffer, 2.5% glutaraldehyde, 3% sucrose) and the fixed ovaries were routinely processed for transmission electron microscopy (TEM). The ultrathin sections were observed in a Phillips CM100 TEM. We recognize in the CC three morphological stages of PDV production, which seems to be different to previous reports made in other braconids (i.e. *Apanteles galleriae*). The intranuclear formation of the PDV envelope in *C. flavipes* is initiated after nucleocapsid production since no empty envelopes were ever observed. In comparison to the 2nd and 3rd stage, the CC in the 1st stage are smaller, have cytoplasmic inclusions and irregular nuclear morphology with no signs of the production of viral envelopes or nucleocapsids. The 2nd stage, however, is characterized by hypertrophied CC showing great amount of free ribosomes in the cytoplasm and nuclei containing free nucleocapsids and PDV particles. The nuclei of the CC in the 2nd stage have a peripheral halo adjacent to the nuclear envelope which is formed by free electron-dense nucleocapsids embedded in a less electron-dense euchromatic region and a central region characterized by the presence of complete PDV particles. CC in the 3rd stage are characterized by the decreased amount of the cytoplasm and by the presence of many complete PDV particles inside the nucleus, though single nucleocapsids are associated with electron-dense viroplasm between and adjacent to nuclear envelope invaginations.

Index Terms: endoparasitoid; virus particles; viroplasm; nucleocapsid.

[2538] THE ROLE OF MOULTING HORMONE IN DETERMINATION OF PUPARIATION BEHAVIOUR IN FLIES

J. Zdarek & P. Myska, Inst. of Organic Chemistry and Biochemistry, Academy of Sciences, Flemingovo nam. 2, CZ-166 10 Prague 6, Czech Republic, E-mail zdarek@uochb.cas.cz.

The moulting hormone ecdysone was originally isolated and identified using a bioassay based on the ability of the hormone to induce sclerotisation of pre-critically ligated hind parts of a blow fly larva (*Calliphora*-test). Later it was found that the hormone injected into non-ligated third instar larvae accelerated the whole process of puparium formation (pupariation), including cuticular tanning and behaviour responsible for attaining the proper shape of the puparium (i.e. frontal retraction and longitudinal body contraction). It was also observed that younger, 20-hydroxy-ecdysone-treated larvae, although perfectly tanned, did not form puparia of normal shape suggesting that pupariation behaviour could not properly be performed. Such a disparity may mean that the cuticular and neural responsivenesses to the hormonal stimulus have different commitment periods. Here we analyse this hypothesis in the flesh fly, *Sarcophaga bullata*. Our aim was to determine the time of commitment to pupariation of the neural motor centres by monitoring pupariation behaviour of the third instar larvae that had been stimulated to pupariate precociously by various doses of 20-hydroxyecdysone during feeding and post-feeding (wandering) periods. We have confirmed earlier findings that only a short feeding period (12 h) in the third instar is needed for determination of metamorphosis. Larvae removed from food after they had consumed a critical amount formed miniature puparia of normal shape, however after a prolonged period of wandering. At any time during that period they could be induced to pupariate precociously by the injection of 20-hydroxyecdysone. Puparia injected earlier remained larval in shape, indicating that only the cuticular aspect of pupariation was stimulated. Complete performance of pupariation behaviour was recorded only in larvae injected later, during the extended wandering behaviour. This indicates that the appropriate motor neurons acquire competence to initiate pupariation behaviour considerably later than the integument becomes committed to sclerotisation. The effective dose (ED50) of the hormone progressively decreased with increasing amount of food consumed.

Index terms: *Sarcophaga bullata*, ecdysterone, metamorphosis, motor centres

[2539] AREAWIDE MANAGEMENT OF LEPIDOPTEROUS PESTS IN PERENNIAL CROPPING SYSTEMS: OPPORTUNITIES AND CONSTRAINTS

S. C. Welter[1], J. F. Brunner[2], E. Beers[2], R. Hilton[3], A. Knight[4], C. Calkins[4], B. Higby[4] & J. E. Dunley[2], [1]Dept. of Environmental Science, Policy, and Management, Univ. of California, 201 Wellman Hall, Berkeley, CA, 94720, USA, E-mail: welters@nature.berkeley.edu; [2]Dept. of Entomology, Washington State University, Wenatchee, WA 98801, USA; [3]Dept. of Entomology, Oregon State University, Corvallis, OR, 97331, USA; [4]Yakima Agricultural Research Laboratory, USDA-ARS, Wapato, WA, 98951, USA

The implementation of multiple areawide mating disruption programs for codling, *Cydia pomonella*, will be used to illustrate the advantages afforded by regionally coordinated pest management efforts. This approach will be contrasted with other successful pheromone mating disruption programs in tree fruit systems that did not implement on an areawide basis, e.g. oriental fruit moth, *Grapholita molesta*, in peach systems. By definition, the costs and benefits of many pest management systems in perennial cropping systems are distributed over time such that programs with higher initial costs, but long term advantages are more easily implemented. Implementation of 17 areawide programs for codling moth in pears and apples has successfully reduced in-season organophosphate use by >70% without loss of fruit quality. The advantages correlated with the areawide programs for codling moth include regional suppression of moth population numbers and hence increased efficacy of the density dependent mating disruption program. Other advantages include reduced risk from pooling of monitoring data, decreased problems with edge effects, and decreased outbreaks of specific secondary pests, e.g.pear, psylla, *Cacopsylla pyricola*. These advantages have also been correlated with decreasing program costs over time. Conversely, increased problems from other secondary pests have also been observed, e.g. the oblique banded leafroller, *Choristoneura rosaceana*. While the advantages clearly outweigh the direct costs, the cost of maintaining the social structure of areawide programs can be high. The role of increased public scrutiny of individual performances and the social inertia of group efforts for improving overall IPM practices will be discussed.

Index terms: codling moth, pheromone mating disruption, pome fruit, stone fruit

[2540] AREAWIDE APPROACHES TO ERADICATION OF ESTABLISHED PESTS IN PERENNIAL SYSTEMS

K. A. Bloem[1] & S. Bloem[2], [1]USDA-APHIS-NBCI, at Florida A&M Univ., CESTA, Tallahassee, FL 32307, USA; [2]USDA-APHIS-NBCI, at Univ. of Florida, NFREC, Monticello, FL 32344, USA; [1,2]E-mail: ksbloem@nettally.com .

Sustainable population suppression and effective management of key insect pests is best accomplished when a pest is dealt with on an areawide basis. The larger the area the less concern there is about immigration of the pest from neighboring areas that are less well managed and the greater the potential for maintaining the pest at low population levels with reduced inputs. A logical (or illogical?) progression of this approach is to continue population suppression efforts to the point of pest eradication. Areawide suppression of an established agricultural pest has been successfully demonstrated for the codling moth, *Cydia pomonella*, in apples in the northwestern United States using pheromone mating disruption. Local eradication of a recently introduced pest has been successfully accomplished with the Mediterranean fruit fly (medfly), *Ceratitis capitata*, in California and Florida using the Sterile Insect Technique (SIT). However, attempts at areawide eradication of established populations of these pests (medfly in Mexico/Guatemala; codling moth in British Columbia, Canada) have proven much more difficult. Based on experiences with these programs, general approaches to areawide pest management will be discussed, as well as factors influencing decisions about whether or not to control or eradicate a pest. Approaches to maintaining pest free status (e.g., the use of quarantine vs. ongoing control measures) will also be discussed.

Index Terms: *Cydia pomonella*, *Ceratitis capitata*, areawide pest management, SIT.

[2541] REGIONAL MAMANGEMENT AND ERADICATION OF INSECT PESTS IN ANNUAL SYSTEMS

R. T. Staten[1], M. Walters, [1] & O. El-Lissy[2], [1]USDA APHIS PPQ Phoenix Plant Protection Center 3645 E. Wier Avenue, Phoenix, AZ 850404, USA, E-mail Robert.T.Staten@USDA.gov; [2]USDA, APHIS PPQ 4700 River Road, Unit 139, Riverdale, MD 20737, USA

Regional management and or eradication of serious annual crop pests are fraught with complexity. These have however been overcome particularly with two pests of cotton, the Pink Bollworm, *Pectinophora gossypiella* Saunders and the boll weevil *Anthonomus grandis* Boheman. The pink bollworm has been managed in several bio based programs and is a potential candidate for future eradication projects. The boll weevil is the target of an extremely larger eradication effort in the United States. Of particular interest are the program's information management systems and the control management functions.

[2542] RESISTANCE MANAGEMENT ON AN AREAWIDE BASIS IN ANNUAL VERSUS PERENNIAL CROPPING SYSTEMS

J. E. Dunley[1], S. C. Welter[2], & E. H. Beers[1], [1]Dept. of Entomology, WSU Tree Fruit Research and Extension Center, Washington State Univ., 1100 N. Western Ave., Wenatchee, WA 98801, USA, E-mail: dunleyj@wsu.edu; [2]Dept. of Environmental Science, Policy, and Management, 201 Wellman Hall, Univ. of California, Berkeley, CA 97420, USA.

Pesticide resistance management is an important component of most successful integrated pest management programs. When implemented, resistance management programs typically are most concerned with the pesticides being used, and only limited consideration is made of biological control or cultural tactics. Perennial and annual cropping systems offer different scenarios for implementing resistance management programs, in reference to chemical, biological, and cultural control strategies available. Perennial systems, such as deciduous tree fruit, have pest populations that are more resident and must be regulated throughout growing seasons. Pests of perennial crops also are less likely to disperse and become pests on other crops. Annual cropping systems, such as vegetables and cotton, tend to have pest populations that are resident for a portion of the growing season, and pests often move between different crops. Comparing perennial and annual systems, the difference in pest residency, dispersal rates and selection for resistance in alternative habitat become important influences in rates of resistance evolution. Areawide pest management programs offer unique situations to examine these effects. Areawide programs in pome fruit implemented in the western US were used to manage organophosphate resistance in codling moth, *Cydia pomonella*. In this case, organophosphate use was dramatically reduced and codling moth control was maintained by mating disruption. In pear, programs were also established to regionally manage resistance in *Cacopsylla pyricola*, pear psylla. Alternative chemistries were used, and pesticide rotations were implemented. Programs developed for resistance management of pear psylla have also included spider mite resistance management. In annual systems such as cotton and strawberry, different strategies have been implemented for spider mite resistance management in Arizona and California. These systems place more emphasis on movement of pest populations between crops, along with considering cropping systems in regional management programs. Problems in implementing areawide resistance management programs in multiple crops will be discussed.

Index terms: *Cydia pomonella*, *Cacopsylla pyricola*, *Tetranychus urticae*, IPM

[2543] SYSTEMWIDE BIOLOGICAL CHANGES: HARVESTING THE COLLATERAL BENEFITS OF AREAWIDE APPROACHES

J. F. Brunner [1] & E. H. Beers [1], [1] Tree Fruit Research and Extension Center, 1100 N. Western Ave., Wenatchee, WA, 98801, USA, E-mail jfb@wsu.edu and eperyea@tfrec.wsu.edu

It has been hypothesized that areawide pest management approaches that target "key pests" could provide additional benefits by reducing densities of non-target pests. Generally the reduction of these secondary benefits are expected to derive from an enhancement of biological control of the non-target pest species. Enhanced biological control derives directly from a reduction of broad-spectrum insecticides used against the key pest. The codling moth, *Cydia pomonella*, is the key pest in western pome fruit orchards. An areawide codling moth management project (CAMP) was initiated in 1995 in three western states (WA, OR, CA). Mating disruption supplemented with insecticides was the primary strategy used against codling moth. Objectives of CAMP included reducing use of broad-spectrum insecticides and enhancing biological control of secondary pests. To document changes in secondary pest and natural enemy populations a selected number of orchard blocks within CAMP were monitored each year. A similar number of orchard blocks located near CAMP sties but that used conventional (organophosphate-based) pest control programs were also monitored. Comparisons of secondary pest and natural enemy populations from both sources were used to determine if CAMP had any positive impact on densities of secondary pests. Biological control agents are effective in western US apple orchards even with the use of organophosphate and other insecticides. These natural enemies have developed a tolerance or resistance to selected organophosphate insecticides. Saying this, we can say that predatory mites were more common in CAMP orchards in most years. Parasitism of overwintering leafhopper eggs was higher in CAMP orchards but this did not always translate into lower populations of leafhoppers in summer. Populations of the western tentiform leafminer were higher in conventional orchards and parasitism levels were lower compared to CAMP orchards. On the negative side densities of leafrollers were generally higher in CAMP orchards compared to conventional orchards. In pear orchards the densities of pear psylla, *Cacopsylla pyricola*, were lower and its natural enemies densities higher in CAMP orchards compared to orchards under conventional management. No new or unexpected secondary pests appeared in damaging numbers in CAMP orchards during the 5 years of the project.

Index terms: Areawide, mating disruption, biological control, codling moth, secondary pests.

[2544] STATUS OF CODLING MOTH MANAGEMENT AND CURRENT CONTROL PROGRAMS: NORTHERN HEMISPHERE

J. Avilla[1] & L.J. Gut[2], [1]Área de Protección de Cultivos. Centro UdL-IRTA de R+D. Universitat de Lleida. Rovira Roure 177. 25198 - Lleida. Spain. E-mail: avilla@pvcf.udl.es; [2]Dept. of Entomology, Michigan State University, 205B Pesticide Research Center, E. Lansing, MI 48824.

Current control programs for codling moth in different areas of the northern hemisphere depend on control measures that are registered in each country. European countries have a greater number of available insecticides than the USA or Canada. Broad-spectrum insecticides such as organophosphates, pyrethroids or carbamates are registered in all northern hemisphere fruit-growing regions and are still widely used. By contrast, selective insecticides such as insect growth regulators (IGRs) representing several modes of action (juvenile hormone analogues, moulting hormone agonists and chitin synthesis inhibitors) are available in many European countries but not in the USA or Canada. Until recently, IGRs were widely used against codling moth in several European fruit-growing regions until resistance problems developed. Insecticide resistance detection and management is now an important part of control programs. Research on new control tools including synthetic and natural insecticides is being conducted in Europe as well as North America. Non-insecticidal control tactics are already registered in many countries. The most widely used alternative control tactic is mating disruption. Several pheromone dispenser technologies are commercially available. Codling moth mating disruption is more successful in cooler fruit-growing areas than in areas with high summer temperatures and several codling moth generations. The 'attract and kill' technique is a new control method for codling moth and is already registered in Europe and North America. The use of microbials is still very limited. Commercial *Cydia pomonella* granulosis virus (CpGv) preparations have been developed in several European countries, but their availability and use are still limited. Although biological control using inundative releases of parasitoids, primarily *Trichogramma sp.*, can be successful it is not yet a commercially viable control method. The effectiveness of the Sterile Insect Technique (SIT) has been demonstrated for control of codling moth but is only used at the present time in British Columbia, Canada. Regional control of codling moth with area wide suppression programs using mating disruption and insecticides have been successful in the western United States and some European fruit-growing regions. In California as well as northern Italy, mating disruption combined with some insecticide use has been effective against resistant codling moth populations. Geographic information system (GIS) and geostatistics techniques may be helpful to map the spatial distribution of codling moth and make these control programs succeed.

Index words: *Cydia pomonella*, insecticides, microbials, mating disruption

[2545] STATUS OF CODLING MOTH MANAGEMENT AND CURRENT CONTROL PROGRAMS: SOUTHERN HEMISPHERE

W.G. Thwaite[1], M. F. Addison[2] & R.H. Gonzalez[3], [1]NSW Agriculture, Orange Agric. Inst., Forest Road, Orange, NSW 2800, Australia, E-mail: graham.thwaite@agric.nsw.gov.au; [2]Hortec, P.O. Box 1231, Stellenbosch, 7599, South Africa; [3]Univ. of Chile, Coll. of Agric., P.O. Box 1004, Santiago, Chile.

Codling moth, *Cydia pomonella*, is a destructive insect pest of apples and pears grown in South Africa, eastern Australia, New Zealand, Chile, Argentina and Uruguay, and walnuts grown in Argentina and Chile. The number of generations per production season (October to April) ranges from one in the cooler parts of Australia and New Zealand to three and a partial fourth overlapping generations in the warmer parts of South Africa. From the late 1940s until the early 1990s, growers across the southern hemisphere relied on a program of synthetic insecticides for codling moth control. Organophosphates (OPs) were most widely used following their introduction in the late 1950s. OPs were very effective in protecting apple and pear crops from codling moth attack, giving almost 100% control with 5 cover sprays or less. This level of control is still achieved in Chile but it declined in Argentina, South Africa and Australia from the late 1970s. It was not until the early 1990s that resistance to azinphos-methyl was first diagnosed. Insecticide resistance (to several OPs with cross-resistance to other groups), food safety, occupational health and environmental concerns as well as restrictions on pesticide residues in food crops in international trade accelerated interest in alternative management strategies for codling moth. Most successful of these has been mating disruption (MD) with or without supplementary insecticides. One third of the area of pome fruit in South Africa and eastern mainland Australia is under mating disruption. Use of MD in commercial pome fruit in South America is on a small (but increasing) scale. In New Zealand, MD is used in organic grown pome fruit. Several insect growth regulator (IGR) type insecticides have been evaluated and are now in commercial use including fenoxycarb, flufenoxuron and tebufenozide. Their use can be as a stand alone program, part of an insecticide resistance (alternation) strategy, or as an insecticide supplement to MD. Use of degree-day models and pest monitoring are important components of current codling moth control strategies across the southern hemisphere. This 'softer' management option does not overcome the current need to have 100% codling moth free fruit for certain world markets such as Colombia, Japan, Korea and Taiwan. Codling moth management strategies are becoming part of integrated fruit production (IFP) programs as they are progressively implemented for both domestic and international markets.

Index terms: *Cydia pomonella*, insecticides, mating disruption, IGRs

[2546] CODLING MOTH ADAPTATIONS: HOST AND GEOGRAPHIC RACES

H. Riedl[1], P. J. Landolt[2] & S. Marti[1], [1]Mid-Columbia Agricultural Research & Extension Center, Oregon State University, 3005 Experiment Station Dr., Hood River, OR 97031, USA; E-mail helmut.riedl@orst.edu [2]USDA/ARS 5230 Konnowac Pass Rd., Wapato, WA 989951, USA

Between the southern and northern boundary of its distribution, the codling moth, *Cydia pomonella*, displays remarkable adaptiveness and is able to synchronize its life cycle with the fruiting periods of its hosts under various climatic conditions. The codling moth has evolved from a monophagous species on apple to an oligophagous species whose hosts include now other pome and stone fruits as well as walnuts. The codling moth has developed genetically distinct host races which differ from the original apple population in terms of ovipositional preference, voltinism, diapause characteristics and possibly developmental heat requirements. Visual as well as olfactory cues guide codling moth adults to potential host trees. Codling moth adults show a distinct preference for host over non-host trees. Visual fruit cues are primarily important for short-range rather than long-range attraction of moths. Neonate larvae are also attracted to fruit by following visual as well as olfactory stimuli. Both neonate larvae and adult moths orient positively to odors of infested apple fruit, indicating a role of induced chemicals in host finding. Attraction responses, either by larvae or by adults, have now been documented to apple, pear and walnut odors and odorants, suggesting either plasticity in host-finding behavior of the codling moth or overlap in odor chemistry among those different host plants. Further elucidation of attractive host chemicals will permit comparisons of populations to determine if utilization of different hosts is in part explained by host searching behavior. Codling moth is not equally successful on all of its hosts. There are large differences in larval mortality between apple and pear. High larval mortality on some pear cultivars is related to certain anatomical and physical characteristics of the fruit which make it difficult for neonates to penetrate to the fruit interior. Differences in food quality between different hosts may affect the reproductive success of codling moth. Codling moth appears to adapt its voltinism more easily to early-blooming and early-maturing hosts than to late-blooming hosts with late fruit development. In addition to host races, codling moth has also developed distinct geographic races which differ in terms of their photoperiodic reaction and possibly other characteristics as well. Populations in the north respond to a longer critical photoperiod than those in the south. In North America the critical photoperiod increases by about 1.2 h for every 10° increase in latitude. Geographic populations differ also in terms of diapause structure with an increase of obligatory univoltinism from south to north.

Index words: *Cydia pomonella*, host selection, host attraction, diapause.

[2547] CODLING MOTH BEHAVIOR AND ECOLOGY: RECENT FINDINGS

S. Dorn, Institute of Plant Sciences, Applied Entomology, Swiss Federal Institute of Technology (ETH), Clausiusstr. 25/NW, CH-8092 Zürich, Switzerland, E-mail silvia.dorn@ipw.agrl.ethz.ch

Cydia pomonella L. has been known as key pest of fruit orchards for decades, and continues to present a major challenge to pest management. The species is often considered sedentary, but studies on tethered flight show that adult individuals of both sexes have a flight capacity sufficient for dispersal over several kilometers in the field. Flight capacity was found to be a heritable trait. The spontaneous locomotor activity of non-tethered females is, however, more limited than that of males. While males are typically attracted to conspecific females, both virgin and mated females orientate towards host-plant derived odors. The pattern of herbivore-induced volatiles in apple fruits changes with the instar of larvae feeding. Implications on pest management will be discussed.
Index terms: *Cydia pomonella*, flight, locomotion, odor, attraction.
References:
Dorn, S., P. Schumacher, C. Abivardi, and R. Meyhöfer. 1999. Global and regional pest insects and their antagonists in orchards: spatial dynamics. Agr. Ecosyst. Environ. 73: 111-118.
Dorn, S., and H. Gu. 1999. Laboratory evaluation of influence of surface residues of azinphos-methyl on adult activity of codling moth, *Cydia pomonella* L. (Lepidoptera: Tortricidae). *In:* Integrated Plant Protection in Orchards (Polesny, F., ed.). IOBC wprs Bulletin, 22 (7), 195-199 (1999)
Hern, A., and S. Dorn. 1999. Sexual dimorphism in the olfactory orientation of adult *Cydia pomonella* in response to α-farnesene. Ent. Exp. Appl. 92: 63-72.
Schumacher, P., A. Weyeneth, D.C. Weber, and S. Dorn. 1997. Long flights in *Cydia pomonella* L. (Lepidoptera: Tortricidae) measured by a flight mill: Influence of sex, mated status and age. Physiol. Entomol. 22: 149-160.
Schumacher, P., D.C. Weber, Ch. Hagger, and S. Dorn. 1997. Heritability of flight distance for *Cydia pomonella*. Ent. Exp. Appl. 85: 169-175.

[2548] CODLING MOTH MANAGEMENT: MONITORING METHODS, CONTROL GUIDELINES AND PREDICTIVE MODELS

T. L. Blomefield[1] & A.L.Knight[2], [1]Pest Management, ARC Infruitec/Nietvoorbij, P/Bag X5013, Stellenbosch, 7599, South Africa, E-mail tom@infruit.agric.za; [2]ARS, USDA, 5230 Konnowac Pass Rd., Wapato, WA 98951, USA, E-mail aknight@yarl.ars.usda.gov

The development of an effective codling moth management strategy requires detailed information on the pest's population density and phenology. Management of codling moth is difficult because it is a mobile pest, generally occurs at low densities, and is a direct internal feeder of pome fruit and walnuts. Thus management decisions based on sampling information require timely and accurate assessment of its population status. Between the 1920s and 1930s bait traps were the standard method used to determine the need and timing of sprays for CM control. The identification of the female sex pheromone in 1972 and its subsequent synthesis opened up new possibilities of monitoring and managing CM. The use of pheromone traps coupled with the development of the automated weather station, and advances in computer programmes has elevated CM monitoring and management to even higher levels of expertise. However, the information provided by these traps is not always easy to interpret. The number of male moths caught in a pheromone trap can be influenced by an array of factors such as, moth density, immigration, temperature, moonlight, wind speed, trap and lure placement and maintenance, and competition between traps and calling females. Failure to adequately manage codling moth has often been blamed on the poor quality of the data obtained from these traps. In particular, 'negative trap catches' which occurs when traps fail to catch moths despite the occurrence of fruit damage, have been problematic. In addition, the establishment of action thresholds for traps placed in orchards treated with sex pheromones for mating disruption is unclear due to both increased immigration of males into these treated-orchards and the masking of the trap by the pheromone flooding in the orchard. The use of different thresholds for each generation and in different regions has been proposed, but not well studied. New research may ameliorate a number of these problems. Predictive models that link the moth 'biofix', based on male capture in pheromone traps with threshold temperatures for mating during the dusk period can improve spray timing. Recent development of a bisexual lure (DA2313) for monitoring CM will open up new opportunities for monitoring, such as timing sprays based on female emergence and subsequent mating. This bisexual lure may also establish improved action thresholds based on the capture of female moths within orchards. This presentation reviews the monitoring, thresholds and forecasting methods that are currently in use and under development in several pome fruit producing regions of the world.
Index terms: Codling moth, pheromone traps, thresholds, phenology models

[2549] INSECTICIDE RESISTANCE IN CODLING MOTH WORLDWIDE: MONITORING, MECHANISMS AND CROSS-RESISTANCES

B. Sauphanor[1], W.G. Thwaite[2], L. Cichon[3] & J.C. Bouvier[1], [1]Unité de Zoologie-Apidologie, INRA, Agroparc, F 84914 Avignon Cedex, E-mail sauphano@avignon.inra.fr; [2]Orange Agricultural Institute, Forest Road, Orange NSW 2800, Australia; [3]EEA Alto Valle INTA, 8332 General Roca, Rio Negro, Argentina.

The codling moth, *Cydia pomonella*, exhibits a propensity for developing resistance to various insecticides. Resistances to arsenates and to DDT were documented in this species in 1928 and 1956, respectively, after many years of continual use. Resistance to organophosphate (OP) insecticides recently occurred in the U.S.A., Australia, South Africa and Latin America. At the same time, European populations of *C. pomonella* became resistant to different insecticide classes registered against this species, e.g. pyrethroids, OPs, and most insect growth regulators, including insecticides such as ecdysone agonists to which there had not been previous exposure. Enzymatic analysis coupled with insecticide bioassays of populations from southern Europe revealed multiple or cross-resistances to several insecticides, frequently involving enhanced oxidative metabolism. Additional mechanisms including insensitivity of the target site of pyrethroids or OPs also occur. These mechanisms can explain the variability of the spectrum or of the magnitude of insecticide resistance in different populations. The resistance conferred by a combination of these mechanisms does not completely suppress the efficacy of the most widely used organophosphates. However, the frequency and the rate of the treatments has to be increased, which also increases the environmental problems associated with higher insecticide use. Insecticide resistance management mostly involves insecticide alternations, considerations about fitness costs associated with resistance and use of insecticides with possible negative cross-resistance. Implementation of control alternatives such as mating disruption or granulosis virus together with limited insecticide use is expected to be the best long-term strategy.
Index terms: *Cydia pomonella*, resistance management, fitness cost.

[2550] THE FUTURE OF CODLING MOTH CONTROL WITH CONVENTIONAL INSECTICIDES, INSECT GROWTH REGULATORS AND MICROBIALS

P.J. Charmillot[1] & H. Riedl[2], [1]Swiss Federal Research Station for Plant Protection, Changins CH-1260 Nyon, Switzerland. E-mail: pierre-joseph.charmillot@rac.admin.ch [2]Oregon State Univ., 3005 Experiment Station Drive, Hood River, Oregon 97031, USA.

Organophosphate (OP) and other broad-spectrum insecticides have been the principal tools for codling moth, *Cydia pomonella*, control for more than four decades. Although OPs have lost some of their usefulness due to resistance and poor IPM fit, growers in many fruit-growing areas still rely on them for codling moth control for lack of suitable alternatives. Among the first alternatives to OP insecticides were the insect growth regulators (IGRs). Over the last 20 years, IGRs have gradually replaced the neurotoxic broad-spectrum insecticides for control of codling moth, particularly in Western Europe. One group of IGRs is the chitin synthesis inhibitors, which block the formation of chitin during moulting. Diflubenzuron was one of the first insecticides in this group to be widely used for codling moth control. Some chitin synthesis inhibitors are more effective against eggs; others are more effective on neonate larvae. A second group of IGRs is the juvenile hormone mimics such as fenoxycarb, which has only ovicidal activity against codling moth. A third group of IGRs is the ecdysone agonists which enhance the activity of the moulting hormone. Ecdysone agonists such as tebufenozide and methoxyfenozide induce a precocious lethal moult in neonate codling moth larvae and, in addition, have also ovicidal activity. Codling moth control with IGRs is highly dependent on the timing of treatments. IGRs are not systemic, are rain fast and are quite stable in sunlight. Some IGRs have a sterilizing effect on codling moth adults. Attracting male moths with pheromone and sterilizing them with IGRs has shown promise as a control method. With the increased use of IGRs in tree fruits, codling moth has recently developed resistance to IGRs in several European countries. Few microbials have so far found widespread use in codling moth control programs. However, the potential of granulosis virus (GV) for codling moth control is promising. One drawback is its short persistence due to rapid inactivation by UV light. GV is not suitable for curative control under high population density. GV is already widely used for codling moth control in organic orchards. In the future, its use for long-term population control may increase in combination with mating disruption or the 'attract and kill' technique. *Bacillus thuringiensis* (BT) based products have not been effective for codling moth control since neonate larvae ingest too little while entering fruit.
Index terms: *Cydia pomonella*, chemical control, IGR, microbials, granulosis virus, BT

[2551] THE ROLE OF NATURAL ENEMIES AND HABITAT MODIFICATION IN CODLING MOTH MANAGEMENT PROGRAMS

N. J. Mills[1], T. Unruh[2] & U. Kuhlmann[3], [1]Insect Biology, Univ. of California, Berkeley, CA 94720-3112, USA, E-mail nmills@nature.berekeley.edu; [2]USDA-ARS Yakima Agric. Res. Lab., Wapato, WA 98951, USA; [3]CABI Bioscience Centre, CH-2800 Delémont, Switzerland.

Traditionally, codling moth management programs have relied almost exclusively on organophosphate insecticides. However, resistance development and regulatory restrictions have led to the replacement of traditional sprays with mating disruption and more selective products, allowing the integration of natural enemies and habitat modification as additional tactics for codling moth management. Recently two parasitoids have been imported from Central Asia, the purported native range of codling moth, and have become established in the western USA; *Liotryphon caudatus* (Hym.: Ichneumonidae) – a solitary ectoparasitoid that attacks codling moth cocoons under bark and is most active mid summer, and *Mastrus ridibundus* (Hym.: Ichneumonidae) – a gregarious ectoparasitoid that attacks codling moth cocoons on the ground as well as under bark and is most active toward the end of the season. A third species, *Bassus rufipes* (Hym.: Braconidae) a larval endoparasitoid, has yet to become established in the USA. Augmentative releases of indigenous natural enemies have also been considered as potential tactics for codling moth management. Although entomopathogenic nematodes are typically soil inhabitants, *Steinernema* species have been isolated from codling moth, and recent studies in Europe and the USA indicate that high levels of parasitism of overwintering codling moth can be achieved in tree bands and fruit bins following nematode application. Similarly, inundative releases of the indigenous egg parasitoid *Trichogramma platneri* (Hym.: Trichogrammatidae) in California indicate that substantial reductions in damage can be achieved for low pressure populations of codling moth in walnuts and pears. Habitat modification can also be an important tactic in the management of codling moth populations. The smooth bark of high-density plantings may limit the availability of cocooning sites in apple orchards and pruning wounds may frequently be used for cocooning in such orchards. Fruit stripping after harvest in pears and removal of untended nearby wild trees have also proved successful in reducing codling moth populations and fruit damage. Similarly, the use of overhead irrigation and ground cover management by altering the orchard microclimate can reduce codling moth damage, but may have undesired effects on the incidence of disease.
Index terms: *Bassus rufipes*, *Liotryphon caudatus*, *Mastrus ridibundus*, *Steinernema* spp., *Trichogramma platneri*

[2552] MANAGEMENT OF CODLING MOTH WITH MASS TRAPPING, ATTRACT AND KILL, AND MATING DISRUPTION

J. F. Brunner [1] and L. GUT [2], [1] Tree Fruit Research and Extension Center, 1100 N. Western Ave., Wenatchee, WA, 98801, USA, E-mail jfb@wsu.edu. [2] Department of Entomology, Michigan State University, East Lansing, MI ZIP, USA, gut@pilot.msu.edu

The codling moth, *Cydia pomonella*, is the "key pest" of pome fruits in most areas of the world where they are produced. Most broad-spectrum insecticides are used in orchards to control the codling moth in ways that can adversely impact management of other pests through disruption of natural controls. Since the discovery of sex pheromones it has been proposed that these could be used as tools not only to monitor but also to suppress pests. Three tactics have been proposed to mitigate populations of codling moth in pome fruit orchards; mass trapping, attract and kill and mating disruption. Mass trapping relies upon male removal and has not provided adequate suppression of codling moth and expenses of this method is too high to have practical application in commercial agriculture. The coupling of codling moth sex pheromone with a rapid acting insecticide, referred to as attract and kill tactic, has shown great promise as a control. This tactic has been tested most in Europe but is now receiving attention in other pome fruit producing areas. Mating disruption has been the most successful use of sex pheromone for managing codling moth. The development of reliable pheromone dispenser systems has helped promote the adoption of this tactic in commercial agriculture. Hand applied devices have been the primary method used to dispense sex pheromone in orchards, however, several new pheromone release methods are under development including sprayable formulations and "puffer" devices. The latter approach relies upon delivering pheromone using a low-density/high-release strategy. Areawide programs in the western US for codling moth control using mating disruption have been highly successful. Changes in the pesticide regulatory environment in the United States and Europe will continue to increase the demand for alternative tactics to control codling moth. Mating disruption and "attract and kill" technologies will play a valuable role along with other management tactics to control codling moth in the 21st century.
Index terms: codling moth, *Cydia pomonella*, mating disruption, mass trapping, attract and kill.

[2553] STERILE INSECT RELEASE IN CANADA: FROM ERADICATION TO AREA-WIDE MANAGEMENT

H.M. Thistlewood[1,2] & G.J. Judd[2], [1]Okanagan-Kootenay Sterile Insect Release Program, P.O. Box 1080, Osoyoos, B.C. Canada V0H 1V0 Email: hthistle@bctree.com; [2]Pacific Agri-Food Research Centre, Agriculture & Agri-Food Canada, Summerland, B.C. Canada V0H 1Z0 Email: juddg@em.agr.ca.

Sterile insect release (SIR) has been employed successfully in the eradication or management of a small number of insects, and is being considered for use against moths in several countries at this time, but the only commercial experience for codling moth is from Canada. Research and pilot studies in the control of codling moth over a 20-year period led to the establishment in 1992 of an SIR program for its eradication from fruit-growing areas in mountainous valleys in the interior of British Columbia. Although achieving considerable success, the program experienced very serious difficulties in staying on budget and on time, or achieving its goals, and was reviewed externally in 1996 and 1998. In 1999, area-wide management became the primary goal, with control by the SIR method being integrated with many other management tools to reduce pesticide use and provide other benefits. We present a critical appraisal of the results in orchard and urban settings from the beginning of the program to the 1999 season, and discuss the biological and ecological factors which may have led to the success in codling moth management but failure to eradicate. These include: assumptions concerning the dispersal and movement of moths by Man and nature; treatment of different habitats of orchards, homes, and other lands, in a homogeneous fashion rather than as a series of ecological islands; aspects of diapause biology; opportunistic pests and levels of biological control; moth quality, and diseases in rearing. Operational difficulties have arisen from the absence of a workable plan for urban, private, or aboriginal lands, owing to most of the research for codling moth IPM or SIR occurring in commercial crops; the interplay between populations in adjacent orchard and urban areas; decisions based on indirect measures of populations, and lack of a cost-effective system for monitoring and management of very low population densities; technology problems in rearing and release; underestimation of regulatory or quarantine controls, and absence of a valid protocol for prevention of re-infestation in a free trade zone. The solutions to some of the above problems are discussed, and we describe briefly the present form of a community-funded and area-wide pest management program serving over 6,500 ha of apple and pear production, and aimed at providing major savings in pesticide use and in costs to the growers, and new market opportunities.
Index terms: *Cydia pomonella*, sterile insect release, area-wide IPM, review

[2554] POSTHARVEST CONTROL OF CODLING MOTH: CHALLENGES AND RECENT ADVANCES

L. G. Neven[1], M. A. Williams[2], J. Hansen[1] & P. Dentener[1], [1]USDA-ARS, Yakima Agricultural Research Laboratory, 5230 Konnowac Pass Road, Wapato, WA 98951, USA, E-mail neven@yarl.ars.usda.gov; [2]Margaret Williams, Department of Primary Industries, Water and Environment, 13 St Johns Ave New Town 7008, Tas, Australia, E-mail Margaret.Williams@dpiwe.tas.gov.au.

Codling moth is a pest of quarantine concern to many Asian Pacific countries. To prevent the introduction of this pest, many procedures have been tested or developed. Traditionally, fumigation with methyl bromide had provided the most direct postharvest control of codling moth larvae in fresh fruit. Other treatments, such as cold storage with controlled atmospheres, have been proposed, but not widely accepted. New innovations in non-chemical control of codling moth include heat treatments, heat plus controlled atmospheres, microwaves, radio frequencies, electroshock, and irradiation have been tested. Also, new fumigants and GRAS (generally recognized as safe) chemicals have been tried. Procedures for mitigating the occurrence of this pest are the systems approach and the establishment of pest-free zones using sterile insect technique. We will discuss each of these procedures, the state of development, and the likelihood of application.
Index terms: *Cydia pomonella*, non chemical, fumigants, systems approach

[2555] HISTORY AND CURRENT STATUS OF *BEMISIA*

M. R. V. Oliveira[1], T. J. Henneberry[2] & R. Leon-Lopez[3], [1]Embrapa Recursos Genéticos e Biotecnologia, P. O Box 02372, CEP 70.849-970, Brasilia, DF, Brazil. E-mail: vilarin@Cenargen.embrapa.br, [2]USDA, Western Cotton Research Laboratory, Phoenix, AZ. E.mail: thenneb@ix.netcom.com. [3]E.mail: leonrl@telnor.net.

Over the last five decades, *Bemisia tabaci* (Hemiptera: Aleyrodidae), has been the most important pest in many subtropical and tropical agricultural crop production areas. The species has been introduced to new areas in the world, probably due to increased traffic of plants and increasing travel of people within and between countries. The whitefly causes direct feeding damage by withdrawing plant sap photosynthate during feeding. The transmission of yield-limiting viruses is probably the most serious damage caused by this *B. tabaci* in crop production. Studies on the population dynamics of *B. tabaci*, have demonstrated the complexity of whitefly taxonomy and the possibility that some members of this taxon are separate species or are representative of a species complex. Although nomenclatural controversy continues, severe losses in agriculture are being reported in many areas of the world. In Mexico, in 1991 and 1992, *B. tabaci* caused a loss higher than 33 million US dollars by damaging fall melon and watermelon, sesame and cotton. In 1955 cotton was planted in about 200,000 hectareas; after the sweep potato whitefly problem in 1992 cotton growers planted only 653 has. In 1997 Mexicali cotton growers got a record yield of 6.2 bales/ha with only 2.7 insecticide applications during the season against the insect complex. Today the SPW is present but not represent a problem for the cotton growers. On the other hand, at this time it is not possible to plant sesame during the summer because of the high SPW infestations. Only a few hectareas have been planted to fall melon using sistemic insecticide, but still it does not represent an economical alternative for the growers. In Brazil, *B. tabaci* as a pest was considered insignificant until an outbreak occurred in 1992. Since the introduction of *B. tabaci* biotype B (*B. argentifolii*), the pest situation has changed dramatically. Overall, the losses caused by the B-biotype in Brazil exceeded 2.5 billion US dollars. Biotype B has now spread to 24 of the 27 states of Brazil. The state of Pernambuco alone, has lost 11,000 agriculturally related jobs. In the melon growing areas, whiteflies are increasing in numbers and in the last three years more than 10 million US dollars have been spent for insecticides to control this pest. The above examples are just few of problems caused by *B. tabaci* in same areas of the world. This insect is also recognised as an important pest of crop production in many other parts of the world that include areas in Central and South America, the Mediterranean countries, Africa and Asia.

Index terms: *Bemisia tabaci*, whitefly, pest, Mexico, Brazil.

[2556] THE *BEMISIA* SPECIES COMPLEX: A CHALLENGING SYSTEMATIC ISSUE

T.M. Perring, Dept. of Entomology, University of California, Riverside, CA 92521, USA, E-mail thomas.perring@ucr.edu

Recent outbreaks of whiteflies in the genus *Bemisia* have caused significant agricultural losses in many regions of the world. At the core of information surrounding *Bemisia*, is the issue related to systematics of the group. From early literature reported on *Bemisia*, scientists have struggled with the proper placement, and evolutionary relationships of whiteflies in the group. The genus *Bemisia* currently contains 38 described species. Most attendees at the conference are familiar with the issues surrounding the *Bemisia tabaci* (Gennadius) species complex, but this is only one of several such "systematic nightmares" in the genus. For example, in South America there is a *Bemisia tuberculata* Bondar species complex; in Africa, we find the *Bemisia afer* (Priesner & Hosney) species complex; and in the western United States, there is the *Bemisia berbericola* (Cockerell) complex. Some of the earliest work on whiteflies reported that larval and pupal characteristics were the most useful features in taxonomic distinctions between species. This accepted methodology has been applied to most whiteflies, including those in the *Bemisia*. The taxonomy of this group is based largely on morphological features of the 4th nymphal instar (sometimes referred to a red-eyed nymph or pupae). Unfortunately, when one starts looking at numerous populations of a "species" within a given geographic area, on various host plants, in various environments, the key morphological characteristics are not consistent. In fact raising whiteflies from a clonal colony on two different host plants can cause the presence or absence of various setae, and alter the morphology of the 4th nymphal instar. This inconsistency has contributed to 22 taxonomic synonyms of *B. tabaci*. Of course this has tremendous impact on the species' reported life history, host range, damage potential, virus vectoring capability, response to specific pesticides, and all of the other features of the species around which we build IPM strategies. The most immediate worldwide concern with the genus *Bemisia*, is the *B. tabaci* species complex. Studies have identified a number of *B. tabaci* biotypes and a separate species, *Bemisia argentifolii* Bellows and Perring, has been described. In this presentation, the author will present biological and genetic studies that resulted in the ascension of this new species, and provide further support that this species is grouped with other old-world populations. In addition, there is increasing evidence that other groups of the *B. tabaci* species complex may constitute separate species. Finally the author will propose certain adult morphological features be used in species differentiation.

Index Terms: Bemisia tabaci, Bemisia argentifolii, morphology

[2557] OVERVIEW OF INSECTICIDAL CONTROL AND RESISTANCE MANAGEMENT

J.C. Palumbo[1], A. R. Horowitz[2] & N. Prabhaker[3], [1] Dept. of Entomology, Univ. of Arizona, 6425 W. 8th St., Yuma, AZ 85364, USA; [2]ARO, Gilat Experiment Station, M.P. Negev, 85280, Israel; [3]Dept. of Entomology, Univ. of California, Riverside, CA, 92521, USA.

In many agronomic and horticultural cropping systems the use of insecticides is the primary strategy employed to control *Bemisia* whitefly (*Bemisia tabaci*, b-biotype and *B. argentifolii*). Historically, *Bemisia* whitefly populations have been difficult to manage with conventional insecticides in both field crops and glasshouses. Prior to 1990, reduction of *Bemisia* abundance was attained primarily through the use of organophosphate, carbamate, cyclodiene and pyrethroid insecticides. Consequently, because of the widespread exposure to these chemistries, *Bemisia* whiteflies developed resistance to a wide range of control agents. In the past several years, a number of new compounds have been introduced that provide a diversity of modes of action that allow producers to effectively control whiteflies and sustain field efficacy. The chemistries with the most immediate impact on control of *Bemisia* whiteflies include the neonicotinoids, and insect growth regulators (IGRs). The neonicotinoids (including imidacloprid, acetamiprid, nitenpyram, and thiamethoxam) are neurotoxins that target acetylcholine receptors in the insect nervous system and are systemic in the plant. Imidacloprid, applied primarily as a prophylactic soil drench, is largely responsible for the sustained management of *Bemisia* whiteflies in vegetable cropping systems worldwide. IGRs have played an important role in control of *Bemisia* whiteflies on cotton in North and South America, and in Israel. This includes the chitin synthesis inhibitor buprofezin, and pyriproxifen, a juvenile hormone mimic. The development of action thresholds has enhanced the effectiveness of these IGR's in several cropping systems. These new chemistries are compatible with most pest management programs because of their selectivity for Homoptera, and relative safety to natural enemies. However, it should be emphasized that *Bemisia* whiteflies are capable of developing resistance to all of the new compounds. There are examples of recent studies documenting shifts in resistance levels of *Bemisia* to buprofezin, pyriproxifen, and the neonicotinoids in Europe, North America and Israel. Susceptibility to these compounds has been shown to vary seasonally depending on factors occurring within cropping systems. The threat of resistance to the neonicotinoids is a major concern because of their widespread use and the high risk of cross-resistance between these compounds. Insecticide resistance management strategies designed to reduce the risk of resistance based on structured and restricted use of new modes of action, coupled with the deployment of other management tactics presently provides the best model for combating resistance to *Bemisia* whiteflies.

Index terms: *Bemisia*, Neonicotinoids, Imidacloprid, Pyriproxyfen, Buprofezin

[2558] BIOLOGICAL CONTROL WITH PREDATORS AND PARASITOIDS

D. Gerling[1] & O. Alomar, [1]Dept. of Zoology, Tel Aviv Univ., Ramat Aviv 69978, e-mail DANGR @post.tau.ac.il [2]ITRA, Cabrils, Spain. e-mail Oscar.Alomar@IRTA.ES

Parasitoids of *B. argentifolii* are solitary hymenoptera. Most belong to the aphelinid genera *Encarsia* and *Eretmocerus* that are synovigenic koinobionts and oviposit mostly in the late second to early fourth instar. The genus *Amitus*, which has only been found parasitizing *B. argentifolii* since its massive population buildups in the New World, is proovigenic and prefers to attack the first instar of its host. The number of parasitoid species attacking *B. argentifolii* has increases with the pest's increase in range, indicating that species, that up to now had only parasitized local whitefly species, have moved on to the newcomer. Therefore, important parasitoids of *B. argentifolii* can be found in most habitats even without introduction. Rates of parasitism may often be high, especially by the aphelinid parasitoids. *Amitus* species, although they have high reproductive potentials, are not as effective, possibly due to the fact that they attack the first instar, before other compensatory mortality factors take effect. Due to their mode of living, in hosts that are attached to the underside of the leaves and whose shells protect them, whitefly parasitoids are mainly susceptible to insecticides as adults. Predators of whiteflies may be specialist predators of Aleyrodidae, like the coccinellid *Delphastus catalinae* or generalists, that feeds whiteflies and other prey. Among the generalists, genera of heteroptera like *Orius, Disyphus, Cyrtopeltis, Macrolophus, Geocoris* and *Deraeocoris,* may invade whitefly-infested greenhouses or appear in the field and greatly reduce their populations. Others, like *Chrysoperla* species, do not find all of their nutritional needs in whiteflies and therefore are less effective. Parasitoids and predators are utilized against *B. argentifolii* in the United States through introduction and release in the field and through conservation. In addition, augmentation is practiced through preinfesting cucurbits with whiteflies and parasitoids in the nursery. In other places, especially where the pest outbreaks are more recent, conservation is the main tool of natural enemy utilization. Utilization of *D. catalinae* faces difficulties due to its high cost. Development of better methodology for artificial rearing of natural enemies will increase the possibilities of their utilization.

Index terms: *Bemisia, Eretmocerus, Encarsia, Amitus, Orius, Disyphus, Mocrolophus, Cyrtopeltis, Lygus*

[2559] BIOLOGICAL CONTROL WITH FUNGI

M. Faria[1], L. Osborne[2] & Z. Landa[3], [1]Embrapa Genetic Resources and Biotechnology, P.O. Box 2372, Brasília, DF, Brazil, CEP 70849-970; [2]Univ. of Florida, IFAS, Mid-Florida Research & Education Center, 2725 Binion Rd., Apopka, FL 32703, USA; [3]University of South Bohemia, Faculty of Agriculture, Department of Plant Protection, Studenstska 13, 370 05 Ceske Budejovice, Czech Republic.

Pathogens, especially fungi, are potentially important biological control agents of whiteflies. Numerous species have been assessed against aleyrodids including *Zoophtora radicans*, *Entomophthora* spp., *Conidiobolus* spp. (the entomophthoraleans), and mainly, mitosporic fungi such as *Paecilomyces fumosoroseus*, *Beauveria bassiana*, *Verticillium lecanii*, *Aschersonia aleyrodis*, *Hirsutella thompsonii* and, more recently, *Metarhizium anisopliae*. Results under laboratory conditions have been variable, depending on fungal species and strain, whitefly species and life stage, bioassay methodology and other factors. Infection rates above 80% are frequent. The natural incidence of epizootics is erratic and usually occurs after pest damage has occurred. The use of these fungi as biopesticides appears to be the most promising approach and application strategies that emphasize early pest detection and treatment have been developed for several commercial formulations in greenhouse production. Still, the relatively high cost of these products must be compensated by a high value of production. The successful use of fungal insecticides has been more limited in field crops and prospect for their utilization overall have diminished with the introduction of novel chemistry such as the neonicotinoids that are cheap and highly efficacious. Because of many factors such as high production costs, variable and delayed efficacy, lack of optimal application technologies, and poor residual activity, the utilization of these biopesticides has not reached the level predicted some years ago. For these reasons they also may not be useful in systems where *Bemisia*-transmitted viruses are a serious problem. Fungal-based insecticides do offer promise as selective materials that can be integrated into IPM systems with minimal disruption of other natural enemies and several studies have demonstrated the compatibility of fungi with whitefly parasitoids. The increasing demand for pesticide-free food has created a large interest worldwide by producers in the use of biopesticides in IPM programs. Advances in fungal production, formulation and application technology are likely to improve the efficiency and use of these biopesticides in a near future. They offer the possibility of reducing the number of chemical sprays and, consequently delaying the development of resistance in whitefly populations and facilitating the overall use of biological control strategies for this pest.
Index terms: *Bemisia tabaci*, *Trialeurodes vaporariom*, microbial control, Aleyrodidae

[2560] CULTURAL PRACTICES FOR MANAGING WHITEFLIES

L. Hilje[1], H. Costa[2] & P.A. Stansly[3], Plant Protection Unit, CATIE. Turrialba, Costa Rica, lhilje@catie.ac.cr; [2]Department of Entomology, University of California, Riverside, CA 92521, hcosta@mail.ucr.edu; [3]Southwest Florida Research & Education Center (SWFREC), University of Florida. Immokalee, FL 34142, pas@icon.imok.ufl.edu

Heavy crop losses and high control costs due to whiteflies and associated geminiviruses have spurred intensified efforts to develop integrated management (IPM) approaches against this pest complex. An important component of any IPM program is the use of cultural practices that deliberately manipulate the cropping environment to make it less favorable for whitefly or geminivirus reproduction, dissemination, or survival. This presentation provides a worldwide review of the current status of the use of cultural practices for whitefly management, in terms of research and field utilization, and discusses their potential application for managing the whitefly-geminivirus complex. Cultural practices to be discussed include crop-free periods, planting dates, crop rotation, weed and crop residue disposal, crop isolation, seedbed and greenhouse coverage with fine screening, floating row covers, inert and living mulches, living barriers, high planting densities, fertilization regimes, trap crops, and sprinkler irrigation. Despite their intrinsically preventative nature, cultural practices are one component of IPM programs that have not received enough attention from either researchers or growers. Constraints for wide acceptance and application are many. For many practices, there are insufficient data to provide a level of pest control required to produce a marketable crop. Furthermore, conventional experimental procedures are often inadequate to quantify and demonstrate the effectiveness of some practices at the single farm level, due to the mobility of whitefly adults. Growers may be reluctant to change conventional cropping practices. Several techniques, such as fine screening, reflective mulch, or floating covers, require higher initial short-term costs compared to chemical methods. Finally, practices like crop-free periods, planting dates, and even weed and crop residue disposal are not effective unless applied regionally. In spite of these difficulties, practices such as crop-free periods, screenhouses and other exclusion methods, have been widely adapted and credited with saving major industries. Other practices, like colored, reflective or living mulches, as well as companion cropping, may hold promise.
Index terms: *Bemisia tabaci*, *Bemisia argentifolii*, geminiviruses, prevention, integrated pest management (IPM).

[2561] INTRODUCTION: HISTORICAL AND ECOLOGICAL FOUNDATIONS OF IPM

M. Kogan, Integrated Plant Protection Center and Dept. of Entomology, Oregon State University, Corvallis, OR 97331-8530. USA.

The concept of Integrated Pest Management evolved from the need to reconcile the rapid domination of pesticides in all phases of crop, human, and animal health protection and with the rising concern about environmental integrity. Starting with the integration of insecticides and biological control for the management of insect pests, the concept was expanded to include all pests, i.e., plant pathogens and weeds, as well as insects and all control tactics, cultural, mechanical, behavioral, plant resistance, as well as the classical biological control methods. The ecological foundations of IPM were initially limited to population dynamics. It is now recognized that IPM needs a foundation in community and ecosystems ecology if it is to advance to higher levels of integration.

[2562] INTEGRATED PEST MANAGEMENT PROGRAMS FOR CORN AND SORGHUM

H. N. Pitre[1], [1]Dept. of Entomology and Plant Pathology, Mississippi State Univ., Box 9775, Mississippi State, MS 39762, USA, E-mail hpitre@entomology.msstate.edu.

Corn and sorghum are attacked by some of the same phytohagous insect pests. Yield losses are influenced by pest species and their populations, plant stage attacked and environmental conditions. Integrated pest management (IPM), as used in this paper, refers
i

[2563] THE UTILIZATION AND VALUE OF TRANSGENIC CROPS WITH RESISTANCE TO INSECTS IN INTEGRATED PEST MANAGEMENT SYSTEMS

D. J. Isenhour, Monsanto Company, 3100 Sycamore Rd, DeKalb, IL 60115, USA.

Both prior to, and since their commercialization, transgenic crops providing resistance to insect pests have received extremely close scrutiny from the general public and the research community. Since 1996, when Bt-cotton was first introduced into the marketplace, its widespread adoption by growers in United States has resulted in an estimated reduction of more than 3.8 million liters of insecticide, according to recently released figures. Bt-maize was first commercialized in 1997 and its usage has also resulted in reductions in insecticide usage by farmers in North America. These declines in insecticide usage for cotton and maize have resulted in a number of benefits to the grower and to society at large. Benefits to the grower include lower labor costs, time savings and a reduction in total capital expenditures. Benefits to society at large are equally significant and include such "sustainability" issues as the savings in the cost of labor, energy and materials associated with the manufacture, distribution, application and disposal of the insecticides. However, concerns are still voiced in regards to the durability of transgenic crops and their role within integrated management systems (IPM). One of the main concerns for transgenic crops with resistance to insects is the potential for the development of resistance on the part of the insect being controlled. A second concern has been that transgenic crops are not a suitable tactic for IPM systems and should not be deployed in the same fashion as crops with conventional resistance. This paper focuses on the following: 1) The benefits of Bt-cotton and Bt-maize; 2) Suitability of transgenic crops for IPM systems; 3) Current and proposed insect resistant management plans for cotton and maize.

[2564] IPM IN COTTON: THE CHALLENGE OF INTEGRATING NEW TOOLS TO MINIMISE PESTICIDE DEPENDENCE

G. P. Fitt [1] & R. Leonard [2], 1 - Australian Cotton Co-operative Research Centre, CSIRO Entomology, P.O. Box 59, Narrabri, NSW, Australia. Email: garyf@mv.pi.csiro.au. 2 - Louisiana State University, Macon Ridge Branch, Northeast Research Station, Rt 5 Box 244, Winnsboro, LA 71295, USA.

Insect pests represent a severe limitation for cotton production in many regions of the world. Heliothine moths (*Heliothis* and *Helicoverpa* spp.) are key pests which are well adapted to exploit such production systems. A diversity of minor and induced pests must also be managed. While many components of IPM are being used; eg. sampling systems, thresholds, cultural practices, the main intervention for the management of key pests remains pesticides and they represent a significant component of the cost of production. Reliance on pesticides brings significant environmental liabilities in the form of off-target drift, chemical residues in waterways, soils and livestock and resistance. The imperative to reduce reliance on pesticides is strong. IPM must be founded on a thorough understanding of the ecology of pest and beneficial species and their interaction with the crop. Ecological understanding of pest dynamics is improving all the time, likewise our appreciation of beneficial insects and alternatives to pesticides. An emerging era of insect resistant transgenic cottons offers real prospects to provide a foundation for more sustainable, economically acceptable IPM with less reliance on pesticides. Transgenics will not provide sustainable pest management alone and must be supported with comprehensive resistance management strategies, but they offer the opportunity to integrate a range of other tactics not easily compatible with the use of disruptive pesticides. In this paper we will outline a range of possibilities for enhanced IPM in the next decade and discuss how these can build on a framework of transgenic varieties.

Index words: Cotton, IPM, Helicoverpa, transgenic cotton

[2565] SELECTIVE CHEMISTRY AND GENETICALLY MODIFIED MICROORGANISMS AS TOOLS FOR IPM IN CONVENTIONAL AND TRANSGENIC CROPPING SYSTEMS

M. Treacy

ABSTRACT NOT RECEIVED

[2566] SUCCESSES WITH PEANUT IPM IN THE SOUTHEASTERN UNITED STATES THROUGH INTERDISCIPLINARY APPROACHES

J. W. Todd[1], S. L. Brown[1], A. K. Culbreath[2], H. R. Pappu[2], D. W. Gorbet[3] & J. A. Baldwin[4], [1]Depts.of Entomol., [2]Plant Pathology & [4]Crop and Soil Sciences, Univ. of Georgia, P.O. Box 748, Tifton, GA 31794, USA, E-mail todd@tifton.cpes.peachnet.edu; [3]Dept. of Crop & Soil Sciences, University of Florida, Marianna, FL 32446, USA.

Key insect pests of peanut in the southeastern United States are not numerous in the conventional sense. Weather patterns, adjacent crops, and pesiticide induced outbreaks influence the severity of problems. One group of insects, however; the Thripidae, has come to the forefront over the last 15 years, and have been the subject of more research in the recent past than all other species combined. Thrips comprise a group of tospovirus transmitters which have become important more because of the virus they spread than for the damage they do directly. Spotted wilt disease, caused by tomato spotted wilt tospovirus (TSWV), has become a major yield and profit limiting factor on numerous agronomic and horticultural crops worldwide. Spotted wilt was first observed in the southern US in the early 1980s with most recent incidence levels as high as 70 to 90% in peanut, pepper, tomato and tobacco. Recent research has shown that although no single practice provided adequate suppression of TSWV in peanut, various combinations of cultural practices have significantly reduced incidence, severity and yield losses resulting from spotted wilt. We developed an integrated management system and a "risk assessment index" for spotted wilt in peanut which includes the following components, (1) use of a "resistant"cultivar (2) avoid very early and very late planting dates (3) plant to achieve a stand of ca. 4 plants per 30 cm of row, (4) use of Thimet7 insecticide at-planting (except where other problems dictate otherwise) (5) plant twin rows instead of single and (6) use conservation tillage instead of conventional. Extensive validation research and "on-farm" surveys conducted from 1996 through 1999 confirmed the utility of the package approach set forth in the UGA-TSWV Risk Assessment Index. The effects of final spotted wilt severity on peanut yield were determined where the various combinations of cultivar, planting date, plant population, and systemic insecticide at-planting were established. Cultivar selection proved to be the most important factor, with planting date, plant populations, row pattern and tillage system and insecticide contributing less, but still giving significant additional reductions in TSWV and resulting in higher yields. Risk index values calculated for each of the treatment combinations also correlated well with TSWV severity (R=0.90) and yield (R=0.81). On-farm surveys of various combinations of practices adopted by farmers gave similar results in reducing TSWV severity.

Index terms: *Frankliniella fusca, Frankliniella occidentalis,* TSWV

[2567] ROLE OF NATURAL ENEMIES IN DEVELOPING IPM STRATEGIES

F. Moscardi, B.S. Corrêa-Ferreira & D.R. Sosa-Gómez, Embrapa – National Soybean Research Center, P.O. Box 231, Londrina, Pr. 86001-970, Brazil, Email moscardi@cnpso.embrapa.br.

The role of natural enemies in IPM programs is unquestionable, but the success of their employment will vary with the characteristics of each biological agent group (predator, parasitoid and entomopathogen) and even the characteristics of subgroups and species within these groups, in relation to the pest-crop-environment involved. The strategies adopted for use of natural enemies in a soybean IPM program in Brazil will be used as a case study in this presentation. This program was implemented in the mid 1970's, and was based primarily on action thresholds for key soybean pests (the velvetbean caterpillar, *Anticarsia gemmatalis*, as a defoliator, and a complex of pod and seed-sucking stink bug species (mainly *Nezara viridula, Piezodorus guildinii,* and *Euschistus heros*), and application of selected insecticides when action thresholds were reached. These initial actions brought down the number of insecticide applications on the crop, in specific regions in Brazil, from an average of ca. 6 to ca. 2 applications per season, in a period of four years. In the late 1970's, a program was initiated at Embrapa (Brazilian Organization for Agricultural Research) for the use of a *Nucleopolyhedrovirus* of *A. gemmatalis* (*Ag*NPV) to control the insect at grower level. In the early 1990's five private companies started production and commercialization of this bioinsecticide, with quality control being made at Embrapa. Use of the *Ag*NPV started in 1983 in ca. 2,000 ha, and increased drastically in subsequent years, reaching 1,000,000 ha/year of soybean in 1990. Nowdays, it has been used annually in ca. 1,400,000 ha (ca. 10% of the soybean cultivated area in Brazil). In the major soybean producing state (Parana) the *Ag*NPV is the major insecticide used against *A. gemmatalis*, corresponding to ca. 27% of the insecticide applications against this pest. The success of *Ag*NPV use is due to its virulence, ability of horizontal transmission and recycling and to persist in the environment of the host, as well as the high tolerance of soybean to defoliation, among other factors. In 1991, a biological control program was developed against stink bugs, through the laboratory rearing of the egg parasitoid *Trissolcus basalis* and release in soybean fields. This program was implemented in 1994 by use in continuous areas of micro river basins with the participation of governmental, industrial and academic partners. Nowdays, this system is being implemented in five counties of Parana State, involving 343 producers, resulting in drastic reduction of chemical insecticides use and change to less toxic insecticides.

Index terms: Insecta, microbial control agents, epizootiology

[2568] IPM SYSTEMS FOR SOYBEAN IN THE SOUTHERN USA: SUCCESSES AND CHALLENGES

D. J. Boethel[1] & R. M. McPherson[2], [1]Dept. of Entomology, Louisiana State University Agricultural Center, Baton Rouge, LA 70803, USA, E-mail, dboethel@agctr.lsu.edu; [2] Coastal Plain Experiment Station, Univ. of Georgia, P. O. Box 748, Tifton, GA 31793, USA.

The remarkable increase in soybean acreage in the Western Hemisphere in the 1960s paralleled the evolution of the integrated pest management (IPM) movement. Expansion of soybean was dramatic in the southern USA, an area at high risk to insect pests. Because of the adverse aspects of over-reliance on insecticides for pests on other southern crops and the economics of soybean production that would not allow excessive expenditures for insecticides, IPM was readily embraced by scientists and producers resulting in limited insecticide usage. Critical components were the development of economic injury levels (EILs) and adoption of economic thresholds (ETs). More EILs exist for soybean than any other commodity. Virtually every soybean insect pest and some pest guilds are managed based on an ET, at least a nominal threshold. Scouting and adherence to ETs has allowed natural enemies to frequently keep pest populations in check. These tactics have resulted in IPM systems that have been environmentally sound and profitable, i.e., expenditures for insect control in Louisiana routinely are <5% of the crop production costs. As successful as the IPM programs have been, challenges remain. The newest innovation has been adoption of early soybean production systems (ESPS) in the mid-south states. ESPS promotes the planting of early-maturity cultivars in April which offer advantages of drought avoidance and escape from migratory late season pests. However, the cultivars demand intensive management of stink bugs. Preventive applications of insect growth regulators (IGRs) along with micro-nutrients and fungicides have gained popularity. Advantages are low cost, reduced scouting, and avoidance of inclement weather during periods of insecticide applications. Concern with the use of IGRs in this manner is the disregard for ETs. Applications occur before the appearance of the target pest species. The same concern may surface when transgenic soybeans expressing genes for insect resistance emerge. Public soybean breeders have incorporated the Bt gene and undoubtedly, the private sector has explored this research area as well. However, this technology and the IGRs being evaluated may complement the current IPM systems to ensure sustained production of one of the region's major crops.

Index terms: soybean, IPM, economic injury level, economic threshold

[2569] IPM PROGRAMS FOR RICE

E. A. Heinrichs, Dept. of Entomology, University of Nebraska, Lincoln, NE 68583-0816, USA, E-mail eheinrichs2@unl.edu.

Rice is the staple food of 2.4 billion people, a number, which is likely to double in the next 50 years. The increased production necessary to meet this demand requires an intensification of production and higher yields. Rice is grown by some 300 million farmers around the world, and many of them have become accustomed to using pesticides. The "green revolution promoted efforts to develop high-yielding crop varieties, supported by agrochemical inputs, to feed the rapidly increasing populations of developing countries. Since the advent of the "Green Revolution" rice varieties, there has been a shift from a primarily unilateral approach of insect control, with a strong reliance on insecticides, to a multilateral approach involving a mix of control tactics. These include numerous primary and secondary cultural control practices. Classical and inundative biological control approaches have had little success in rice. However, research has shown that indigenous natural enemies have a strong impact on rice pest populations and their conservation is an essential part of rice IPM programs. Resistant cultivars are sought as a major tactic in an integrated approach to rice insect control. However, there are still numerous insects for which commercial insect resistant rice varieties are not available. Recent advances in biotechnology provide the possibility of solving some of the constrints that have limited the practical use of genetic resistance to insects in rice pest management programs. IPM programs have had a significant impact on minimizing the adverse effects of insecticides, and in increasing the profitability of rice production. It has been estimated that the cost savings from research leading to increased insect pest management efficiency on rice in South and Southeast Asia was $973 million in insecticide saved by the year 2,000. Irrigated lowland rice IPM development and implementation Asia in the 1990's induced a paradigm shift to a problem-solving strategy in which farmers are considered as IPM experts and ecosystem managers and where major emphasis is placed on regular field observations, growing a healthy crop and conserving natural enemies. These principles were first taught through the "Farmers' Field Schools" (FFSs) approach in Asia and later in West Africa. Rice IPM in the FFSs serves as an entry point for the training of farmers in a holistic approach to sustainable crop production. The FFSs have had a significant impact on minimizing the adverse effects of pesticides and in increasing the profitability of rice production. Major emphasis has been on irrigated lowland rice. Development of IPM programs for rice grown in other habitats, such as upland rice, a major rice culture in West Africa, are needed.

Index terms: Rice, *Oryza sativa,* insects, integrated pest management, insecticides, biological control, cultural control, plant resistance to insects, Asia, Africa

[2570] COTTON IN THE SOUTHERN USA AS A MODEL IPM SYSTEM

S. G. Turnipseed, Dept. of Entomology, Clemson Univ., P.O. Box 247, Blackville, SC 29817, USA, E-mail:strnpsd@clemson.edu

Cotton production historically has depended upon high input of broad-spectrum insecticides to control several major pests. Natural enemies were destroyed, pest resurgences were common and a classical "pesticide treadmill" was the rule. Resistance to organochlorines and organophosphates became widespread in *Heliothis virescens* and *Helicoverpa zea*. These pests are rapidly developing resistance to pyrethroids. Several recent developments have allowed us to develop IPM remedies for this situation. First, a program to eliminate the boll weevil, *Anthonomous grandis grandis*, as an economic pest has been highly successful in the southeastern USA. This was accomplished using fall diapause sprays and sprays in the next year prior to fruit development that killed *A grandis grandis* before reproduction occurred. Secondly, data from SC and other states showed that cotton recovered from extensive loss of pre-floral buds in early season without any adverse impact on maturity, yield or quality of the crop. Thus, few, if any, applications were necessary until mid-July for flights of *H. virescens, H. zea*, and other lepidopterous pests. Natural enemies thrived in early-season and helped regulate these pests. In conventional cotton genotypes, pyrethroids are usually applied to control *H. zea* where its populations have not developed resistance. Where field failures have occurred using pyrethroids, alternative chemistries such as thiodicarb and spinosyn are recommended. Another key development in cotton IPM was the genetic modification (GM) of plants by Monsanto Corporation to contain the delta endotoxin of the Cry1A(c) strain of *Bacillus thuringiensis* for control of certain lepidopterous pests. Called B.t. cotton, these varieties controlled *H. virescens*, gave ca. 80% control of *H. zea* and allowed further reductions in applied insecticides with concurrent increases in important natural enemies. Also, effectiveness of pyrethroids showed dramatic improvement in B.t. compared with conventional genotypes. Now, GM cotton genotypes from Monsanto that contain a strain of B.t. named CryX in addition to Cry1A(c), are undergoing field testing. These two-strain genotypes appear to have substantially increased activity against lepidoptera and little insecticide will be needed for supplemental control. Only non-lepidopterous pests, which are of less importance, will occasionally require control. With the above-described developments, we have been enabled to advance from high insecticide cotton production where IPM was relatively unimportant, to low-insecticide production wherein natural enemies reach their full potential, pests are controlled only when needed, and model IPM systems prevail.

[2571] AN ECOLOGIST'S VIEW OF IPM

P.G. Risser, Oregon State Univ., 600 Kerr Administration Bldg., Corvallis, OR 97331-2128, USA, E-mail Paul.Risser@orst.edu.

Ecosystem management, in its various forms, is now a significant strategy for making management decisions about natural resources such as forests and rangeland. Essential ingredients of ecosystem management include: assessment of a broad range of benefits, costs, and risks from multiple perspectives and spatial and temporal scales; application of science to detect and predict ecosystem change; joint planning among management and regulatory agencies; involvement of the interested public in decisions, and implementation of adaptive management and flexibility. In the new century, integrated pest management will benefit from application of the basic framework of ecosystem management. Although IPM has achieved notable successes, long-term pest management will be most successful if it has the potential to involve many structural and functional characteristics of the ecosystem. Landscape ecology focuses on temporally and spatially defined interactions of abiotic and biotic components of ecosystems. As farming systems are considered in terms of landscape ecology, considerable complexity becomes available as raw materials for integrated pest management. Multi-trophic interactions among, for example, plants, herbivores and parasites or predators offer a potentially powerful vertical approach to the biological control of pests. The spatial distribution of different crop species and vegetation over a matrix of soil types presents options for managing pests. Timing of tillage practices, irrigation and fertilizer application, vulnerability of life-cycle stages, seasonal difference in susceptibility to diseases all offer temporal dimensions of pest management. Integrating these vertical, horizontal and timing dimensions across a farm or region with landscape ecology techniques offers useful options for integrated pest management. Landscape ecologists have developed spatially explicit models of such processes as water and nutrient flow, and movement of insects, birds, mammals, and seeds. These models are particularly useful within the ecosystem management framework because they permit the integration if many ecosystem processes. Moreover, they offer a mechanism for analyzing and predicting the consequences of alternative management strategies. Applying these models, with embedded pest control processes, represents a potentially advantageous method for IPM.

Index terms: Landscape ecology, ecosystem management, ecosystem models.

[2572] ARTHROPOD BEHAVIOR AND IPM

R.J. Prokopy[1] & B.D. Roitberg[2], [1] Dept. of Entomology, Univ. of Massachusetts, Amherst, MA 01003, USA, E-mail prokopy.umass.edu; [2] Dept. of Biological Sciences, Simon Fraser Univ., Burnaby, BC V5A1S6, Canada, E-mail bernard.roitberg@sfu.edu.

Ecological theories stem from principles that reflect patterns of relationships between organisms and their environment. Ecological principles may embody, at least indirectly, aspects of the behavior of organisms. For example, principles of population dynamics of organisms incorporate elements of the state of the biotic environment, such as resource abundance and quality, habitat structure, competitors, and natural enemies, as factors that shape a population's dynamics. In turn, in evolutionary as well as contemporary time, individuals may adjust their behavior in response to properties of environmental structure. This presentation will focus on how the state of the biotic environment affects the resource foraging behavior of agricultural pests and approaches to behavioral control of pests. Studies on the behavior of apple maggot flies, *Rhagoletis pomonella*, a key pest of apples in much of North America, will be used to illustrate major points. Apple maggot flies originate from wild hosts, where they feed, mate and lay eggs in fruit, using odor and visual stimuli to locate these essential resources. Subsequently, many fly into commercial orchards in search of additional resources. Abundance, quality and distribution of food and egglaying sites, and abundance of intra-specific competitors, both outside and inside of commercial orchards, can profoundly affect female foraging behavior and ultimately population dynamics. These factors also affect degree to which females respond to odor/visual traps used to ring commercial orchards to prevent fly penetration into orchards. Models incorporating abundance, quality and distribution of resources and intra-specific competitors as factors affecting the probability of capture of apple maggot flies by odor/visual interception traps will be described.

Index terms: Ecological principles, habitat structure, foraging behavior, IPM, *Rhagoletis* flies

[2573] PESTICIDES, ECOLOGY AND IPM: OPTIMIZING PESTICIDE USE WITHIN PEST MANAGEMENT SYSTEMS

P.C. Jepson, Dept. of Entomology, Oregon State University, Cordley Hall, Corvallis, OR 97331, USA.

Can pesticides be exploited more effectively, with reduced risks of pest resistance, pest resurgence, impacts on beneficial organisms and environmental contamination? The next phase in the short but complex history of synthetic pesticide use in agricultural crops should make use of accumulated knowledge of pesticide science to tune the selection of active ingredient, and the pattern and level of use, to the agroecosystem in question. Pesticide application and delivery to the target is an inefficient process and there is evidence that efficiency could be improved through more detailed investigation of dose delivery. This includes not only the application and distribution process and the behavior of the pesticide, but also a knowledge of pesticide exposure and uptake by target and non-target organisms. The small number of current examples of the successes that can be achieved through this process will be outlined, including research on locusts, cotton Lepidoptera, non-target organisms in small grain cereals and pests of potato. The analysis will consider conventional and transgenic means of pesticide delivery. Following application, ecological impacts evolve within and beyond the treated area. There is again, evidence that these impacts can be mitigated by taking physical and ecological attributes of exposed habitats more fully into account in pesticide decision making. This requires integration of our knowledge of environmental fate, susceptibility and exposure of a wide range of taxa, and the ecology and life history of organisms at risk. An analysis of the most recent advances in this area will be presented, including candidate decision aids for pesticide users. Without more widespread us of these approaches, it will not be possible to properly exploit the opportunities that are being presented by new active ingredients.

Index terms: bioavailability, ecotoxicology, environmental fate, resistance management, transgenic crops

[2574] HOST PLANTS / HERBIVORES / NATURAL ENEMIES: MODELING THE DYNAMICS OF TRITROPHIC INTERACTIONS

A. P. Gutierrez

ABSTRACT NOT RECEIVED

[2575] APPLICATIONS OF MOLECULAR ECOLOGY TO IPM – WHAT IMPACT?

P. J. De Barro[1], O. R. Edwards[2], P. Sunnucks[3], [1]CSIRO Entomology, PB 3 Indooroopilly, QLD 4068, Australia, paul.debarro@brs.ento.csiro.au; [2]CSIRO Entomology, Private Bag No. 5, Wembley, WA 6913, Australia; [3]Department of Biological Sciences, Monash University, Clayton, Victoria 3168, Australia.

In 1985 Alec Jeffreys published an article in Nature which coined the term "DNA fingerprint" and at the same time started a revolution in the way we address ecological questins dealing with parentage and relatedness, population structure, movement and origin, and species and biotype identification. The development of multilocus minisatellite probes was soon followed by the use of polymerase chain reaction (PCR) to amplify specific regions of DNA and together they provided researchers with the tools with which to study populations at a scale finer than had previously been possible. In the study of integrated pest management the techniques of molecular biology have been used to address questions of:

- Origin in terms of pest incursions and refuges for both pests and their natural enemies.
- Species dispersal within and between habitats.
- Biotype and sibling species identification in terms of diagnostics.
- Genetic variation with respect to a number of traits, but primarily host utilisation.
- Spatial and temporal variation in population structure on various geographic scales.

However, in terms of the overall research output, the impact has been minor with fewer than 80 papers being published on a narrow range of pest and natural enemy taxa. The reasons are varied. First was the lack of availability of techniques that were suited to studying small organisms. This was overcome in the early 1990's with the development of PCR. The PCR revolution paved the way for the development of informative molecular markers such as those developed for Random Amplified Polymorphic DNA-PCR and more recently microsatellites and so resolved the second bottleneck. The final step towards more widespread adoption has been the development of statistical analyses that are appropriate to studying organisms that are often introduced and inhabit unstable ecosystems. With these three developments the way is now clear for more widespread adoption.

Index terms: DNA, pest populations, molecular biology

[2576] ECOLOGY OF ENTOMOPATHOGENS

F Moscardi & D.R. Sosa-Gómez, Embrapa – National Soybean Research Center, P.O. Box 231, Londrina, Pr. 86001-970, Brazil, Email moscardi@cnpso.embrapa.br.

The knowledge about the ecology of entomopathogens, especially the factors that affect their epizootics (characterized by a rapid change in the prevalence of a disease on host populations), is the key aspect to be considered for their use in IPM programs. Different groups (bacteria, fungi, viruses, protozoa, and nematodes), as well as genera and species within a group, have different characteristics (virulence, speed to kill the host, host range, persistence, susceptibility to abiotic factors, mode of infection, mode of transmission and dispersal, population distribution and density, etc), which, combined to characteristics of the pest population, to the ecosystem considered, and other cultural and control practices adopted will help to define the best approach for use of an entomopathogen in a given IPM program. The approaches of entomopathogen use are: 1) introduction and establishment (classical biological control); 2) environmental manipulation (for conservation and augmentation of the natural occurrence of entomopathogens); 3) inoculative release (application and further multiplication and transmission of the pathogen on host populations); and 4) inundative release (microbial insecticides, applied as needed to maintain host populations below damaging levels, similar to the application of chemical insecticides). Modeling studies have indicated that entomopathogens best suited for introduction and establishment should have moderate virulence, good transmission (horizontal and vertical), and produce high amount of inocula of a persistent and infective stage. On the other side, entomopathogens used as microbial insecticides, should be highly virulent so as to maintain the target insect below damaging levels, and transmission (horizontal and vertical) may relatively unimportant. For proper use of these agents in IPM programs, and considering the current trend towards developing genetically engineered organisms, in-depth studies about the ecology of entomopathogens will become more and more important. There is an obvious need of research on microecology in the soil substrate and general microenvironment (as the surface of plant substrates), the positive and antagonic interactions with the microflora and microfauna, specially for those entomopathogens which have their efficacy highly affected by the environment. Also there is a need to study the relationships of crop phenology with the expression of entomopathogens.

Index terms: Insecta, microbial control agents, epizootiology

[2577] ECOLOGY OF GENETICALLY TRANSFORMED FOST PLANTS AND NATURAL ENEMIES

G. Kennedy & F. Goud

ABSTRACT NOT RECEIVED

[2578] ECOSYSTEMS ECOLOGY AND IPM

M.A. Altieri , C.I. Nicholls, University of California, 201 Wellman hall, Berkeley, California 94720, USA

Ecological theory has informed the conceptual basis of IPM but in few cases ecological principles have been applied to the practice of IPM. In fact, not many existing agricultural systems have been designed by scientists utilizing ecosystem ecology principles. Current economic and institutional trends work against the application of ecology into agricultural practice. The massive deployment of transgenic crops and the genetic homogenization of large agricultural landscapes is a major negative trend for the advancement of ecologically based IPM. Despite these trends, farmers in many parts of the world have through trial and error developed and/or adopted systems that reflect ecological principles of diversity, succession and biological control resulting in IPM benefits. By examining a series of such agroecosystems, we will explain the ecological underpinnings at work, and suggest ways on how to use such underlying mechanisms to design pest-stable agroecosystems. Experimental case studies will be used to illustrate how ecosystem ecology can be translated into agronomic practices that enhance IPM.

Index terms: Applied ecology, pest-stable agroecosystems, case studies

[2579] INTEGRATED METHODS FOR CONTROL OF PIERCE'S DISEASE: INSECTICIDES TO VEGETATION MANAGEMENT

A. H. Purcell[1], [1]Univ. of California, Div. of Insect Biology, Berkeley, CA, 94720-3112, USA.

Pierce's disease (PD) of grape, caused by the bacterium *Xylella fastidiosa*, is a serious and persistent problem in coastal California, where the principal vector is the blue-green sharpshooter (BGSS), *Graphocephala atropunctata* (Hemiptera: Cicadellidae). The ineffectiveness of removing vines with PD or controlling vectors within vineyards with insecticides in reducing the later spread of PD imply that vectors originating outside vineyards are responsible for most spread of PD and that vine-to-vine spread of PD is minimal. Insecticides applied outside vineyards for vector control have had some effectiveness. Populations of *X. fastidiosa* in the new growth of vines infected during previous years are first detectable in early summer (June-July). Most infections made during summer do not usually persist through the following winter because the bacteria do not move fast enough to reach parts of the vine that will not be eliminated by winter pruning. Infections made during early spring months seem to be most critical for establishing chronic PD, so reducing the numbers of BGSS during early spring months should be the most effective control strategy. PD strains of *X. fastidiosa* infect many plant species that can serve as acquisition sources of bacteria for vectors. The principal natural habitats of BGSS are riparian vegetation along streams. Although BGSS feeds on a very wide range of plants throughout the year, it has a much more restricted range of oviposition hosts. Surveys over a four year period identified the plant preferences of BGSS for feeding and ovipositing in riparian zones. The selective removal of BGSS preferred oviposition plants such as *Rubus* spp. and wild grape followed by restoration plantings of a variety of native riparian tree species in three sites over three years reduced the numbers of BGSS to very low numbers, as indicated by yellow sticky trap monitoring for adult BGSS flight activity. Compared to undisturbed control plots, vegetation management reduced trap catches 97% to 99% in one site and at least 70% in two other sites. Trap catches in two treated sites were on single traps located near BGSS spring habitats. It was not possible to estimate differences in natural infectivity of BGSS from treated and control plots because of the very small remaining populations of BGSS in treated plots. Riparian vegetation management provides an alternative to insecticide treatment of riparian vegetation to control PD vectors but requires attention to environmental quality with selective plant removal and restoration plantings to increase biodiversity and minimize erosion.

Index terms: *Graphocephala, Xylella*, riparian, Cicadellidae, vectors

[2580] ORGANOPHOSPHATE RESISTANCE IN GRAPE LEAFHOPPERS AND IPM STRATEGIES

V. Girolami, N. Mori, E. Marchesini & C. Duso, Institute of Agricultural Entomology, University of Padua, Via Romea 16, 35020 Legnaro (Padova), Italy, E-mail ento@agripolis.unipd.it

In the last two decades the control of grape leafhoppers, in particular *Empoasca vitis* (Homoptera Auchenorryncha, Cicadellidae), in North-eastern Italy, was achieved by irregular insecticide treatments most of them made to prevent grape berry moth damage. The application of fewer pesticides favoured natural control of phytophagous mites by predators, mainly phytoseiids. In the late 90ties, the spread of «Flavescence dorée» a grapevine disease transmitted by *Scaphoideus titanus* (Homoptera Auchenorryncha, Cicadellidae) and, to a lesser extent, by the nearctic *Metcalfa pruinosa* (Homoptera Auchenorryncha Flatidae) caused an increase of insecticide use in vineyards. Meanwhile, the control of grape leafhoppers (*E. vitis*) with treatments with broad-spectrum pesticides became ineffective. Experiments carried out to estimate the effectiveness of a number of organophosphates on *E. vitis* populations in vineyards showed field resistance. This phenomenon was confirmed in semi-laboratory tests. Moreover, the increased use of insecticides had disrupted the balance between phytophagous mites and their predators causing mite outbreaks.

Index terms: *Empoasca vitis*, Flavescence dorée, pesticide resistance, Phytoseiidae.

[2581] INTERACTIONS BETWEEN MITES AND PLANT PATHOGENS AND IMPLICATIONS FOR BIOLOGICAL CONTROL IN GRAPES

G. English-Loeb[1], A.P.Norton[1], J.P. Nyrop[1], W.F. Wilcox[2], G.D. Gadoury[2] & R.C. Seem[2], [1]Dept. Entomology, Cornell Univ., New York State Ag. Exp. Stat., Geneva, NY, USA 14456; [2]Dept. Plant Pathology, Cornell Univ., New York State Ag. Exp. Stat., Geneva, NY, USA 14456.

Successful implementation of biological control in grapes can benefit from knowledge of, and integration across the disciplines of entomology and plant pathology. We examined the impact of fungicides on the predatory mite *Typhlodromus pyri* in grapes. Mancozeb (an EBDC fungicide), whether used during the full season, only early in the season, or only late in the season, prevented the establishment of *T. pyri* on small three-vine plots which previously had no predatory mites. In a second small-scale experiment, multiple applications of mancozeb dramatically reduced *T. pyri* populations that were present in high numbers prior to the start of the experiment whereas the application of myclobutanil had no impact. Using large plots (0.75 ha) of *V.labrusca* grapes in a commercial vineyard, a mancozeb-based fungicide program prevented establishment of *T. pyri* whereas we were successful in establishing *T. pyri* with a fungicide program based on captan (a non-EBDC fungicide). Moreover, vines only experienced high populations of the pest mite, *Panonychus ulmi*, on vines treated with mancozeb. Mites can also play a role in the biological control of a plant pathogen. We discovered that a species of tydeid mite *Orthotydeus lambi* is able to suppress grape powdery mildew (GPM) on wild grape *V. riparia*. We have also shown that these mites can significantly reduce GPM on vines grown under realistic vineyard conditions. However, grape genotype and in particular, leaf morphology, plays a large role in mediating interactions between tydeid mites and GPM. Those genotypes with well-developed domatia, which are tufts of non glandular hairs in vein axils, supported higher densities of *O. lambi* than genotypes with small domatia and this translated into greater reductions in GPM. Domatia provide mites with a refuge from generalist insect predators. The potential exists, therefore, for using *O. lambi* and possibly other tydeid mites to control GPM either alone or in combination with fungicides. Some fungicides, however, are deleterious to *O. lambi* (sulfur, mancozeb) while other fungicides are compatible. Hence, management practices for pathogens and mites are interrelated and the recognition of this may provide insights into enhancing biological control programs.

Key words: *Typhlodromus pyri*, mancozeb, Tydeid mite, domatia, fungicides

[2582] EPIDEMEIOLOGY OF DISEASES CAUSED BY PHYTOPLASMA IN ISRAEL

E. Tanne, Dept. of Virology, ARO, The Volcani Center. Bet-Dagan 50250. Israel.

In the last decade a sudden emergence of yellows diseases occurred in Israel, damaging severely various crops. In many cases, phytoplasma has been associated with yellows symptoms. Phytoplasmas are uncultivable microrganisms belonging to the Mollicutes, transmitted by phloem-feeding insects, mainly leaf/planthoppers. Studies aiming to determine the causative agents of these diseases were based on the analysis of the highly conserved gene coding for the 16S rRNA and the spacer region between the 16S and the 23 rRNA. This resulted in detection of at least 3 types of phytoplasmas, infecting grapevines, vegetable crops (carrot), flowers and some fruit trees. In some perennial crops such as grapevine, a relative rapid spread was observed. First infection was recorded in the cv. Chardonnay in the north of the country, spreading in a few years to all viticultural regions and many vine cultivars. In annual crops as carrot, the presence and severity of infection varies between seasons and years. The spread and progress of plant diseases is generally influenced by inoculum density and the presence of a vector. Epidemiological studies carried out in order to control the spread of yellows diseases were composed of several steps. 1. Monitoring infection rate and determining phytoplasma presence in vineyards in the north and south of the country. 2. Verifying the spread by insects and determining infection time in carrot fields. 3. Survey of leaf/planthoppers in and around infected vineyards and annual crop fields, and identification of potential vectors of yellows disease in Israel. 4. Inoculativity and transmission tests of some leaf/planthoppers to determine their vectorial nature. The survey conducted in vineyards demonstrated a rapid spread with clustering in some cases. Three types of phytoplasma were identified by PCR and RFLP analysis, Aster Yellows, a WX-resembling type and Stolbur. The survey also pointed out difference in disease susceptibility of different rootstocks. Covering of small carrot plots with an insect-proof net and the differential removing of these nets, determined disease spread by insects and established the infection time. Insects trapped in and around vineyards and annual crop fields, were identified and PCR tested for the presence of phytoplasma in their body. Selected leaf/planthoppers, known to be vectors of viruses or phytoplasmas were used for inoculativity and transmission tests. The presence of phytoplasma in insects and the circulative nature of the insect-phytoplasma interaction have been demonstrated. The ability of some insects to transmit yellows diseases has been confirmed. This is the first report determining potential vectors of phytoplasmas in Israel. Based on these data control means can be devised.

[2583] MATING DISRUPTION TO CONTROL GRAPE MOTHS: FROM RESEARCH TO FIELD APPLICATION

P.J. Charmillot, Swiss Federal Research Station for Plant Protection, Changins CH-1260 Nyon, Switzerland, E-mail: pierre-joseph.charmillot@rac.admin.ch

In Europe, the most important pests in vineyards are the grape moths. The grape vine moth *Lobesia botrana* develops principally in hot and dry regions of the Mediterranean basin in 2 to 3 annual generations; the grape berry moth *Eupoecilia ambiguella* evolves in 2 generations in more northern and humid regions; both species cohabit in intermediate climates. During the last 10 years, mating disruption (MD) to control grape moths extended very quickly. MD is currently applied over more than 40'000 ha European vineyard, principally with the BASF dispensers Bocep Viti or RAK 1 containing Z9-12:Ac to control *E. ambiguella*, with RAK 2 containing *E*7,Z9-12:Ac to control *L. botrana* and with the combined RAK 1+2 dispensers for a simultaneous control of both species. Isomate dispensers are also used in Italy. The standard applied density is 500 dispensers per ha with spacing of 2-3 m on the borders. However, experimentation shows that in vineyards with low population, it is possible to reduce after one or two years dispenser density to 250-350 per ha by increased spacing inside the vineyard but by retaining the same distance on the borders. In spite of costs higher than with classical control, MD was applied in Switzerland over 4'500 ha in 1999, representing a third of the total vineyard surface. Generally, MD proved to be more efficient than classical control and gave very good results on more than 90% of the surfaces. Some spots of damage, essentially localised in borders, may appear especially during the first few years in vineyards with high initial populations. MD application needs a special organisation. Due to the low size of plots and the high number of growers, it is cumbersome to convince everybody from a village or a region to participate in MD. Installation of the dispensers and sampling of first generation damage have to be coordinated. This sampling is primordial to detect spots where a complementary treatment as to be applied in the second generation.

Index terms: *Lobesia botrana, Eupoecilia ambiguella*, pheromones, dispensers, damage

[2584] PROBLEMS OF CITRUS IPM IN BRAZIL: CVC, LEPROSIS AND CANKER

S. Gravena[1], [1]GRAVENA-Manejo Ecológico de Pragas Ltda, Rua Monteiro Lobato, 856, 14870-000, Jaboticabal, SP, Brazil. E-mail gravena@asbyte.com.br.

The citrus IPM in Brazil is already an applied system in almost all over the citrus production area. But about 80% of the Brazilian citrus orchards for juice are concentrated in State of São Paulo in a continuos cultivation that obstruct ecologically the performance of the citrus IPM. The monitoring procedures and spider mite control have fit the universal principles of IPM but new spider mite and insect pests associated to bacterial and viruses diseases have arisen into the citrus ecosystem by the last decade that have delayed the full citrus IPM implementation. Before the advent of the xylem-limited bacteria *Xylella fastidiosa* transmitted by the sharpshooters (Homoptera: Cicadellinae) practically no broad spectrum insecticide was necessary in the IPM system. Afterwards, indiscriminate chemical control of the sharpshooters have been made by the citrus growers to try to prevent the bacterial disease infection in younger and older plants. Beside the broad spectrum insecticides for the sharpshooters other sprays were need for other insect pest that was introduced in 1996: the citrus leafminer *Phyllocnistis citrella* Stainton which was found to increment the citrus canker disease through the injuries on young leaves. Both insect pests, one as vector of *X. fastidiosa*.and other associated to the citrus canker *Xanthomonaaxonopodis* pv. *Citri* have been heavily sprayed bringing too many other secondary insect outbreakes. How to fit these insect pests into the IPM system is the effort of the Brazilian researchers and is discussed here together the spider mite *Brevipalpus phoenicis* Geijskes responsible for the leprosis disease which is still one of the main problem that the citrus IPM faces nowdays in Brazil. New strategies and tactics are being implemented in order to recover the performance of the citrus IPM after the new insect problems brought about by the last years. Classical biological control was done during 1978-2000 by Embrapa-Meio Ambiente, ESALQ-USP, Fundecitrus and GRAVENA-ManEcol Ltda in conjuction worked to introduce the parasitoid *Ageniaspis citricola* to control the citrus leafminer to avoid the insectides to prevent the citrus canker disease, the worst problem of Brazilian citrus plantations. Environment manipulations were studied and applied for the sharpshooter vectors instead of chemical sprays to reduce the incidence of CVC.

Index terms: Citrus IPM, *Xylella fastidiosa*, CVC, citrus leprosis mite, citrus canker.

[2585] INTEGRATED PEST MANAGEMENT OF CITRUS IN FLORIDA

J. Knapp

ABSTRACT NOT RECEIVED

[2586] INTEGRATED PEST MANAGEMENT OF CITRUS IN THE WESTERN US

T. S. Bellows, Dept. of Entomology, Univ. of California, Riverside, CA 92521, USA

Citrus is grown widely in varying climates and regions throughout California, and is subject to a diverse set of pest insects. Primary cropping regions include the southern subcoastal region, the southern desert regions, and the central agricultural valley of California. Among the principal pests attacking citrus in these regions are Homoptera (including scales, whiteflies, aphids, and mealybugs), Lepidoptera (including both leaf feeding and fruit damaging types), phytophagous mites, and thrips which scar fruit and young leaves. These pests have been the object of considerable research toward control. Many of these pests are not native to California, but are adventive to the region. Important pests in this group include many of the scale insects (both Diaspididae and Coccidae), mealybugs (Pseudococcidae), and whiteflies (Aleyrodidae). In many of these cases, importation of natural enemies has provided excellent biological control of the pest population. However, among this group of exotic pests are some that are not currently controlled by natural enemies, and these are the targets of integrated control programs. These include, for example, the diaspidid California red scale and the coccid brown soft scale. Control options currently employed for such species include augmentative releases of natural enemies and use of pesticides. Other pests are native to the region, including the principal lepidopterous pests and the thrips pest. Populations of these native pests are limited to some degree by natural enemies. Additional control is often required for these pests, however, and they are usually subject to pesticide applications. Commercial sources of natural enemies for augmentation are not generally available for these species. The integration of biological control agents and pesticide applications is challenging, as effective pesticides for some groups of pests are often quite detrimental to natural enemies of other pest groups. The addition of newer post-harvest washing technology has lessened the demand for pest-free fruit at packout, and can serve together with an IPM program to reduce the amount of pesticide necessary to provide a market-ready crop.

Index terms: biological control, whiteflies, scale insects.

[2587] IPM FOR CITRUS IN SPAIN

J.A. Jacas, Dept. de Ciències Experimentals; Univ. Jaume I; Campus de Riu Sec; E-12071-Castelló de la Plana (Spain). E-mail: jjacas@exp.uji.es

Spain is one of the largest producers of citrus for the fresh market worldwide (5,492 10^3 Tm in 1998), mainly oranges, tangerines and lemons. Therefore cosmetic standards are quite high. Furthermore, requirements for unblemished fruit are common, especially when fruit is to be exported (around 60 % of production). Moreover, dependence of production on market demands, makes spanish citriculture very dynamic with old varieties being replaced by new ones very often. These premises are a key factor in developing our citrus IPM schemes. Except for some notable exceptions (Cirus Tristeza Virus, CTV, and *Phytophthora* spp.), pathogens are not important under our growing conditions. In addtion, many pests are kept under excellent (*Icerya purchasi*, *Insulaspis gloverii*) or satisfactory (*Aleurothrixus floccosus*, *Panonychus citri*, *Chrysomphalus dyctiospermi*, *Coccus hesperidium*, *Ceroplastes sinensis*, *Planococcus citri*, *Saissetia oleae*) natural control. Three scales are considered the key pests of citrus in Spain: *Parlatoria pergandei*, Cornuaspis *beckii* and *Aonidiella aurantii*. Besides, aphids (*Aphis gossypii*, *A. spiraecola* and *Toxoptera aurantii*), *Tetranychus urticae* and *Phyllocnistis citrella* may require especial attention from the grower occasionally. Because of quarantine regulations, *Ceratitis capitata* is subjected to mandatory control by governamental agencies. Careful monitoring of fruit infestation by scales both at harvest and during the summer are the basis of spanish IPM schemes. Potential pests are also scouted during the summer months. Identification of selective pesticides to be used when needed and improvement of the efficiency of biological control (especially classical biological control programs against key pests) are also fundamental for the implementation of these schemes. Integrated Production (I.P.) guidelines have been developed during the last years in Spain, and an I.P. label is guaranteed to growers following these rules.

[2588] CITRUS IPM IN AUSTRALIA AND EAST AND SOUTHEAST ASIA

G. A. C. Beattie[1] & D. J. Rae[2], Centre for Horticulture and Plant Sciences, University of Western Sydney Hawkesbury, Locked Bag 1, Richmond, New South Wales 2753, Australia. E-mail: [1] a.beattie@uws.edu.au; [2] d.rae@uws.edu.au.

Australian citrus IPM is highly effective, but has taken almost a century to develop. Current programs are based on natural enemies and sparing use of biorational pesticides. Although the industry represents only 0.5% of global plantings (36,000 ha), it is geographically widely dispersed and requires control of more than 100 pests and diseases. Some of these pests were imported on live planting material from Asia and Africa soon after the European invasion of the Australian continent in 1788. Biological control was attempted in the late 1800s but limited knowledge of the taxonomy and biogeography of the pests and the development of pesticide-based programs led to a period of 70 years of reliance on pesticides. Initially hydrogen cyanide and then organophosphates were heavily used until concerns about an unsustainable pesticide treadmill became widespread in the 1960s. The foundations for IPM were enhanced by the introduction and release of key parasitoids of *Aonidiella aurantii* and *Ceroplastes destructor* from the 1940s to the 1970s, and the availability and widespread use of horticultural mineral oils (HMOs) from the late 1960s. A marked reduction (70-100% depending on location) in pesticide use in Australia was aided by increased incidence of natural enemies, improved HMO formulation and application technologies, grower awareness through research and extension and the activities of commercial insectaries and monitoring services. In East and Southeast Asia citrus IPM is generally not practiced, despite increasing government support since the early 1980s. Throughout the region low levels of farmer education, a lack of effective government or private research and extension services (particularly United Nations funding of research and development), exploitation of farmers by chemical companies, and limited access to disease-free planting material has led to widespread misuse of pesticides and highly disturbed citrus ecosystems. Natural enemy and HMO-based IPM programs cooperatively developed and tested in the region over the last 4-7 years are highly effective and could be implemented immediately in temperate regions where huanglongbing (HLB; greening disease), which is transmitted by *Diaphorina citri*, is absent. However there are number of impediments to this including grower education, poor orchard management and spray application practices and limited access to high quality HMOs. In regions where HLB occurs, sustainable citrus production can be achieved by incorporating better propagation, monitoring, canopy management and spray application practices into the natural enemy and HMO-based IPM programs.

Index terms: *Aonidiella aurantii*, *Ceroplastes destructor*, *Diaphorina citri*, horticultural mineral oils, extension

[2589] NON-TARGET EFFECTS OF PESTICIDES ON BENEFICIAL INSECTS

V. Hattingh[1], A.B. Ware[1], T.G. Grout[1] & S.D. Moore[2], [1]Outspan Citrus Centre, P.O. Box 28, Nelspruit 1200, South Africa, E-mail vaughan_hattingh@capespan.co.za; [2]Outspan Citrus Centre, P.O. Box 12531, Centrahil 6006, South Africa, E-mail sean_moore@capespan.co.za

Due to the large complex of pests and potential pests associated with the crop, the preservation of viable biocontrol populations is well recognised as a pre-requisite to good agricultural practice for citrus production in southern Africa. The use of agrochemicals is viewed as the single most potentially disruptive factor in the maintenance of a stable IPM system on citrus in the region. With presently available management options, the use of agrochemicals for the control of key pests and diseases is unavoidable. Furthermore, the development of new agrochemical products periodically changes the dynamics of established IPM practices. Experience with the introduction of highly disruptive new treatments, despite claims by the agrochemical companies of IPM compatibility, emphasized that the need for the development of a standardized technique to evaluate the potential non-target effects of such new chemicals. Outspan Citrus Centre, in collaboration with the regulating authorities in S.A. and the agrochemical industry, have developed such a system for the testing of products to be used on citrus in southern Africa. A battery of indicator species, of relevance to local production of the crop, was selected. Bioassay techniques were developed by comparing results with well established field knowledge of the IPM compatibility of numerous older products. The system has been adopted by the local agrochemical industry and regulatory body as a standard component for the registration of all new products for use on citrus in S.A.

[2590] ROLE OF PREDATION IN BIOLOGICAL CONTROL OF MITES ON CITRUS

C.C. Childers[1], [1]Citrus Research & Education Center, 700 Experiment Station Road, Lake Alfred, FL 33850-2299, USA, E-mail ccc@lal.ufl.edu.

There are more than 90 species of phytophagous mites within seven acarine families that are recognized in one or more areas of the world as pests on citrus including: Tetranychidae, Tenuipalpidae, Tuckerellidae, Tarsonemidae, Eriophyidae, Diptilomiopidae and Tydeidae The family Tetranychidae contains the greatest diversity of mite species that are pests on citrus worldwide followed by the Eriophyidae. Numerous species of predacious mites and insects prey upon one or more species of phytophagous mites. Very little is known about the species of predacious arthropods involved in the regulation or suppression of pest mite species beyond the acarine family Phytoseiidae. This paper reviews many of the acarine families identified as predators of one or more phytophagous pest mite species on citrus. Data are presented from research conducted on Florida citrus to identify the species of predacious mites, their distribution, seasonal and relative abundance within citrus trees. On-going efforts are being directed towards the establishment of an alternative control strategy on citrus that relies on soft or selective pesticides and optimizing predacious arthropod numbers within the citrus grove sites previously on harsh foliar pesticide programs. Results of these studies are summarized in this paper.

Index terms: Phytoseiidae, Stigmaeidae, Cheyletidae, Ascidae, Integrated Pest Management, petroleum spray oil.

[2591] MANAGEMENT STRATEGIES FOR BROWN CITRUS APHID AND CITRUS TRISTEZA VIRUS

H. Broning & J. P. Michaud

ABSTRACT NOT RECEIVED

[2592] MANAGEMENT STRATEGIES FOR CITRUS VARIEGATED CHLOROSIS

Marcos Pozzan[1], Vanderlei Rodas[1], Julia Beretta[2] & Ken Derrick[2], [1]Montecitrus Trading, P. O. Box 34, Monte Azul Pta, SP, Brazil, 14730-000, E-mail marcos.pozzan@montecitrus.com.br, [2]CREC, University of Florida, Lake Alfred, 33850, EUA.

A new disease of citrus was discovered in the northern area of Sao Paulo State in 1987. The disease was named citrus variegated chlorosis (CVC) and was found to be caused by a strain of the bacterium *Xylella fastidiosa*. Following its initial discovery, the disease spread rapidly and is now a major constraint to citrus production in Brazil. Various strains of *X. fastidiosa* cause several serious diseases of plants and are readily transmitted by sharpshooters. Most strains of *X. fastidiosa* have wide host ranges and transmission of the bacteria from alternate hosts, usually weeds, to the agronomic host by sharpshooters is important in the epidemiology of the diseases they cause. Alternate hosts do not appear to be involved in CVC, and spread of the disease is from citrus to citrus. This observation and the finding that the bacteria move slowly in infected trees led to the development of control strategies for CVC in Brazil. Plants should be propagated using CVC-free trees, since bud transmission of the disease can occur, although it is rare when using buds with small amounts of wood. Nurseries should be as far as possible from groves, should be kept free of weeds and monitored frequently for sharpshooters. Insecticides should be used when necessary to suppress sharpshooter populations in both nurseries and groves. It is important to make regular inspections for CVC and trees less than four years old with symptoms should be removed immediately. Any affected branches of older trees should be removed on a regular basis. Control of CVC is based on reducing the inoculum pressure. Removing limbs with symptoms does not "cure" a tree but reduces the amount of inoculum in the grove. Regular inspections should be made even in young groves planted with trees from "disease free" nurseries. Symptoms may not have been seen on plants in the nursery, but the trees may be infected and show symptoms within a year of being planted in a grove. Growers should assume that they have CVC in their groves and make every effort to keep the amount of inoculum to a minimum. They should also be aware that it is very difficult to control CVC in their groves if citrus on adjacent properties is not under a good control program. Moreover, it is almost impossible to manage CVC in a grove that is adjacent to an abandoned grove where both CVC and sharpshooter populations are out of control. There should be a requirement in Brazil that all the trees in abandoned groves be burned.

Index terms: *Xylella fastidiosa*, citrus, sharpshooters

[2593] INTEGRATION OF BIOLOGICAL CONTROL INTO CITRUS PEST MANAGEMENT

D. Smith, Department of Primary Industries, Maroochy Research Station, PO Box 5083, SCMC, Nambour, Australia, 4560. E-mail: smithd2@dpi.qld.gov.au

Biological control is a dominant component of citrus pest management. The selective use of pesticides and cultural techniques are also important but will be counter productive if they are excessively disruptive to natural enemies. For biological control to realise its potential key issues are: 1. Improved knowledge of the pests (habits, importance, damage and action levels). 2. Improved knowledge of the natural enemies (identity, efficacy, the presence of key species, exotic introductions where necessary, cultural techniques to improve the environment, level of disruption by pesticides, augmentation). 3. Simple monitoring procedures to record both pests and natural enemies and apply action levels. 4. Careful use of pesticides with low toxicity to natural enemies, effective spray application against the pests and minimisation of off target drift. 5. IPM systems that are reasonably complete and have been shown (in commercial citrus orchards) to give satisfactory control of important pests within a citrus growing region. Continuing research and extension are vital to preserve IPM systems and to deal with problems as they arise and extend the concept to orchardists. Commercial scouts can play a major role in this. There are about 100 pests (exotic and native) of citrus in Queensland. From 1940 to 1970 about 12 disruptive sprays were applied each season. Biology studies increased in the late 1960s, followed by classical biocontrol introductions in the 1970s for key scale pests. An IPM system was developed by 1978 and was used on a 400ha orchard. A commercial scout worked closely with researchers to manage the program and extend scouting services to other orchards. Selective pesticide treatments were developed (eg. protein baiting for fruit fly control) and augmentative releasing began. IPM was extended during the 1980s to other orchards and 12 successful introductions of parasitoids for exotic pests were made. New selective pesticide treatments for some pests were developed, monitoring techniques were refined and biology studies made of several native pests. By the early 1990s about 90% of the citrus area used IPM, employing 12 scouts and enjoying savings of at least 50%. Well illustrated IPM publications were produced and field days conducted for orchardists and scouts. Since IPM was first used in 1978 levels of pesticide use have fluctuated but the system has progressed steadily over 20 years to include most orchardists. Sound monitoring and continuing applied research funded by the citrus industry have been vital factors.

Index terms: Natural enemies, selective pesticides, monitoring, parasitoid introductions, Queensland.

[2594] OPPORTUNITIES FOR INTEGRATION IN RICE PEST MANAGEMENT RESEARCH

K. L. Heong, International Rice Research Institute, MCPO Box 3127, 1271 Makati City, PHILIPPINES, E-mail kheong@cgiar.org.

The emphasis of pest management research in rice has tended to be pest-centered, focussing on technologies that "kill". Common activities are insect resistance, genetic engineering, new biocides, formulations and delivery systems. Ecological research is often confined within taxonomic groups, limiting the scope of application. In developing countries ecological relationships in agroecosystems remain poorly understood. Because scientists do not really conduct agriculture like farmers, they tend to see agriculture in a disciplinary, reductionist way, confined to the laboratory. Meanwhile, farmers rely on biased information from advertising, limiting their options to spraying pesticides. Most farmers still believe insects to be important constraints and are strongly motivated to spray. However, ecological research now questions the need for such intervention. Cross-discipline integration can minimize this knowledge gap. IPM tends to center on the integration of tactics, in most cases without understanding how farmers will actually use them. This paper explores new opportunities for cross-discipline integration that can influence decision making in a way that will improve farmer practices, thereby adding value to entomological research. Farmer participatory research has proven an effective tool for ensuring IPM research is adopted at the farm level in Asia. Over 300,000 farmers in Vietnam have been involved in participatory research programs aimed at reducing insecticide applications used against leaf folders. Training programs may be successful in changing farmers' pest management practices, but are expensive, and often unacceptably slow in areas where extension-farmer ratios are low and public spending in agriculture is declining. Opportunities for integration of communication sciences into IPM can further add value. In understanding farmers, ethnoscience frameworks and methods may be applied. Mass media is important in the daily lives of farmers and research on content development, framing of IPM lessons and delivery formats, like drama series and animated videos, are worth exploring. Research into the information environment and how daily competing messages affect farmer decisions may help in developing better IPM implementation strategies.

Index terms: Rice, IPM, decision making, communication, farmer participatory research, delivery systems, implementation.

[2595] IMPLEMENTING RICE IPM IN DEVELOPING COUNTRIES: ECOSYSTEM BASES, COMMUNITY SCIENCE AND POLICY REFORM

P. kenmore

ABSTRACT NOT RECEIVED

[2596] INTERNATIONAL SURVEILLANCE FOR LONG RANGE MIGRATORY RICE PESTS

Y. H. Song[1], [1]Dept. of Agricultural Biology, Gyeong-Sang National University, Chinju 660-701, Republic of Korea. E-mail: yhsong@gsnu.ac.kr

Many species of insects associated with cultivated rice do not over-winter in the temperate areas of Korea and Japan, but immigrate into these areas each year. Risk assessment of these migratory rice pests is important in terms of achieving stable rice production in Asian rice areas. To understand better the origins of these immigrations, as well as the geographic distribution of rice pests in Asian rice growing regions, intraspecific variations of the two species of rice planthoppers, *Nilaparvata lugens* and *Sogatella furcifera*, and a species of rice leaf folder, *Cnaphalocrosis medinalis*, were examined by using *Cytochrome oxidase*-I (COI) in mitochondrial DNA. The results clearly indicated that populations south of the Red River Valley in Vietnam experience regular mixing, and are distinct from populations to the north of the Red River Valley, which contribute to yearly immigrations. Risk assessment for the effective management of migratory rice pests can mostly be facilitated by the "international rice pest surveillance and forecasting system". This paper discusses the three main components of the Internet based "international surveillance of long range migratory rice pests" in Asia. These are (1) the Boundary Layer Atmospheric (BLAYER) Model to predict their movements, (2) the use of geographic information systems (GIS), and (3) the Internet based pest surveillance database management system (PeMos).
Index terms: DNA, *Nilaparvata lugens*, *Sogatella*, *Cnaphalocrosis*, Internet, model.

[2597] INTEGRATED MANAGEMENT OF KEY INDIAN RICE INSECT PESTS

Anand Prakash and Jagadiswari Rao, Division of Entomology, Central Rice Research Institute, Cuttack-753006, Orissa, India, E-mail prakas52@yahoo.com

In India, rice is grown in 42.3 million ha under varying moisture regimes and diverse ecological situations like rain-fed upland (7.1 m ha), irrigated medium land (17.7 m ha), favorable low land (10.0 m ha), unfavorable low land (6.0 m ha) and deep water (1.5 m ha), having an annual grain production of 82.1 m tons (1997-98), contributing to 45% of cereal production of the nation. Rice being a crop of warm and humid environment is very conducive to pests, diseases and weeds and subjected to 20-30% yield losses every year. Insect pests alone are reported to cause about 10-20% of yield losses to rice crop in India. Yellow stem borer, *Scirpophaga incertulus* Walk; rice gall midge, *Orseolia oryzae* Wood-Mason; brown plant hopper, *Nilaparvata lugens* Stal.; white-backed plant hopper, *Sogatella furcifera* Horvath; rice leaf-folder, *Cnaphlocrosis medinalis* Guen. and rice earhead bug, *Leptocorisa acuta* Thunb. are the major/key insect pests causing direct damage to rice plant/grain, whereas rice green leaf hoppers, *Nephotettix* spp. especially *N. virescens* Dist. is a principal vector of tungro associated viruses causing indirect considerable losses to rice production. The integrated management of key Indian rice insect pests discussed in this paper includes four major components as follows: 1. Needs strong support from the government particularly with regards of availability inputs like seed of the selected varieties, irrigation water for synchronized planting (a supplemental irrigation)/life saving irrigation especially for rain-fed rice, pest surveillance, forecasting and the over all monitoring of the crop and the pest in the IPM area. 2. IPM being a dynamic and constantly evolving approach, its components as well as tactics should be changed as the situation warrants. 3. Training of the farmers in IPM specially identifying pests and their natural enemies, damage concepts of economic levels being the most important to enable them in making their own decisions & 4. The concept of safe and least application of pesticide only during the specific situations like large populations of migratory insects and virus vectors, where immediate reductions in their populations are required. Safe pesticides are those, which cause minimum damage to non-target organisms including bio-agents and environment.
Index terms: Rice, gall midge, earhead bug, yellow stem borer, green leafhopper, brown plant hopper

[2598] RICE INTEGRATED PEST MANAGEMENT STATUS IN BRAZIL

J.F. da S. Martins[1], E. Ferreira[2] & J. A. F. Barrigossi[2], [1]Embrapa Clima Temperado, Caixa Postal 403, 96.001-970, Pelotas, RS, Brazil, E-mail martins@cpact.embrapa.br; [2]Embrapa Arroz e Feijão, Caixa Postal 179, 74.001-970, Goiânia, GO, Brazil.

In Brazil, basically, there are two rice production systems, flooded and upland, which occupy 1,2 and 2,1 million hectares, in lowland and upland ecosystems, respectively. The flooded rice is concentrated to the southern region, notoriously, in the Rio Grande do Sul State, and the upland rice is cultivated in the central region, mainly, in Mato Grosso State. Insect species occur in both ecosystem damaging seeds, roots, seedlings (pre-tillering phase insects), stems, leaves and grains (vegetative and reproductive phase insects), reducing grain production from 10 to 35%. Fall armyworm (*Spodoptera frugiperda*, Lep.: Noctuidae), in the pre-tillering phase, rice water weevil (*Oryzophagus oryzae*, Col.: Curculionidae), in the vegetative phase, and rice stem bug (*Tibraca. limbativentris*, Hem.: Pentatomidae), in the reproductive phase, are the most damaging insects to flooded rice. Root termite (*Procornitermes triacifer*, Iso: Termitidae), lesser corn stalk borer (*Elasmopalpus lignosellus*, Lep.: Pyralidae) and grass spittle bug (*Deois flavopicta*, Hom.: Cercopidae), in the pre-tillering phase, stripped grassworm (*Mocis latipes*, Lep.: Noctuidae), in the vegetative phase, and wheat caterpillar (*Pseudaletia* spp., Lep.: Noctuidae), in reproductive phase, are the most damaging insect species to upland rice. Rice water weevil, in flooded rice, and the pre-tillering phase insects, in upland rice, are the majors pests of Brazilian rice crop, due to economic losses they can cause, which are estimated at a minimum of US$ 40 and US$ 50 million, respectively. There is scientific basis for integrated pest management (MIP) in Brazil, for both rice production systems, including cultural and chemical control, resistant cultivars and methods of monitoring insect population in rice fields. Destruction of crop refuses, soil leveling, early flooding, use of supplementary nitrogen dosage and aerial application of liquid and granulated insecticides, are usual practices in flooded rice. In upland rice, it is recommended to destruct crop refuses, deep plowing, sowing time management, insecticide seed treatment,, avoid infested areas, practice crop rotation, use less susceptible cultivars and occasionally, spray insecticides. However, there are MIP errors, mainly, related to the curative chemical control in flooded rice. Defined criteria to scouting and economic thresholds have been little considered by rice farmers. There are commercial interests of the chemical insecticides market, which stimulate unnecessary use of these products. Due to the necessity of evolution of the MIP on rice production systems in Brazil, research and technology transference strategies are being conducted which aim to reduce the yield losses caused by insects, focusing on profit increase and environmental impact risk reduction.
Index terms: crop production systems, key-insects, control methods, research strategies

[2599] AN ECOLOGICAL BASIS FOR SUSTAINABLE PEST MANAGEMENT IN RICE ECOSYSTEM

J.A.Cheng, (Inst. Appl. Entomol., Zhejiang Univ., Hangzhou, China 310027).

Comparison of population development patterns between rice ecosystems indicated that the high growth rate of pest population was the most important reason for frequent outbreak of pests in cropping system. The analysis of historical data and experiments showed that the growth rates of pest populations were closely related to the interactions among community structure, cropping systems and management practices. Field investigation of community structure in rice cropping systems revealed that the systems with high growth rate of pest population were usually characterized by low population size of detritors at early stage, as well as low proportion of parasitoids and carnivores. The cropping system design was fundamental base for establishment of arthropod community structure. The non-rice habitats provided sources for initial population and recruits, as well as alternative and supplemental foods, for arthropod populations in rice habitats. The plant community structure in non-rice habitats could affect the development of arthropod community in rice habitats. Management practices could also affect arthropod community directly or indirectly. The replacement of organic fertilizers with chemical fertilizers reduced densities of spider populations due to the reduction of food source (detritors) for spiders at early stage of crop season. Application of herbicides increased growth rate of planthoppers because of the favorable change of nutritional conditions in rice plants and the side effects on spiders. Rice varieties would not only affect growth rate of planthoppers, but also behaviors of natural enemies. The growth rate of pest population could be reduced through manipulation of habitat conditions and improvement of management practices. A sustainable pest management program was designed and tested in fields.

Growth rate; Community; Cropping systems; Management practices

[2600] PLANT ARCHITECTURE AND IPM: PROGRESS IN DEVELOPING 'VIRTUAL RICE'

T. Watanabe[1], P.M. Room[2] & J. S. Hanan[2], [1]Department of Information Science and Technology, National Agriculture Research Center, Kannondai 3-1-1, Tsukuba, Ibaraki 305-8666, Japan, E-mail tomoya@narc.affrc.go.jp; [2]Centre for Plant Architecture Informatics, Department of Mathematics, The University of Queensland, Brisbane, Qld 4072, Australia

Most insects spend most of their time on or in plants. For these insects, plants are dynamic and spatially-complex environments which contain resources and dangers. Insect herbivory affects the chemistry and architecture of plants which in turn change the environment experienced by the insects and organisms associated with them. Depending on the damage-responses of the plants, microclimate, food quality and distribution, deposition of pesticides, persistence of pathogens, and searching efficiencies of predators and parasitiods may become more or less conducive to the insects. Certain plant responses to damage, such as induced chemical defences, have receiving considerable attention whereas morphogenetic responses have been relatively neglected. We report early progress towards factoring-in to IPM interactions between pest insects and morphogenesis of rice plants. We will present 'Virtual rice', a computer simulation of the 3D structural dynamics of individual rice plants. The underlying model was built using the L-system formalism and runs in the 'Virtual Laboratory in Botany' (vlab) computing environment. The graphics and animations produced by virtual rice will contribute to improved communication of complex information in research, extension and education.

Index terms: plant architecture, rice, simulation, IPM.

[2601] INTEGRATED RICE PEST MANAGEMENT IN THE SOUTHERN UNITED STATES

M. O. Way[1], [1]Dept. of Entomology, Texas A&M University Agricultural Research and Extension Center, 1509 Aggie Drive, Jefferson County, Beaumont, TX 77713, USA, E-mail m-way@tamu.edu.

In the U.S., rice is produced on approximately 1.24 million ha of which about 80% is grown in the southern rice producing states – Arkansas, Florida, Louisiana, Mississippi, Missouri and Texas. Virtually all rice in the U.S. is irrigated. Most rice in the southern U.S. is dry-planted and flushed until application of the permanent flood about 2 to 6 weeks after rice emergence through soil. Under favorable conditions (early harvest during dry weather and no disease problems), a large percentage of main crop rice is ratoon cropped in Florida, Louisiana and Texas. The above cultural practices are extremely important in developing insect integrated pest management (IPM) programs for rice. The most serious insect pests of rice in the southern U.S. are the rice water weevil (RWW), *Lissorhoptrus oryzophilus*; the rice stink bug, *Oebalus pugnax*; the fall armyworm, *Spodoptera frugiperda*; the chinch bug, *Blissus leucopterus leucopterus*; two species of stem borers – the sugarcane borer, *Diatraea saccharalis* and the rice stalk borer, *Chilo plejadellus*; and a complex of rice seed midges in the Family Chironomidae. The RWW is the most serious insect pest of rice in the U.S. IPM for the RWW in the southern U.S. is rapidly evolving due to recent changes in regulatory policies. In 2000, southern U.S. rice farmers will not be able to use granular carbofuran because the U.S. Environmental Protection Agency withdrew its registration due to avian toxicity problems. Until 1997, granular carbofuran was the only insecticide labeled for RWW control in the U.S. Before the 1998 growing season, lambda-cyhalothrin was granted a federal registration. Before the 1999 growing season, fipronil and diflubenzuron were granted federal registrations. For the last decade, southern U.S. rice entomologists evaluated these insecticides in the context of IPM. Formulations, rates and timings of application were evaluated to achieve optimum efficacy, safety and affordability with minimal disruption to the environment. Fipronil is currently registered as a seed treatment. Diflubenzuron and lambda-cyhalothrin are currently registered as foliar sprays applied early post-permanent flood.

Index terms: *Oryza sativa*, *Lissorhoptrus oryzophilus*, United States.

[2602] IPM IN AUSTRALIAN RICE FIELDS – BALANCING AGRICULTURAL AND ENVIRONMENTAL REQUIREMENTS

M. M. Stevens, NSW Agriculture and Cooperative Research Centre for Sustainable Rice Production, Yanco Agricultural Inst., Private Mail Bag, Yanco NSW 2703 Australia. E-mail: mark.stevens@agric.nsw.gov.au.

The Australian rice industry produces approximately 1.2 million tonnes of paddy rice each year. Over 90% of the crop is sown by fixed-wing aircraft, a practice which makes the crop vulnerable to a range of aquatic pests including chironomid midge larvae (particularly *Chironomus tepperi*), snails (*Isidorella newcombi*), and the introduced oligochaete *Eukerria saltensis*. IPM programs for establishment pests have been developed primarily in response to concerns about the environmental consequences of widespread pesticide use, rather than in response to economic pressures or pesticide resistance problems. *Eukerria* damage can be minimised through crop rotations, laser-levelling of fields and maintaining shallow water. *Isidorella* infestations are caused primarily by dormant snails overwintering in the soil, and can also be managed through crop rotations. The environmentally hazardous use of copper sulphate for snail control is declining, and will hopefully be eliminated within the next three years as alternative compounds are developed for use on farms where rotation-based snail control is not considered feasible. Efforts to identify rice varieties resistant to chironomid larvae have so far been unsuccessful, however the chemical inputs required for effective chironomid control have been reduced by 77% over a six year period through the introduction of compounds with a higher degree of target specificity, and further reductions are anticipated. A strong emphasis has been placed on developing seed treatments for chironomid control in order to minimise aerial spraying and the risk of off-target spray drift.

Index terms: Chironomidae, Gastropoda, Oligochaeta, crop rotations, cultural control

[2603] WHY AND HOW HETEROPTERANS ARE DIFFERENT AS PESTS

C. W. Schaefer[1], [1]Department of Ecology & Evolutionary Biology, University of Connecticut, Storrs, CT 06269-3043, USA. Email: schaefer@uconnvm.uconn.edu

The two groups in Hemiptera, Heteroptera and Homoptera, are alike in the way they feed, and unlike in where they feed.' Hemipterans feed by puncturing other organisms and removing fluids. All homopterans and very many heteropterans feed on plants; many heteropterans feed on animals--other insects mostly, but a few feed on vertebrates. This manner of feeding tends to protect hemipterans from pesticides on the surfaces of plants, as well as from structural defenses plants bear on their surfaces as defenses against chewing herbivores. Homopterans take fluids from plant somatic tissues and cells; they thus may weaken the plant and may introduce pathogenic microörganisms into the plant's circulatory system. Heteropterans are more likely to feed on the reproductive structures of the plant--flowers, fruits, ripe and unripe seeds; some heteropterans feed on somatic tissue but in so doing cause the plant to mobilize soluble nitrogen. Heteropterans' damage is thus caused by reducing available nitrogen of the plant. Moreover, humans too prefer reproductive parts, and thus are in direct competition with heteropterans. Being larger than homopterans has preadapted heteropterans for the advantages of aposematicism and the use of scent for defense; being larger has also rendered heteropterans more mobile, which enables them to find more readily newly planted crops.

Index terms: Heteroptera, Homoptera, Hemiptera, feeding, damage

[2604] HETEROPTERANS TRANSMITTING PLANT DISEASES

P. L. Mitchell[1], [1]Department of Biology, Winthrop Univ., Rock Hill, SC 29733, USA. E-mail: mitchellp@winthrop.edu.

The ability of piercing-sucking insects to transmit pathogens is closely linked to feeding mode and target tissue. As vectors of plant pathogens, Heteroptera are generally considered of minimal importance, although they share similar feeding methods with the Homoptera. Modes of feeding in Heteroptera include "lacerate-flush", intracellular penetration to vascular tissue, and an osmotic pump mechanism to empty parenchyma cells without direct penetration of the cell membrane. Transmission by true bugs of a fungal pathogen, several viruses, and trypanosomatid flagellates has been documented. The relationship between the feeding mode and the nature of pathogens transmitted is explored through a literature survey of heteropteran feeding behavior and vectoring capability. One of the most valuable tools in homopteran vector relations is the electronic feeding monitor, which permits the quantification of feeding behavior *in situ*. Despite extensive use of this technique with Auchenorrhyncha and especially Sternorrhyncha, few electronic monitoring studies have been done with plant-feeding Heteroptera; only four genera (*Anasa*, *Leptoglossus*, *Nezara*, *Lygus*) from three families (Coreidae, Pentatomidae, Miridae) have been examined. Results of AC electronic monitoring research on the probing and feeding behavior of *Nezara viridula* and *Leptoglossus phyllopus* will be presented, and the potential usefulness of this technique for vectoring studies will be assessed.

Index terms: *Nezara viridula*, *Leptoglossus phyllopus*, vector, feeding behavior

[2605] MANAGING HETEROPTERAN OF GRASSLANDS, CORN AND WHEAT IN THE TROPICS

V.R. Chocorosqui[1] & A.B. Malaguido[2], [1]Departamento de Zoologia, Universidade Federal do Paraná, Caixa Postal 19020, Curitiba, PR, BRASIL E-mail: viviane@cnpso.embrapa.br, [2]Fundação Mato Grosso, Caixa Postal 79, Rondonópolis, MT, 78705-040, BRASIL. E-mail: fundacaomt@fundacaomt.com.br

The tropical region, specially Brazil, is subject to the attack of heteropterans in almost all cultivated areas, including grasslands, corn and wheat cultures. Extensive damage on grasslands have been observed from Central-West to Southern Brazil, caused by the "percevejo castanho das raízes", which is a polyphagous pest that lives underground sucking the roots of many cultivated and non-cultivated plants, including soybean. There are two species in Brazil: *Scaptocoris castanea* and *Atarsocoris brachiariae*, and they are little known. Basic studies about their biology, behavior, natural enemies (microorganisms), host plants, and effect of fertilizers and soil management on their abundance are been conducted. The chinch bugs *Blissus* spp. (Blissidae) are causing damage on grasslands (Tangola grass) since the seventies in the State of Mato Grosso do Sul, Brazil. Recently, similar damage to Tangola grass and *Brachiaria arrecta* has been attributed to these bugs in other Brazilian regions. The chinch bug presence is noticed by irregular spots of dead or stunted plants that increase in size as insect numbers increase. Stinkbugs *Dichelops (Diceraeus) melacanthus* and *D. (Diceraeus) furcatus*, once secondary pests of soybean, are becoming important pests of wheat and corn crops, particularly to seedlings. Field evaluations indicated that these bugs are associated with the no-tillage cultivation system, which favors their biology. Nymphs and adults are found mostly on the soil, near the plant stems and underneath crop residues of the preceeding crop. Stand reduction is the main damage caused by *Dichelops* on both cultures. Management strategies to eliminate debris on the soil and the reduction of areas cultivated with corn, a second time in the summer before winter, may contribute to reduce the impact of these pests on wheat and corn.

Index terms: *Scaptocoris*, *Atarsocoris*, Cydnidae, *Blissus*, Blissidae, *Dichelops*, Pentatomidae, grassland, corn, wheat

[2606] LIFE HISTORY STUDIES AND ECOLOGICAL SIGNIFICANCE OF HOST PLANTS OF PENTATOMIDS FOR THEIR MANAGEMENT

A.R. Panizzi[1], [1]Centro Nacional de Pesquisa de Soja (CNPSo), Empresa Brasileira de Pesquisa Agropecuária (EMBRAPA), Caixa Postal 231, Londrina, PR, 86001-970, BRASIL. E-mail: panizzi@cnpso.embrapa.br.

Phytophagous hemipterans (heteropterans) are polyphagous, feeding on a wide array of plants. These plants are important food resources for development of nymphs and reproduction of adults, and play an important role in the buildup of pest populations. To illustrate this, I will discuss the host plant sequence utilized in northern Paraná state, Brazil, by three major pentatomids pests of soybean, which are: the southern green stink bug, *Nezara viridula*, the small green stink bug, *Piezodorus guildinii*, and the neotropical brown stink bug *Euschistus heros*. These bugs also feed on less preferred plants including several uncultivated-wild, and cultivated plants. On these plants they may change their feeding behavior, from a typical seed/fruit sucking habit, to leaf/stem feeding, with consequences to its nymphal and adult performance. In their life history, other strategies are used to overcome periods when food sources are scarce. For instance, *E. heros*, will pass 6 to 7 months underneath fallen dead leaves, without feeding, in a state of partial hibernation (diapause). The knowledgment of their life history is important to development managing strategies to avoid outbreaks on summer crops such as soybean.

Index terms: Pentatomidae, stink bugs, host plants, diapause, managing strategies.

[2607] MANAGING HETEROPTERAN PESTS OF RICE IN THE TROPICS

E. A. Heinrichs, Dept. of Entomology, University of Nebraska, Lincoln, NE 68583-0816, USA, E-mail eheinrichs2@unl.edu

The rice stink bugs (order Hemiptera) are well known by rice farmers the world over for the foul odor produced by the scent glands on their abdomen. Most common stink bug damage is by the feeding on the panicle. Both, nymphal and adult stages feed on the individual grains and on the primary and secondary branches of the panicle. They penetrate the developing grain with their sucking mouthparts and remove the white fluid referred to as "milk". Damage, early in the development of the grain, prevents grain filling. Later attack results in "pecky rice" which is referred to as the condition of the grain after being sucked by stink bugs and the grain being subsequently stained by the bacteria or fungi which enter the puncture wounds. The "dirty panicle" symptom, often observed in rice fields in West Africa, is believed to be caused by a combination of bug feeding and fungal infection. In some countries the market price of pecky rice is reduced. In Southeast Asia, the black bugs, *Scotinophora* spp., feed mostly at the base of the stems where they remove plant sap and cause "deadhearts". High infestations lead to "burned" plants. The major rice feeding heteropteran species vary from one geographical region to another. *Oebalus pugnax*, is a pest of rice in the southern USA. In West Africa, common grain sucking bugs on rice are the pentatomids, *Aspavia* spp., the alydid bugs, *Mirperus* spp., *Riptortus* spp. and *Stenocoris* spp. Major Southeast Asian species are the alydids *Leptocorisa* spp., and the pentatomid *Nezara viridula*. Weedy plants play a major role in the ecology and biology of the rice stink bugs. Weeds serve as alternate hosts. Ecological studies in West Africa indicate that the stink bugs are more abundant in weedy than non-weedy fields. Also, toposequence site studies indicated higher populations in lowland fields compared to upland fields. Because of the large number of pest species and the vagaries of attack, management tactics for stink bugs are not as well developed as for some other rice insect feeding guilds. Cultural practices such as weed management, and spraying of insecticides are some of the control measures used. Host plant resistance studies have identified rice varieties with moderate levels of resistance to certain stink bug species. However, commercial rice varieties with higher levels of resistance to stink bugs are needed.

Index terms: rice, *Oryza sativa*, stink bugs, weeds, Hemiptera, *Oebalus pugnax, Scotinophora* spp., *Riptortus* spp., *Stenocoris* spp., *Leptocorisa* spp., *Nezara viridula*, Asia, Africa, USA

[2608] MANAGING HETEROPTERANS IN TROPICAL SOYBEANS

L. A. Foerster, Dept. of Zoology, Universidade Federal do Paraná. P.O. Box 19.020 (81531-990) Curitiba, PR, Brazil. E-mail: foerster@bio.ufpr.br

Brazil is the second world largest producer of soybeans and has led research on integrated pest management since the expansion of the crop in the mid-seventies. The green stink bug *Nezara viridula*, the brown stink bug *Euschistus heros* and the small green stink bug *Piezodorus guildinii* are the most destructive species of pod suckers in tropical growing areas. Economic injury levels and low dosages of effective insecticides were the basic components of stink bug management programs in Brazil. More recently, intensive research on scelionid egg parasitoids has led to mass releases of *Trissolcus basalis* for the control of *N. viridula*. Population levels of this pentatomid have dropped sharply in the areas of release, and *E. heros* has replaced *N. viridula* as the most abundant stink bug species. Eggs of *E. heros* and *P. guildinii* however, are intensively parasitized by *Telenomus podisi* and simultaneous releases of both parasitoids should have a significant impact on the three principal pod-suckers of soybeans. Besides the Pentatomidae, an alydid, *Neomegalotomus parvus* has been reported in increasing numbers in Northern Paraná State. Up to 32 species of Heteroptera have been listed on soybeans in Brazil, but many are predaceous and others are associated to weeds growing within the crop. Four families, namely Nabidae, Lygaeidae, Anthocoridae and Pentatomidae (Asopinae) contain predatory species which are common in soybean fields. The genera *Nabis*, *Geocoris*, *Orius* and *Podisus* are examples of predatory heteropterans. However, their taxonomy and biology are poorly studied in tropical ecosystems and their role in pest management programs is not yet clear. Eggs of *P. nigrispinus* for instance, are heavily parasitized by *T. podisi*; thus the importance of *P. nigrispinus* as a control agent may be overestimated. Other predatory pentatomids include *Brontocoris tabidus*, *Tynacantha marginata* and *Alcaeorrhynchus grandis*. Many unidentified species of Coreidae, Pyrrhocoridae and Reduviidae are commonly found in the soybean ecosystem, but their presence is likely to be associated to weeds infesting the crop. Although of no economic importance, these species may have a role as alternative hosts for stink bug egg parasitoids. Reliance on insecticides is still high; however their impact on natural enemies may be significantly reduced by the finding that the addition of 0.5% common salt (sodium chloride) to the tank mixture can reduce the dosage of the recommended insecticides by 50%, without loss in the efficiency of the insecticides. The integration of chemical and biological control methods to cultural practices, such as plant resistance and trap crops, have proved sufficient to provide an effective control of the economically important pod-sucker species in tropical soybeans. Further research on the bioecology of parasitoids and predators however, should increase their importance in pest management programs.

Index terms: Stink bugs, *Nezara viridula*, *Euschistus heros*, *Piezodorus guildinii*.

[2609] MANAGING HETEROPTERAN PESTS OF BEANS (COWPEA, PIGEONPEA AND COMMOM BEAN) IN THE TROPICS

E. D. Quintela, Embrapa Arroz e Feijão, Caixa Postal 179, Santo Antônio de Goiás, GO, Brazil, 75375-000. E-mail: quintela@cnpaf.embrapa.br.

One of the most important production constraints of beans in tropical areas is the occurrence of a wide range of insect pests. Among these insect pests, various species of pod-sucking bugs (PSBs) infest beans during pod production and cause considerable damage and yield losses. Loss estimates resulting from PSBs damage ranged from 60-90% including both market value and seed viability reduction. The species distribution of the principal heteropteran pest varies according to the region or country. In Africa, most of the species infesting beans and other legumes are members of Coreidae (*Clavigralla* spp, *Anoplocnemis curvipes, Riptortus* spp.). Some members of Pentatomidae (*Nezara viridula, Piezodorus guildini, Aspavia armigera*) are often recorded as minor pests. Similar to Africa, in India, most species are members of Coreidae (*Clavigralla* spp, *Anoplocnemis* spp., *Riptortus* spp) and some are in the Pentatomidae (*Piezodorus* sp., *Dolicoris indicus* and *N. viridula*). In South America the predominant species are members of the Pentatomidae family (*N. viridula, Acrosternum marginatum, P. guildini, Euchistus* spp., *Thyanta perditor, Edessa meditabunda*) while other species are members of the Coreidae (*Crinocerus sanctus*), Alydidae (*Neomegalotomus parvus*) and Tingidae (*Gargaphia torresi*). The same genera of Pentatomidae found in South America occur also in Central America, except *Edessa*. Other heteropterans include species of Alydidae (*Burtinus notatipennis, Hyalymenus tarsatus*) and Coreidae (*Leptoglossus zonatus*). In general, these insects suck sap from developing pods, thereby shrivelling pods and seeds. Affected pods turn yellow, dry prematurely, seeds do not develop, and, in severe infestation, pods fall off the plants. In addition, the species *N. viridula* and *N. parvus* ta nsmit the yeast spot disease *Nematospora coryli* to seeds. Most emphasis in heteropterans management has been in the areas of multiple cropping, planting date manipulation, host resistance and chemical control. Chemical control is perhaps the most common method of controlling PSBs. Moreover, insecticides are often too expensive or unavailable to subsistence farmers in many developing countries. Barriers to implementation of IPM include limited knowledge of pest ecology, limited availability of resistant cultivars, over-reliance on chemical control and lack of dynamic economic thresholds.

Index terms: Alydidae, Tingidae, Coreidae, Pentatomidae, IPM, *Aspavia armigera Clavigralla* spp, *Anoplocnemis curvipes, Riptortus* spp, *Nezara viridula, Piezodorus guildini, Euchistus* spp., *Thyanta perditor, Edessa meditabunda, Crinocerus sanctus, Neomegalotomus parvus, Gargaphia torresi, Burtinus notatipennis, Hyalymenus tarsatus, Leptoglossus zonatus, Anoplocnemis* spp, *Dolicoris indicus*

[2610] MANAGING HETEROPTERAN PESTS OF PERENNIAL CROPS IN THE TROPICS

D.G. James, Irrigated Agriculture Research and Extension Center, Washington State University, 24106 North Bunn Road, Prosser, WA 99350, USA. Email: djames@tricity.wsu.edu.

A review is provided of heteropteran pests of perennial crops and their management in tropical and subtropical regions. Representatives from at least seven heteropteran families (Pentatomidae, Miridae, Coreidae, Scutelleridae, Tessaratomidae, Lygaeidae, Tingidae) are important pests of perennial crops like citrus, coffee, coconut, macadamia, passionfruit, mango, paw paw, banana, cocoa and custard apple. Heteropteran damage usually occurs on ripening/ripe fruit or on new shoot growth. Important genera or species include *Amblypelta* (Coreidae), *Lincus*, *Rhynchocoris humeralis, Nezara viridula, Biprorulus bibax, Bathycoelia thalassina, Antestiopsis* (Pentatomidae), *Creontiades, Austropeplus* (Miridae), *Musgraveia sulciventris* (Tessaratomidae), *Ulonemia concava* and *Stephanitis typicus* (Tingidae). Most pest species are cryptic and monitoring of populations can be difficult. Control of tropical heteropterans is often based on the use of broad spectrum insecticides. This is not always effective and frequently results in secondary pests outbreaks (e.g. mites, scale insects, aphids) which can be more important than the heteropteran. However, integrated pest management tactics such as biological and cultural control are increasingly being developed and practiced to control heteropteran pests in tropical and subtropical perennial crops. The spined citrus bug, *Biprorulus bibax*, for example, is now managed in Australian citrus using a combination of conservation-based biological control and judicious use of a selective insecticide. The use of hymenopteran egg parasitoids in the management of tropical heteropterans has received particular attention from researchers and is often the basis of biological control. Recent research on sex and aggregation pheromones of pentatomids and mirids in particular, provides the potential for new and less disruptive ways of managing tropical heteropterans in the future.

Index terms: Heteroptera, insecticides, biological control, pheromones, integrated pest management

[2611] MANAGING HETEROPTERAN PESTS: FROM THEORY TO PRACTICAL IMPLEMENTATION

L. G. Higley[1] & T. E. Macedo[1], [1]Dept. of Entomology, Univ. of Nebraska-Lincoln, 202 Plant Industry Bldg., Lincoln, NE 68583-0816, USA, E-mail lhigley1@unl.edu

Sucking insects, including the Heteroptera, have unique features contributing to their importance as pests. Fluid feeding has a much stronger association with disease transmission than many other modes of feeding. Also, responses of plants to fluid feeding are strikingly different from responses to other types of injury. For insects, fluid feeding may pose nutritional challenges, which in turn have important implications in the evolution of life history challenges. All of these factors are relevant to the importance of fluid feeders as pests and to their management. Although Homoptera and Heteroptera share many of these features, clear differences in pest status between the two groups point to the importance of other factors besides fluid feeding. Two obvious differences pertain to reproductive potential and host specificity. On this latter point, variability in host specificity seems to be a key issue in limiting pest status of Heteroptera and may help explain why hematophagous Heteroptera are not more important as medical pests. As plant pests, we frequently cannot explain how heteropteran feeding injures plants. Undoubtedly much of the impact arises not from removal of photosynthates, but from detrimental physiological effects of salivary compounds. Possibly injury form Heteropteran feeding is intrinsically detrimental, but damage may also follow through feeding triggering inappropriate plant stress responses. Understanding such relationships lies at the heart of finding new approaches for better managing heteropteran plant pests, such as through plant resistance. Additionally, better understandings are essential in helping improve decision tools like economic injury levels and economic thresholds for heteropterans.
Index terms: Heteroptera, pest management, economic injury level, plant stress.

[2612] THE EFFECT OF STUFFING POMEGRANATE NECK (CEELYX) ON REDUCTION OF POMEGRANATE NECK WORM *SPECTROBATES CERATONIAE* (LEP. PYRALIDAE: PHYCITINAE) DAMAGE

A. Aghamirkarimi, Department of plant protection, University of Tehran

Pomegranate is one of the most important fruit trees in Midle East and some other areas of the world. Pomegranate neck worm, *Spectrobates ceratoniae* Zell. (Lep. pyralidae) is the most important pest of pomegranate fruit in Iran. This pest is responsible for %60 to %80 losses in pomegranate fruit of Varamin area in south of Tehran. Stuffing neck of fruits (place for egg deposition of the pest) with different materials, used to control the pomegranate neck moth. The neck of fruits were stuffed with clay, glue+sawdust and cotton lints (mainplot) in three different periods: early June, early July and early August (subplots) with experiment units of 5 trees of 10 years old. Percent of damaged fruits and total weight of fruits per plot was used as evaluation indexes. A completely randomized block design with splited plots for time was employed to analyse the resulted data. For comparison between means Duncan method was used. According to the results, stuffing with different material resulted in significantly different yield between plots. The results showed that, stuffing neck of fruits with clay in early June reduced the wormy fruits to about 1/3 and increased the total weight of fruits per plot to 115.88 Kg. The differences were statistically significant with α = %5. When stuffing the fruit neck with the mud of under trees was hundred percent effective, its cost was nothing. Using this method, natural enemies did not affected and also there was no harm to the environment.
Keywords: sawdust, dust glue, pomegranate neck, wormy fruits, cotton lints.

[2613] THE EFFECTS OF CITRUS LEAF MINER INFESTATIONS IN CITRUS GROVES

M. Anagnou-Veroniki, D. Doukas and D. Kontodimas, Dept. of Entomology & Agric. Zoology, Benaki Phytopathological Inst., 8 S. Delta Str., 145 61-Kifissia (Athens), GREECE, E-mail bpilibr@otenet.gr

Citrus leafminer *Phyllocnistis citrella* Stainton (Lep. Gracillaridae) is one of the most important insect pest for citrus in Greece. The time of (insect's) infestation on both leaf surfaces of orange-trees, tangerin-trees and lemon-trees has been studied. The existence and dynamics of the insects parasitoids has been also investigated in the areas of Marathon and Poros, where the research has been carried out. The effects of the infestation on tangerin-trees was estimated by counting the shoot growth and the fruit diameter in treated with imidacloprid in comparison with untreated control. The results showed, in all cases of studied trees, the insect growth stages were more progressive in the lower leaf surface than those in the uper surface. The parasitoids *Pnigalio* sp., *Cirrospilus* sp., *Neochrysocharis formosa* and *Citrostichus phyllocnistoides* have been recorded in all cases. The high effectiveness of imidacloprid has been verified. The infestation in the treated trees did not exceed 18,52% compared with 98,04% of the control. The overhall shoot growth as well as the fruit diameter did not show any statisticaly significant difference from the control.
Index terms: *Phyllocnistis citrella*, parasitoids, imidacloprid.

[2614] EFFECT OF NITROGEN FERTILIZATION ON THE RESISTANCE OF CORN PLANTS TO THE ATTACK OF FALL ARMYWORM (LEPIDOPTERA: NOCTUIDAE)

G. G. Andrade[1]; J. C. Moraes[1]; P. S. L. Silva[2] & R. Zanetti[1], [1]Deptº de Entomologia, Universidade Federal de Lavras, 37200-000, Lavras, MG – Brazil. E-mail: jcmoraes@ufla.br; [2]Deptº de Fitossanidade, Escola Superior de Agricultura de Mossoró, 59600-970, Mossoró, RN – Brazil.

In Brazil, the most important pest on maize crops (*Zea mays* L.) is the fall armyworm *Spodoptera frugiperda* (Smith). In northeast region of the country, mainly, the use of fertilization is low. Considering those two factors (pest and low use of fertilizers), as responsible for the low productivity, this study aimed to evaluate the effect of the nitrogen fertilization on corn plants c.v. Centralmex, and also on the fall armyworm. The visual damage in the plants with artificial infestation with newly hatched worms, through note scale, leaf area consumption of the plants treated with 0, 60, 120 and 180 kg of N/ha (ammonia sulfate) and infested with 15, 30 and 45 cartepillar/plant were evaluated. The visual damage in the leaves with natural infestation and the consumption of leaf sections, using a choice tests, in plants fertilized with the same doses of nitrogen were also evaluated. The effect of the nitrogen variation on the pest, naturally or artificially infesting the crop, was negative both for the lowest and highest doses of nitrogen. The results pointed out in addition, that nutritional needs of the plant and the cartepillar related to the nitrogen, although not so different, but the optimum for cartepillar is less than the optimum for the plant.
Index terms: IPM, *Spodoptera frugiperda*

[2615] GROWTH STAGE-DEPENDENT RESISTANCE OF RICE PLANT TO THE WHITEBACKED PLANTHOPPER

K. Arimura, Y. Suzuki & M. Matsumura, Lab. of Pest Management Systems, Kyushu Nat'l Agric. Exp. Stn. Suya 2421, Nishigoshi, Kumamoto, 861-1192, JAPAN, E-mail arimurak@knaes.affrc.go.jp.

The whitebacked planthopper (WBPH), *Sogatella furcifera* Horváth, is one of the most important insect pests of rice in Asia. We recently demonstrated that many Japonica rice varieties have an ovicidal response which is induced by the stimuli of WBPH oviposition. This responce is greatly affected by the growth stage of rice plant. Other aspects of WBPH traits such as oviposition and wing-form expression can be affected by the plant stages. To clarify stage-dependent resistance of rice to WBPH, we investigated the relationship between the growth stage of rice and oviposition, egg and nymphal mortality, honeydew excretion, and wing-form ratio. The rice variety used was Hinohikari (Japonica). The experiments were done in a green house. The number of eggs laid per WBPH female was high at 5 and 8 weeks after transplanting (WAT), decreased at 11 WAT, increased again at 14 WAT, and was lowest at 16 WAT. Egg mortality caused by ovicidal response was lowest at 5 WAT, highest at 8 WAT, and thereafter decreased again. Both the nymphal mortality and the percentage of macropters increased with increasing growth stage. Honeydew excretion was highest at 5 WAT and decreased as the plant growth progressed, suggesting that inhibition of sucking is an important factor that determine the stage-dependent increase in nymphal mortality and percentage macropterous. The result suggests that Japonica rice variety resistance to WBPH is feeble at tillering stage, and operate multiply after tillering stage.
Index terms: *Sogatella furcifera*, oviposition, ovicidal response, nymphal mortality, wing-form ratio

[2616] EVALUATING SWEET POTATO FOR RESISTANCE TO THE WEST INDIAN SWEET POTATO WEEVIL

M. E. B. Assi[1], A. M. R. Junqueira[1], & F. H. França[2], [1]Universidade de Brasília, FAV, NUCOMP, P.O. Box 4508, CEP 70.910-970, Brasília, BRAZIL, [2]Embrapa Hortaliças, Brasília, P.O. Box 218, DF 70.359-970, Brasília, DF, BRAZIL, E-mail franca@cnph.embrapa.br.

The West Indian Sweet Potato Weevil (WISPW), *Euscepes postfasciatus* is the most important pest of sweet potato in Brazil. IPM tactics such as crop rotation, use of non-infested propagative cuttings, high hilling, and prompt harvesting are recommended. Chemical control is not suggested because there is no insecticide registered for the commodity. Host plant resistance has been consistently considered as an efficient control strategy in recent years for the WDS complex in Brazil but yet not available for WISPW control. The objective work was to evaluate in laboratory 12 accessions for resistance and susceptibility to WISPW that were previously identified either as resistant or susceptible to the pest in a field-screening test. Two free-choice experiments were carried out using sliced roots and non-cut roots of sweet-potato accessions. Sliced roots were arranged in Petri dishes (12 cm diameter) and non-cut roots were assembled in plastic boxes (0,6m x 0,4m x 0,1m). Each type of arena was infested, respectively, with 46 (23 males and 23 females) and 60 adults (30 males and 30 females) in each of six replications. Adult counts were taken every 12 hours during the next six days following infestation and transformed to $\sqrt{x \pm 0,5}$ before statistical analysis. Fischer's Protected LSD separated means. About 76 to 80 % of alive adults were recovered at the end of the evaluations in both experiments. Respectively, the most and least preferred accessions WISPW were CNPH 295 and CNPH 46 when non-cut roots were evaluated. Sliced roots of accession CNPH 9 were more preferred by WISPW than that of accession CNPH 5. In both experiments there was 6-fold difference between preferred and non-preferred hosts.
Index terms: host plant resistance; *Euscepes postfasciatus*

[2617] EFFICACY OF PLANT EXTRACTS AGAINST NYMPHS OF WHITEFLY, *BEMISIA TABACI* GENNADIUS

K. M. Azam & S. A. Razvi, Dept. of Agronomy, Horticulture, Entomology and Plant Pathology, Sultan Qaboos University, College of Agriculture, P. O. Box 34, Al-khod 123, Sultanate of Oman.

Leaf extracts of eight plants namely Azadirachta indica, Annona squamosa, Acacia nilotica, Myrtus communis, Crotolaria juncea, Jatropa dhofarica, Sueda aegyptica and Boswellia sacra were prepared by steeping 12.5 gm of shade dried leaf / seed powder of the plants in 62.5 ml of water-ethanol (1:4 v/v) for 24 hours. The extracts were suction filtered. One ml of the filtrate was diluted to 10, 20 and 50 ml with water containing 0.01% emulsifier (Triton X-100) to get 10, 5 and 2 per cent spray solutions, respectively. Cucurbit leaves with whitefly nymphs were sprayed with the extracts. The leaves were kept in contact on filter papers for 2 hours just before spraying and for 24 hours after spraying of the extracts. These filter papers were sprayed with ninhydrin (0.4% in ethanol) which gave purple spots due to honeydew secreted by whitefly nymphs. The difference between the number of spots before and after spray gave the mortality of nymphs. The extracts were not effective at 2% concentration, while at 5%, A. nilotica recorded 62.1% mortality followed by A. squamosa (44.6%) and A. indica (41.7). The mortality of nymphs at 10% concentration was highest in A. nilotica (70.4%), followed byA. Indica (57.4%), C. juncea (53.9%), A. squamosa (50.0%) and B. sacra (44.2%). The mortality in S. aegyptiaca, M. communis and J, dhofarica was low ranging from 11.57% to 23.02%. Aflix insecticide used as treated control recorded a mortality of 72.7 to 89.7% at 0.1% concentration.
Index terms: Anona Squamosa, Acacia nulitica, steeping, emulisifier, aflix.

[2618] EFFICACY OF THIAMETHOXAM AND ALDICARB IN THE CONTROL OF *DIABROTICA SPECIOSA* (COLEOPTERA – CHRYSOMELIDAE – GALERUCINAE) ON POTATO CROP (*SOLANUM TUBEROSUM.*) IN PINHEIRAL CITY, RJ -BRAZIL

E.H.de Azeredo[1] & P.C.R.Cassino[2], [1]Universidade Federal Fluminense, "Colégio Agrícola Nilo Peçanha", UFF/CES, Pinheiral, RJ, BRazil. [2]UFRural Centro Integrado de Manejo de Pragas "Cincinnato Rory Gonçalves", BR 465 Km 07, CEP 23.890-000, Seropédica, RJ, Brazil, E-mail: pr.cassino@uol.com.br, Email:cimp@ufrrj.br.

Thiamethoxam and Aldicarb were tested against *D. speciosa* on potato crop in a experiment performed at "Universidade Federal Fluminense" in Pinheiral city, state of Rio de Janeiro, Brazil from September to November, 1999. The experimental design used was a randomized block design with 5 treatments: THIAMETHOXAM 10G (ACTARA 10G) at 20 kg/ha, THIAMETHOXAM 250 WG (ACTARA 250 WG) at 4, 8 and 16g/ plant, and ALDICARB 150 G (TEMIK 150 G) at 6,5 g/plant as a standard treatment, plus the control The insecticides in the granular formulation were applied twice to the soil. The first application was realized at the moment of cultivation into the planting furrow, and the second application was made before the mound over the rows. The wettable granular inseticides were sprayed on the base of the plant. The treatments were replicated 4 times. the cultivars "ACHAT" and "MONALISA" were planted with 0,80 X 0,40m of spacing. The experimental area consisted of 1440 plants, however , 25 plants per block was randomly selected for evaluation. Evaluations of the number of *D. speciosa* adults at the 1/3 of the bottom, middle and top of the plant were done prior to spraying and 10, 20, 30 and 40 days after application. The evaluations were made basing in the methodology proposed by CASSINO (1983) and modified by AZEREDO (1998), that aims the prior-randomness for counting the number of alive insects on the plant. The results showed that THIAMETHOXAM 10G at 20 kg/ha were more efficient than the standard ALDICARB ($P \leq 0,01$) at 10 days after the application (i.e., 40 days of phenology cicle of *S. tuberosum*) when the *D. speciosa* decreased in 95,3%. However, THIAMETHOXAM 250 WG at 16 g/plant was less efficient even in presence of the frmulation 10 GR.
Index Terms: Coleoptera – Chrysomelidae; Potato; Thiamethoxam; *Diabrotica speciosa*

[2619] FIELD EVALUATION OF EFFICACY OF THIAMETHOXAN 250WG AND ALDICARB 150G IN THE CONTROL OF *CEROTOMA ARCUATA* (OLIVER) (COLEOPTERA: CHRYSOMELIDAE) IN BEAN (*PHASEOLUS VULGARIS*) IN PINHEIRAL CITY , RJ, BRAZIL

E.H.de Azeredo[1] & P.C.R.Cassino[2], [1] Universidade Federal Fluminense, "Colégio Agrícola Nilo Peçanha", UFF/CES, Pinheiral, RJ, Brazil, [2]UFRural, IB, Centro Integrado de Manejo de Pragas "Cincinnato Rory Gonçalves", BR 465 Km 07, CEP 23.890-000, Seropédica, RJ, Brazil, E-mail, pr.cassino@uol.com.br, Email-:cimp@ufrrj.br.

C. arcuata is one of the most common pest of bean (*P. vulgaris*) in Brazil; causing damages by consuming leaf tissue or transmitting viruses, resulting in reduced yield. THIAMETHOXAN 250WG and ALDICARB 150G were tested against *C. arcuata* on bean crop cultivar "manteiga" in a experiment conduted at "Universidade Federal Fluminense", in Pinheiral, RJ – Brazil, from September to November , 1999. A randomized block desing was used with 5 treatments (THIAMETHOXAN 250 WG (ACTARA 250WG) at 2, 4 and 8g a.i./plant, and ALDICARB 150G (TEMIK 150G at 2g.a.i./plant) plus control replicated 4 times. Evaluations of the number of adults on the plants were done prior to spraying and 10, 20, 30 and 40 days after application. The mean numbers of adults between treatments were not significantly different according to Tukey's least significant difference test (P≥0,05). However, THIAMETHOXAN 250WG at 4g/plant was more effective
than ALDICARB 150G (standard).

Index Terms: Coleoptera – Chrysomelidae; bean ; *Phaseolus vulagaris;* Thyamethoxan; *Cerotoma arcuata*

[2620] OCCURRENCE OF THE ENTOMOPATHOGENIC FUNGUS *ASCHERSONIA* SP. INFESTING *SELENASPIDUS ARTICULATUS* (HOMOPTERA: DIASPIDIDAE), IN THE STATE OF RIO DE JANEIRO, BRAZIL

O.R.F. Azevedo[1]; R. Silva-Filho[1]; P.R.R. Silva[1,2]; P.C.R. Cassino[1,3]; W.C. Rodrigues[1] & S.S.P. Souza[1], [1]Dept. de Entomologia e Fitopatologia, IB, Centro de Manejo de Pragas "Cincinnato Rory Gonçalves", UFRRJ, BR 465 Km 07, Seropédica, RJ, CEP 23890-000, BR. cimp@ufrrj.br; [2]E-.mail: pramalho@fst.com.br. [3]E-mail: pr.cassino@uol.com.br.

Fifteen expeditions were realized in Rio Bonito and Araruama cities (RJ), Brazil, from October, 1999 to December, 1999, with aim of surveying the insects that feed upon *Citrus* spp. In each expedition, we monitored 16 plots of 210 plants of the orange cultivars "Folha Murcha" and "Seleta", tangerine "Poncã " and "Tahiti" true lime. Leaves infested by the armored scale *Selenaspidus articulatus* (Diaspididae) were colleted from 4 opposite branches (one from each quadrant of the canopy). Great numbers of the armored scales were infested by the fungus belonged to the genus *Aschersonia* sp. (Deuteromycotina: Hyphomycetos). *S. articulatus* is a major pest of citrus in the state of Rio de Janeiro, and bioassays for determining pathogenicity of this fungus on *S. articulatus* should be held on the laboratory, and its potencial for biological control of this pest.

Index terms; Entomopathogenic fungus; *Aschersonia* sp.; *Selenaspidus articulatus;* "Folha Murcha" orange; "Seleta" orange; Tangerine "Poncã"; "Tahiti" true lime

[2621] USE OF THIAMETHOXIAM IN THE OF CONTROL *PINNASPIS ASPIDISTRAE* (HOMOPTERA:STERNORHYNCHA) AND ITS ON THE POPULATION OF NATIVE PARASITOIDES IN *CITRUS* SPP., IN ARARUAMA CITY, RJ, BRAZIL

O.R.F. Azevedo[1]; R. Silva Filho[1]; P.R.R. Silva[1,2]; P.C.R. Cassino[1,4] & M.A. Diodato[3], [1]Dept. de Entomologia e Fitopatologia IB, Centro de Manejo de Pragas "Cincinnato Rory Gonçalves", UFRRJ BR 465 Km 07, CEP 23.890-000, Seropédica, RJ, BR, E-mail: cimp@ufrrj.br; [2]E-mail: pramalho@fst.com.br; [3]Entomologia Florestal Universidade do Contestado, Canoinhas, SC, E-mail: diodato@yahoo.com.br; [4]E-mail: pr.cassino@uol.com.br.

A experiment was performed in São Vicente de Paulo county, Araruama city (RJ), Brazil, form September, 1999 to November, 1999, aiming to evaluate the effect of Thiamethoxiam (ACTARA GR) on the *Pinnaspis aspidistrae* population, and the selectivity for its natural enemies. The experimental design was randomized block design with 5 treatments and 5 replications. The experimental area was consisted of 210 plants of true lime (cultivar "Tahiti") and was evaluated 25 plants. Evaluations were done at 5, 30, 45 and 60 days after the application of the treatments (ACTARA GR at 50, 75 and 100g/plant, TEMIK at 130g/plant, plus control). There was significant difference between treatments according to Duncan's test ($P \leq 0.05$). ACTARA GR 75 at and 100g/plant had the same performance and were more effective than the standard (TEMIK). ACTARA at 75g/plant had better performance at 60 days after the application. There was no significant difference between the other treatments. The selectivity of Thiamethoxam was of 100% for *Chrysoperla sp.*, 30% for *Pentilia egena*, and 20% for *Cycloneda sanguinea*, when it was used up to 75g/plant at 30 days after the application.

Index terms; Thiamethoxiam – Actara, Temik; *Pinnaspis aspidistrae*; *Chrysoperla sp.*; *Pentilia egena*, *Cycloneda sanguinea*

[2622] INSECT DEVELOPMENT DELAY PRODUCED BY WITHANOLIDES FROM SOLANACEAE

S. G. Bado[1], G. Mareggiani[1], M. I. Picollo[2] E. Zerba [2]& F. Vilella[3], [1] Cátedra de Zoología Agrícola- Facultad de Agronomía (U.B.A.) Av. San Martín 4453 (1417). Argentina. **Erro! Indicador não definido.**, [2] cipein@citefa.gov.ar, [3] Cátedra de Producción Vegetal- F.A.U.B.A.

Undesirable effects of increased application of synthetic agrochemicals, create the necessity of research on new molecules with more favorable properties. The effect of withanolides from *Nicandra physaloides* were tested against *Tribolium castaneum* (Herbst) CIPEIN strain in comparison with the previously studied salpichrolide A from *Salpichroa origanifolia* and withaferoxolide from *Datura ferox*. Compounds were added to the diet of neonatae larvae and kept at 24±2°C, 65±3% HR. Each ten days development stage was registered. Development times required for adult emergence of 50% of exposed insects were calculated according to Probit analysis (p=0.05). Nicandrenone produced a development delay (DD): 25,5% compared with the control. These results are not statistically different (p:0.05) from those obtained with salpichrolide A (DD:23.4%) and withaferoxolide (DD:18.7%). Probably causes of the similar activity measured are here analyzed in relation to analogies in the chemical structure of the three withanolides.

Key words: withanolides, nicandrenone, salpichrolide, withaferoxolide, *Tribolium castaneum.*

[2623] ONLINE DECISION SUPPORT SYSTEM FOR INTEGRATED CODLING MOTH MANAGEMENT

W. L. Baiwa, M. Kogan & L. Coop, Integrated Plant Protection Center (IPPC), Oregon State University, Corvallis, OR 97331-8530, USA.

Successful management of Codling Moth (CM), *Cydia pomonella* L., a key pest of deciduous fruits, depends heavily on accurate and timely information. Internet offers new opportunities to accessing and disseminating current information quickly and inexpensively. It provides excellent interfaces for all kinds of interactive network databases, and many kinds of online analyses and data processing. The number of computers connected to the Internet has grown exponentially in the past few years and the potential exists to reach more people, and faster electronically than through hardcopy. An internet-based Codling Moth Information Support System (CMISS) has recently been developed to support IPM implementation for the Codling Moth. CMISS is a comprehensive source of biological and management information on the codling moth and represents the state-of-the-art for web applications and decision support systems. This site uses both static (text, graphics, and tabular) information and dynamic (database-driven and server-side applications) information. CMISS currently hosts various databases and knowledgebases on different aspects of codling moth biology, ecology, and integrated management. It also provides compilations on various aspects of codling moth phenology and population dynamics including modeling parameters, etc. Its bibliographic database provides access to an almost complete coverage (over 6,000 references) of worldwide codling moth literature from 1700 to 2000. This database is designed to allow convenient searches by author, year of publication, title, publication type (journal/book title), and keywords. A generalized degree-day calculator can be used from anywhere in the world for forecasting codling moth phenology under local conditions. The program works by allowing the client computer to upload a local weather data file to the server. An online population dynamics model allows users to determine the combined effects of multiple control measures such as mating disruption and reduced rate of chemical insecticides. CMISS is available at http://ippc.orst.edu/codlingmoth/.

Index terms: Phenology, population dynamics, IPM, Internet, knowledge-base

[2624] INTEGRATED CONTROL OF MEDITERRANEAN SNAILS IN SOUTHERN AUSTRALIA, INCLUDING THE USE OF PARASITIC SARCOPHAGID FLIES

G.H. Baker[1], D.C. Hopkins[2] & J.B. Coupland[3], [1]CSIRO Entomology, P.O. Box 1700, Canberra, A.C.T. 2601, Australia, E-mail geoffb@ento.csiro.au; [2]SARDI, Entomology, P.O. Box 397, Adelaide 5001, South Australia; [3]CSIRO Biological Control Unit, 34982 Montferrier sur Lez, France.

Three introduced species of white and conical snails, *Theba pisana* (Helicidae), *Cernuella virgata* and *Cochlicella acuta* (Hygromiidae), climb on to the heads, pods and stalks of cereals and legumes in late spring to aestivate in southern Australia. During harvest, the snails clog machinery and contaminate grain. Significant time is wasted by farmers when they have to clear snail blockages from their machinery. The contaminated grain is either unacceptable to grain handling authorities or is down-graded in quality. Farmers may also incur significant costs having rejected grain cleaned to remove snails, but this can be difficult to achieve, especially with small *C. acuta*. Shipments of grain have been rejected overseas because of snail presence in consignments. Snails pose a serious threat to the export marketing of Australian grains. *T. pisana*, *C. virgata* (to a lesser extent) and a fourth introduced species, *Cochlicella barbara*, also feed on legume-based pastures (e.g. annual medics, lucerne, clovers) and seedling crops (e.g. barley, oil seeds) causing severe damage. Large numbers of snails have invaded native ecosystems (e.g. woodlands). This paper will discuss recent developments in methods to control the snails, and some of the problems associated with them. Molluscicides can be effective but are expensive for broad acre use. Wind-rowing crops prior to harvest can help reduce contamination for some species (but not for *C. acuta*). Burning pasture and crop residues prior to sowing new crops and soil cultivation kill many snails, but these practices run counter to attempts to improve soil conservation. Surveys throughout the western Mediterranean have identified several potential biological control agents for use against the snails, particularly parasitic flies, *Sarcophaga* spp. (Sarcophagidae). Three of these agents, *S. uncicurva* and *S. balanina* which attack *T. pisana* and *C. virgata*, and *S. penicillata* which attacks *Cochlicella* spp., have been imported under quarantine to evaluate their host-specificity against native Australian snails (36 species, 11 families) and hence their suitability for release. *S. uncicurva* and *S. balanina* have proven to be unacceptable risks, but *S. penicillata* appears strongly host-specific. Permission to release it has been sought. In Europe, levels of parasitism of *C. acuta* by *S. penicillata* can be high (up to 90%). Levels of hyper-parasitism can also be high (up to 79% of *S. penicillata* parasitised by the pteromalid wasp *Novitzkyanus cryptogaster)*. In the absence of such hyper-parasites in Australia, *S. penicillata* may be more effective than in Europe.

[2625] SELECTIVE PESTICIDES AND WEEDY MARGINS: SYNERGISTIC EFFECTS OF INTEGRATED PEST MANAGEMENT

J.E. Banks[1] & J.D. Stark[2], [1]Univ. of Washington – Tacoma, 1900 Commerce St., Tacoma WA, 98402 USA E-mail: banksj@u.washington.edu; [2]Washington State Univ., Puyallup Research & Ext. Ctr., 7612 Pioneer Way E., Puyallup, WA 98371 USA.

We conducted a series of field and laboratory experiments designed to test the compatibility of the use of increased vegetation diversity with the use of a selective pesticide in controlling aphid pests in a crucifer agroecosystem. In a factorial design field experiment, we established plots of broccoli surrounded by (a) bare ground or (b) weedy margins; these plots were then sprayed with either (a) zero, (b) low, or (c) high levels of Imidacloprid. Analysis of aphid counts throughout an entire growing season revealed a synergistic effect of weedy margins and pesticide spray levels on pest densities. Furthermore, laboratory tests and a mathematical model suggest that field distributions of aphids may be determined by a combination of aphid response to vegetation patterning and natural enemy responses to selective pesticides.

Index terms: Brassica, Myzus persicae, Brevicore brassicae, vegetation diversity

[2626] INTEGRATED MANAGEMENT OF THE APHID, APHIS GOSSYPII, IN INDIAN CHERRY TREE, IN IRRIGATED AREAS OF THE SÃO FRANCISCO VALLEY

F. R. Barbosa[1], K. M. M. Siqueira[2], E. A. de Souza[1], W. A. Moreira[1], F. N. P. Haji[1] & J. A. de Alencar[1], [1]Embrapa Semi-Árido, Caixa Postal 23, CEP 56300-970, Petrolina-PE, E-mail: flavia@cpatsa.embrapa.br; [2]UNEB. Dept. de Tecnologia e Ciências Sociais, CEP 48900-000, Juazeiro-BA.

The knowledge of indian cherry tree pests and beneficial insects at the São Francisco Valley are scarce. Sampling procedure was done in commercial orchards of Petrolina (Pernambuco State) from September 1998 through October 1999, and the aphid, *Aphis gossypii*, was found to be a key pest. Those insects were observed infesting leaves, new shoots and fruit peduncle, promoting mal formation, wilting, leaf dryness, fruit drop and yield reduction. Besides, there is a lowering in the photosynthetic capacity, due to sooty mould. Natural enemies observed were: *Cycloneda sanguinea*, Scymnus sp., spiders, chrysopa, sirphid flies and staphilinids. The weeds in the orchard were also sampled, and those tar arbor *Aphis gossypii* were: *Portulaca oleraceas* L., *Amaranthus spinosus* L., *Boechaavia coccinea* Mill, *Sida cordifolia* L. An experiment was done to control the aphid by alternative methods. A randomized block design with three treatments was used as follow: control, neutral detergent (160 ml / 20 liters of water), and wheat flour (1000 grams/ 20 liters of water). Five replicates were used, having the experimental unit 3 plants each. Treatment effect was evaluated after 3 and 7 days of spraying, by counting infested shoots with alive aphids. Treatment efficiency was obtained by using Abbott's (1925) formula. The mean number of infested shoot in the control was 30.53, while in the wheat flour and detergent treatments, it was 15.5 (%E = 49.2) and 25.3 (%E = 17,1), respectively.

Index terms: *Malpighia* spp., natural enemies, alternative control

[2627] PROTECTION OF WINTER WHEAT AND BARLEY CROPS AGAINST DISEASES AND PESTS BY AN INTEGRATED CONTROL SYSTEM

A. Bărbulescu[1] & C. Popov[2], [1,2] Research Inst. for Cereals and Industrial Crops, 8264 Fundulea, N. Titulescu Str., 1, Calarasi District, Romania, E-mail:fundulea@cons.incerc.ro

In Romania, production of winter wheat and barley crops is often conditioned by various pests and pathogens, of which particular interest is shown by: *Zabrus tenebrioides, Agriotes spp., Eurygaster integriceps, Lema melanopa*, some flies and aphid species for both crops, *Tilletia spp., Fusarium spp., Erysiphe graminis, Septoria spp., Puccinia spp.* to wheat, and respectively *Ustilago nuda, Pyrenophora spp., Erysiphe graminis, Rhynchosporium* spp. to barley. These species, by the attack induced, can determine heavy losses and even compromising crops. In order to save yield, rather often inadequate measures have been used, this imposing in the recent decades development of a real integrated control system of damaging organisms. Methodology. The experiments have been performed in field, having as goals: effect of crop rotation and of seed-time on evolution, particularly of soil pests; effect of a widely diversified range of chemicals on different damaging organisms; effects of some parasitoids on population levels of sunn pest and wheat wasp. Efficacy of trialed factors has been rated according to one of the parameters: frequency of attacked plants, attack level, density of pests per square meter or per plant, parasitization percentage. Results. Marked monoculture of winter spiked cereals and early sowing of these crops favourise apparition and evolution mainly of the ground cereal beetle, cereal flies and aphids, therefore protection of winter wheat and barley is recommended by avoiding monoculture of winter spiked cereals and early sowing of these. Insecticide-fungicide mixtures applied as seed dressing provide simultaneous protection from the ground cereal beetle and wireworms, as well as from wheat smut and black smut of barley. A diversified assortment of chemicals provide protection to winter wheat and barley crops from seed- and soil – born pathogens, and of those inducing foliar- and spike- diseases, as well as against the sunn pest and cereal leaf beetle. *Trissolcus grandis* and *Collyria coxator*, secured significant decrease of pest populations, by their high parasitization level. Conclusions. As a result of numerous experiments performed in field, an opportunity resulted for saving yield of winter wheat and barley crops, protecting these by including a series of agricultural, chemical and biological factors in a real system of integrated control.

Index terms: *Zabrus tenebrioides, Eurygaster integriceps, Agriotes spp.*.

[2628] SPECIES OF HETEROPTERA IN CROATIAN APPLE ORCHARDS

B. Baric & I. Ciglar, Faculty of Agriculture University of Zagreb, 10000 Zagreb, Svetošimunska 25, Croatia, Europe, e-mail baric@agr.hr

Croatia is a little country in the South-East of Europe. The climate in Croatia is continental and mediterranean in the South. Agriculture is the main branch of production. Apple production is one of the most important kinds of fruit production in Croatia. In the apple production we use IPM like other countries in Europe. IPM means using low toxic pesticides and selective pesticides. In this plant protection there is a new problem with insects which was not a problem when we used broad spectrum insecticides. A new problem in the orchard plant protection in Europe is the appearance of phytophagus Heteroptera like Campylomma verbasci, Lygus rugulipennis etc. They damage apple and other fruit species. This problem is very serious because species of Heteroptera are resistand to many insecticides. Our poster presents results of the research over a five-year period, from 1992 to 1996 at several large orchard facilities. In the fauna research we used the visual method and the beating method. We determined the species for all gathered bugs using determination keys by Stichel, Kelton and Wagner. We wanted to investigate all species of pests, which of them causes the biggest problem, and their domination. We wanted to know if the phytophagus bugs are a problem in modern Croatian orchards or not. In this five-year period we gathered the total of 16,947 samples of insects and bugs. The research included the entire fauna of insects and bugs. Abundance, domination and frequency of a particular order in the overall fauna were calculated, with a special emphasis an bugs, the number of species, as well as a domination and frequency of bugs within the bug fauna. The research has shown as follows: the eudominant order in the apple-tree orchards is Acarina, bugs (Heteroptera) present a subdominant order in the apple-tree orchards, 24 species of bugs were registered in the orchards, the constant bug in the apple-fruit orchard is Orius sp. which is a predatory bug species. Our research has shown certain correlation among bugs and a major pest in apple Panonychus ulmi.During the five-year research on insect fauna we recognized many beneficial Heteroptera from families Anthocoridae, Miridae, Nabidae and Pentatomidae. Our poster shows fauna structure of insects, domination of particular species and the role of bugs in the overall fauna, as well as whether the phytophag bug species have inflicted any considerable damage to Croatian orchards.

Key words: phytophagus bugs, predatory bugs, fauna.

[2629] EFFECT OF PHYSIOLOGICAL PRODUCTS ON ADULTS OF *ANTICARSIA GEMMATALIS*

A. Batista Filho[1], E.S. Loureiro[1], J.E. M. Almeida[1], C. Lamas[1], [1]Lab. Controle Biológico, Centro Exp. Inst. Biológico, P.O. Box 70, Campinas, SP, 13001-970, Brazil, E-mail batistaf@dglnet.com.br

Insects growth regulators are the last generation of chemical insecticides and it include compounds which affect the growth and development of insects. These products, besides their effect on cuticle formation and metabolism of larvae, they can cause sterility when applied against adults of several orders of insect pests, affecting their fecundity and/or viability of their eggs. This research evaluated the effects of physiological insecticides methoxyfenozide (Intrepid® 240 SC) and tebufenozide (Mimic® 240 SC) on adults of *Anticarsia gemmatalis* and their progeny. Thirty pairs of moths (males and females) were confined in three cages (10 pairs /cage) containing pots with soybean plants. Insecticides at proportional dose of 24 grams of active ingredient /ha were applied on the leaves. The control was sprayed with water alone. Number and viability of the eggs, as well as developmental life cycle on F1 generation were considered in the evaluation. The results showed that: (1) adults of *A. gemmatalis* were not killed by the insecticides (2) Intrepid applied on adults cause a decrease in eggs production without affecting their viability, (3) Mimic did not affect the production and viability of eggs, (4) Intrepid affected the duration of larval and pupal phases, (5) Mimic affected only the duration of the pupal phase. Egg production and viability in the F2 generation were not affected by the insecticides.

Index terms: insecticide, velvetbean caterpillar, control.

[2630] THE SOYBEAN'S VARITIES INFLUENCE THE *ANTICARSIA GEMMATALIS* FITNESS ?

Monica Bazzan Dessuy[1] & M.C.G. Pansera-de-Araújo[1], [1]Dept. of Biology and Chemistry, Univ. Reg. do Noroeste do Estado do RS, R. S. Francisco, 501, Ijui, RS, Brazil. CEP. 98700-000. E-mail pansera@main.unijui.tche.br

The tritrophic interactions among plants-lepidoptera-natural enemies could be studied by the fitness analysis. This approach intends to suggest new strategies to integrated pests management. The analysis of the egg-adult viability, developmental rate and longevity of *Anticarsia gemmatalis* associated with different soybean (*Glycine max*) varieties used by the farmers of Ijui region/RS. The planting system used was direct and the varieties were COBB, RS7, FtAbyara, BR16, OCEPAR 13, CODETEC 201 and IAS5. *Anticarsia gemmatalis* were collected once a week and they were kept individually in laboratory conditions (25ºC±1ºC; 60%UR; photophase 14-10). The adults emerged were maintained in cages PVC, and were fed with honey and water. Oviposition occurred in an artificial substrate. The eggs were collected, counted, weighted and divided into groups according to the varieties. The ecloded larvae were created individually and feed with each soybean variety. The most infested varieties were RS7, OCEPAR 13 and IAS5. Some of the field's larvae were infected by *Nomureae riley, Baculovirus anticarsia e Microcharops bimaculata*. The most susceptible larvae were found eating the following soybean varieties: FtAbyara, OCEPAR 13 and BR16. The larvae viability was higher when feed with IAS5, COBB and RS7 soybean varieties. In the next generation the viability egg-adult shoed also an association with the soybean varieties. The developmental mean rate varied since 19,3 d until 22,2d, and showed an association with each soybean variety. For example, the Ocepar 13 was the most infested, but the developmental rate was higher, and suggest that it could be used by the natural natural enemies to found easily the larvae. These results could be used in the IPM programs.

Index terms: Community, viability, parasitoids, developmental rate

[2631] EFFECTS OF IVERMECTIN ON CARRION-BREEDING FLIES

M. A. Z. Borges[1] & A. L. De Melo[1], [1]dept. Of Parasitology, Federal University Of Minas Gerais, P.O. Box 486, Belo Horizonte, Mg Brazil, E-Mail Magno@Icb.Ufmg.Br.

The effects of ivermectin, a semi-synthetic drug widely used for treatment of livestock parasites, were observed on calliphorid and sarcophagid flies that breed in rat carrion in the field. Rats (*Rattus norvegicus*) received, subcutaneously Ivomec® at the recommended dosage of 0,2 mg kg^{-1} of ivermectin. Untreated rats were used as controls. 24 h after drug injection; the animals were killed by cervical dislocation and placed in the field. One sarcophagid and three calliphorids species emerged from carcasses: *Pattonella intermutans, Lucilia eximia, Hemilucilia segmentaria* and *H. semidiaphana*. Two of them (*P. intermutans* and *L. eximia)* were considered for statistical analysis. The output of fly puparia from carcasses and number of emerged adults were higher in control group ($p< 0,001$). No difference in the length of developmental period was observed, but the dry weight of adults differed between sexes and treatments, being higher in treated flies ($p< 0,001$). Ivermectin residues in tissues of treated carcasses were physiologically significant to kill a large proportion of fly larvae. When compared with control group, about 53% of larvae that feed in tissues with ivermectin exhibit gradual loss of mobility, following paralysis and death. The increase of dry weight in treated flies probably results of reduced intensity of larval competition by killing part of the population.
Index terms: Calliphoridae, Sarcophagidae, *Lucilia, Pattonella, Hemilucilia*

[2632] IMIDACLOPRID AND THIAMETHOXAM AS NEW TOOLS FOR GRAPE PEST MANAGEMENT

M. Botton[1] & I. Teixeira[1], [1]Embrapa Uva e Vinho, P.O. Box 130, Bento Gonçalves, RS, CEP 95.700-000 Brasil. E-mail marcos@cnpuv.embrapa.br.

Brazil is one of the most important grape-growing countries of South America with about 58.000 ha of vineyards. Production consisted mainly of American varieties destined basically for wine, juice and table grapes for internal consumption. An limiting pest of grape is the ground pearl called *Eurhizococcus brasiliensis* (Hemiptera: Margarodidae). It attacks root sucking sieve, causing plant decline and death. For its control, growers use cultural practices associated with vamidothion (Kilval 300) by spraying leaves. However, since 1999, this chemical is not available to the growers anymore. Alternatives of immediate control should be achieved to stop plant decline and death in infested areas and new plantings. Neonicotinoid insecticides like imidacloprid and thiamethoxam have shown efficient control of sucking and chewing insects in many cultures. This new group of insecticides has acropetal systemic action, long residual activity against sucking insects, selectivity to major groups of natural enemies and low toxicity to humans, and so presents a promising tool for pest management in many cultures. To control ground pearl in grape, the compounds were evaluated by soil application of Confidor 700 WGR (imidacloprid 70%) in a drench system and Actara 10 G (thiamethoxam 1%) directly distributed in the soil. Experiments were conduced in natural infested fields using 101-14 rootstock planted in june/98 evaluating the number of insects in the roots one year after planting. Pest control was higher than 95 % after insecticide application in dosages of 0,12 to 0,18 g of active ingredient per plant. Other experiments are being conducted to evaluate dosages, time, methods of application and grape production after compounds used in commercial grape orchards. Besides ground pearl, the experiments seek for grape phylloxera, aerial scales and leafhoopers control, considering the last group of insects as virus potential vectors. The scope of possibly controlled pests by neonicotinoids like imidacloprid and thiamethoxan in grape make this group an important tool for pest management in the culture.
Index terms: Neonicotinoid, grape phylloxera, *Eurhizococcus brasiliensis*

[2633] STRATATEGIC MANAGEMENT FOR THE CONTROL OF SOURSOP PESTS IN NORTHEAST BRAZIL

R. Braga Sobrinho[1], A.L.M. Mesquita[1] & C.T. Bandeira[1], [1]EMBRAPA-Brazilian Agriculture Research Corporation, Av. Dra. Sara Mesquita, 2270. 60.511-110 – Fortaleza-CE Brazil, E-mail: braga@cnpat.embrapa.br.

The soursop plant *Annona muricata* L. family Anonaceae is typical fruit tree grown mainly in the northeastern, northern and southwestern parts of Brazil. This commercial fruit tree in Northeast Brazil has been attacked by several pests especially the fruit borer, *Cerconota anonella* Sepp, the seed borer, *Bephrateloides maculicolis* Bondar, the stem borer, *Cratossomus spp.*, the leafminer, *Prinomerus anonicola* Bondar, the "irapuá bee" *Trigona spinips* Fabricius and some species of Membracidae, Coccidae, Diaspididae and Aphididae. Several pesticides have been used by growers for the control of these pests. Residual problems in fruits have been a general concern. The objective of this study was to evaluate different management strategies regarding the control of soursop fruit pests. Field studies from 1996 to 1999 in the Paraipaba county state of Ceará-Brazil evaluated the potential damage and management strategies of soursop pests. The most important pests were the fruit borer and the "irapuá bee". Field trials using different insecticide application methods and alternative control like covering the fruits with paper and plastic bags were undertaken. The average damage of fruits treated with insecticides varied from 12.3% to 16.2%, and the untreated plot 24.1%. The chemically treated plots were statistically significant ($p<0.05$) compared to untreated plot. On the other hand, plots under alternative control treatments were not statistically significant compared to treated plots. Fruits protected with paper bags presented high advantage regarding shedding problems. The importance of these results and the ecological advantages of the use of alternative control strategies will be discussed.
Index terms: *Cerconota anonella, Trigona spinips, Annona muricata*

[2634] CRUISER® 70 WS: A NEW-LOOK NEONICOTINOID SEED TREATMENT FOR CEREAL CROPS

J.A. Brits, C.F. van Eeden & F. Roos, Novartis South Africa (Pty) Ltd., Crop Protection Sector, P.O. Box 92, Isando, 1600, South Africa, E-mail johann.brits@cp.novartis.com.

The introduction of the neonicotinoid chemistry has set a new standard of insect control by means of seed treatment in cereal crops. CRUISER (thiamethoxam), a second generation neonicotinoid belonging to the subclass of Thianicotinyl compounds, was the second neonicotinoid to be introduced into the cereal seed treatment market in South Africa. Over the last number of years, CRUISER was evaluated extensively against the soil inhabiting pest complex of maize and the Russian wheat aphid (*Diuraphis noxia*) in wheat. At equal rates, CRUISER was proven to be as effective as the industry standard (imidacloprid 70 WS) in controlling black maize beetle (*Heteronychus arator*), *Astylus atromaculatus* larvae and the false wireworm (*Gonocephalum & Mesomorphus spp*) complex in maize. However, against ground weevils (*Protostrophus spp*) in maize and Russian wheat aphid in wheat, the control achieved with CRUISER was significantly superior to the control achieved with the industry standard. Crops on which development is in process include sorghum, sunflower and cotton.
Index terms: *Thiamethoxam*, CRUISER, seed treatment, soil insects & aphids

[2635] DEVELOPMENT OF A METHOD OF RISK ASSESSMENT TO FACILITATE INTEGRATED MANAGEMENT OF SPOTTED WILT DISEASE OF PEANUT IN GEORGIA

S.L. Brown[1], J.W. Todd[1], A.K. Culbreath[2], D.W. Gorbet[3], J.A. Baldwin[4], J.P. Beasley[4], S. Fletcher[5] & A. Luke[5], [1]Depts. of Entomol., [2]Plant Pathology, [4]Crop and Soil Sciences & [5]Agricultural Economics, Univ. of Georgia, P.O. Box 1209, Tifton, GA 31793, USA, E-mail bugbrown@arches.uga.edu; [3]Dept. of Crop and Soil Sciences, Univ. of Florida, Marianna, FL 32446, USA.

Spotted wilt disease of peanut, caused by the thrips-vectored tomato spotted wilt virus (TSWV), has seriously threatened the peanut industry in Georgia during the past decade. Research has identified several different factors that combine to influence spotted wilt severity. Some factors are clearly more important than others, but no single factor can be utilized for effective control. However, research has shown that when several cultural practices are integrated, losses can be significantly reduced. Furthermore, a pre-season evaluation of pertinent production practices can be used to assess an individual field=s relative risk for losses and thereby indicate the need for a modification of those practices. While incidence cannot be predicted with total accuracy, by indentifying high-risk situations, growers can avoid those combinations of cultural practices that are conducive to severe yield losses. The University of Georgia Spotted Wilt Risk Index for Peanuts was developed as a tool for evaluation of the relative level of risk associated with individual peanut production scenarios. The index combines what is known about individual factors that influence disease severity into a comprehensive but simple estimate or risk for a given production plan. The index assigns numeric values to 23 options within the following seven production factors known to affect spotted wilt severity: peanut cultivar, planting date, plant population, at-plant insecticide, row pattern, tillage method and previous disease losses. Value of an individual factor is weighted to reflect its relative influence on overall spotted wilt incidence, and the total of all seven values indicates the level of risk associated with that combination of production practices. The original version of the index was developed in 1996 and every year since, small plot experiments and on-farm observations have been used to validate its performance. Slight modifications have been made each year. Grower acceptance of the index has resulted in major shifts in peanut production practices in Georgia, and statewide losses have decline in the past two years. Economic analysis has indicated increased net returns for growers using the index.
Index terms: thrips, TSWV, model

[2636] MANAGEMENT OF CODLING MOTH WITH MASS TRAPPING, ATTRACT AND KILL, AND MATING DISRUPTION

J. F. Brunner [1] and L. GUT [2], [1] Tree Fruit Research and Extension Center, 1100 N. Western Ave., Wenatchee, WA, 98801, USA, E-mail jfb@wsu.edu. [2] Department of Entomology, Michigan State University, East Lansing, MI ZIP, USA, gut@pilot.msu.edu

The codling moth, *Cydia pomonella*, is the "key pest" of pome fruits in most areas of the world where they are produced. Most broad-spectrum insecticides are used in orchards to control the codling moth in ways that can adversely impact management of other pests through disruption of natural controls. Since the discovery of sex pheromones it has been proposed that these could be used as tools not only to monitor but also to suppress pests. Three tactics have been proposed to mitigate populations of codling moth in pome fruit orchards; mass trapping, attract and kill and mating disruption. Mass trapping relies upon male removal and has not provided adequate suppression of codling moth and expenses of this method is too high to have practical application in commercial agriculture. The coupling of codling moth sex pheromone with a rapid acting insecticide, referred to as attract and kill tactic, has shown great promise as a control. This tactic has been tested most in Europe but is now receiving attention in other pome fruit producing areas. Mating disruption has been the most successful use of sex pheromone for managing codling moth. The development of reliable pheromone dispenser systems has helped promote the adoption of this tactic in commercial agriculture. Hand applied devices have been the primary method used to dispense sex pheromone in orchards, however, several new pheromone release methods are under development including sprayable formulations and "puffer" devices. The latter approach relies upon delivering pheromone using a low-density/high-release strategy. Areawide programs in the western US for codling moth control using mating disruption have been highly successful. Changes in the pesticide regulatory environment in the United States and Europe will continue to increase the demand for alternative tactics to control codling moth. Mating disruption and "attract and kill" technologies will play a valuable role along with other management tactics to control codling moth in the 21st century.
Index terms: codling moth, *Cydia pomonella*, mating disruption, mass trapping, attract and kill.

[2637] EFFECTS OF SEED TREATMENT WITH INSECTICIDE ON THE GERMINATION, NUTRIENTS, NODULATION, YIELD AND PEST CONTROL IN BEAN (*PHASEOLUS VULGARIS*) CULTURE

M.H. Calafiori & A.A. Barbieri., Agronomic Engineering Course. CREUPI. Postal Box 05. 13990-000 - Espírito Santo do Pinhal – SP – Brazil. E-mail: cpagrpin@rantac.com.br

Normally, the chemical products are analysed about efficiency for the control of pests and diseases. However, there are factors that can influence their efficiency and they aren't studied. The experiment was realized to verify the influence of fertilizer on the insecticide and the effect of both on the plant. The tests was carried out in experimental campus of Agronomic Engineering Course – CREUPI, Espírito Santo do Pinhal – SP, in October, 1998, March, 1999 and October, 1999, with bean, variety Carioca. The experimental design was complete randomized block with 5 replications. The treatments were: A- control; B- NPK; C- NPK + thiamethoxam 700 WS (35 g i.a./100 kg of seeds); D- NPK + thiamethoxam 700 WS (70 g i.a./100 kg of seeds); E- NPK + thiamethoxam 700 WS (140 g i.a./100 kg of seeds); F- NPK + carbofuran 350 TS (700 g i.a./100 kg of seeds); G- thiamethoxam 700 WS (35 g i.a./100 kg of seeds); H- thiamethoxam 700 WS (70 g i.a./100 kg of seeds); I- thiamethoxam 700 WS (140 g i.a./100 kg of seeds); J- carbofuran 350 TS. The fertilization was based on soil analysis. The evaluations were made for germination, grades of nutrients in the leaves; nodulation, yield and population of *Thrips tabaci*, *Diabrotica speciosa*, *Bemisia tabaci*, *Empoasca kraemeri*. The results allowed to conclude: a) the greatest germination occurred in thiamethoxan (35 g a.i.) + NPK; b) the best control to *D. speciosa* was thiamethoxan (70 g a.i.) without NPK; c) all treatments, excepting NPK, controlled *T. tabaci* during the second and the third test; d) *B. tabaci* was controlled in dry and rainy season by the insecticides alone or together with NPK; e) *E. kraemeri* was controlled only in the third test by all treatments, excepting NPK; f) the greater number of viable nodules occurred in thiamethoxan (140 g a.i.) + NPK during the first test and in thiamethoxan (35 g a.i.) in dry season, and in the third test all treatments presented smaller number than treatment without insecticide and NPK; g) the results of nutrients grades were different in dry and rainy season; h) the yield of dry season was greater in the treatment with NPK and thiamethoxan (70 g a.i.) + NPK.
Index terms – bean, seed treatment, tonic effect, pest control.

[2638] ASSESSMENT OF DAMAGE DUE TO *PHYLLOCNISTIS CITRELLA* STAINTON IN CITRUS NURSERIES IN SICILY; GROWTH DELAY, ESTHETICAL DAMAGE AND ECONOMIC INJURY LEVELS

V. Caleca, Istituto di Entomologia Agraria, Univ. of Palermo, viale delle Scienze, 90128 Palermo, Italy, E-mail caleca@unipa.it.

In the Mediterranean Basin no economic loss in citrus fruit production due to the citrus leafminer (CLM), *P. citrella,* has been recorded until now; nevertheless this moth is commonly considered noxious to young and newly grafted plants. In this study carried out in 1998 and 1999, from June to November, trunk diameter, photosynthesising and damaged leaf area, and the economic value of young citrus plants managed following the common practice (weekly sprays alternating imidacloprid and methomyl) have been compared with untreated plants values, both in shaded tunnel and in uncovered plots. Tested plants were sour orange seedlings of three sizes (A, sown in the previous winter; B, 1-2 years old; C, close to grafting), and lemon trees newly grafted on 3-4 years old sour orange. The flush in both years was not significantly different between the blocks. The mean parasitism rate was 11.8% in 1998 and 18.3% in 1999. The growth of untreated plants was not affected by CLM infestation levels (means: 1.7 larvae + pupae/leaf in 1998 and 1.3 in 1999), since their photosynthesising area did not result statistically different from that one of treated plants; moreover in both years one of the four size-groups of untreated plants showed a significantly better trunk diameter, suggesting a phytotoxic effect of insecticide treatments. The commercial value of size A seedlings was not affected by esthetical damages (necrosis up to 11% of leaf area; leaf area with clear damages up to 14% of total), because growth parameters, before the transplantation, are more important than esthetical ones. On the contrary untreated newly grafted lemon trees are not saleable, from July to the next spring flush which covers old damaged leaves, because of esthetical damages (necrotised leaf area 3 ± 1.4% in 1998, and 7.7 ± 2.3% in 1999; leaf area with clear damages 53.8 ± 13.7% in 1998, and 29.9 ± 5.7% in 1999); their depreciation is about 30% of the price of treated plants. The commercial value of untreated size B-C plants at the end of treatments season vs. CLM was 37-50% lower of treated plants, due to the necrotised area rate (from 3.1 ± 1 to 5.3 ± 0.8%) and the amount of leaf area with clear damages (from 13.9 ± 2.6 to 53.9 ± 11.4%). The economic injury levels for sour orange rootstocks, cultivated only to be grafted, have not been reached during this study, but they surely are >1.7 CLM larvae + pupae/leaf as mean infestation level, and >8% as necrotised leaf area. On the contrary the economic injury levels, actually esthetical damage thresholds, for young citrus plants, including ornamental ones, cultivated to be sold from July to the next spring flush, are <0.5 larvae + pupae/leaf as mean infestation level, <3% as necrotised leaf area, and <13% as leaf area with clear damages.
Index terms: citrus leafminer, damaged leaf area, trunk diameter.

[2639] INTEGRATED PEST MANAGEMENT OF A LEAF BEETLE IN EUCALYPT PLANTATIONS IN TASMANIA, AUSTRALIA

S. G. Candy[1], R. Bashford[1], J. A. Elek[1] & N. Beveridge[1], [1]Forestry Tasmania, GPO Box 207 and Cooperative Research Centre for Sustainable Production Forestry, GPO Box 251-12, Hobart, Tasmania, Australia 7001, Email: Jane.Elek@forestrytas.com.au.

The Tasmanian *Eucalyptus* leaf beetle, *Chrysophtharta bimaculata* (Olivier) (Coleoptera: Chrysomelidae) is the most economically damaging pest of the rapidly expanding *Eucalyptus* plantation estate in Tasmania, Australia. Both the larvae and adults feed on the new season's adult-phase foliage. The major natural controls are by cantharid and coccinellid predation of eggs. Protection of trees from defoliation by leaf beetles can potentially triple their wood volume witin 8 years. Forestry Tasmania has developed an integrated pest management (IPM) system for managing the leaf beetles. The larval populations are monitored at least 3 times each summer in all *E. nitens* plantations from 3 to 5 years old. The population size is assessed using a combination of methods: either numbers of leaves occupied by egg batches per shoot on 20 trees or numbers of occupied trees out of 40 per forest compartment. To determine whether the estimate of population density represents an economically damaging population if left uncontrolled, it can either be compared to a pre-determined economic threshold, based on feeding and impact models, or used in a cost-benefit analysis with inputs specific to the forest compartment. The cost-benefit analysis can be carried out using the 'Farm Forestry Toolbox', a freely available plantation management software program. If control gives a greater benefit to cost ratio than the 'no control' option, the egg and larval populations are re-monitored a week later to check the level of egg predation that has occurred. If this later population density estimate indicates that control is still economically justified then insecticidal spraying is recommended. A pyrethroid is currently the standard for routine control but some alternative biological insecticides are being tested to minimise the impact of spraying on the natural predators. Methods of reducing the costs of monitoring are also being investigated.

Index terms: IPM, *Eucalyptus nitens* , Chrysomelidae, forest insect pest, *Chrysophtharta bimaculata,* monitoring

[2640] SELECTIVITY OF INSECTICIDES USED IN CHRYSANTEMUS PEST CONTROL TO *ORIUS INSIDIOSUS*

G. A. Carvalho[1], F. A. Drummond[1], J. L. R. Ulhôa[1].& L. C. D. Rocha[1], [1]Deptº. de Entomologia, Univ. Federal de Lavras, C.P. 37, Lavras, MG 37200-000, Brasil, E-mail: gacarval@ufla.br.

Orius insidiosus is a predator frequently found in crysantemus under protected crop systems an is an important predator of egg and larva of mites, thrips, aphids and small caterpillars, therefore stimulating its permanence in such environments is of great importance. Studies were carried out to evaluate the influence of some insecticides used in the control of chrysantemus pests to *O. insidiosus*. The essays were performed in the Entomology Department of the Federal University of Lavras (UFLA) with the following products, in grams of active ingredient/l (g i.a./l) of water: imidacloprid (0.3150), fenpropathrin (0.500), abamectin (0.0900) and cyromazine (0.1125). The control treatment was sprayed only with water. Petri dishes containing six 4th instar nymphs of *O. insidiosus* were sprayed with an average volume of 1.8 mg/cm^2, following the IOBC Working Group Pesticides and Benefitial Organisms recomendations. The statistical scheme was of a completely randomized treatments with 10 replicates (1Petri dish with 6 nymphs/replication). Mortality evaluation was conducted after 1, 3, 6, 12, 24, 36, 48, 60, 72, 84, 96, 108, and 120 hrs after sprays. It was found that 100% and 93% of nymphs treated respectively with fenpropathrin and imidacloprid died 3 hours after treatment. On the other hand 10% of nymphs treated with abamectin, 90% with cyromazine and 91.67% with water reached adult stage. The number of adults obtained, the amount of eggs/female during 5 days of oviposition and fertility was observed. According to the categories of classification proposed by the Working Group, fenpropathrin and imidacloprid were harmful (>99% of reduction in the adult formation, class 4); abamectin was moderately harmful (80-99%, class 3) and cyromazine harmless (<30%, class 1). As to the production of eggs and fertility, imidacloprid and fenpropathrin were harmful, and cyromazine and abamectin harmless.

Index terms: Biological control, protected crop, *Chrysanthemum cinerariaefolium*, pesticides

[2641] CONTROL OF *ANTICARSIA GEMMATALIS* IN SOYBEAN BY RIMON 10 EC (NOVALURON) IN PARANÁ, BRAZIL.1999

M. Cassinelli [1] ; F.A. de Jesus [2] ; D. A. Fornarolli [3] & V. Tavela [4], [1,2,3,4] Research and Development Dept. - Milenia Agro Ciências S/A. - Londrina - PR - Brazil - 86.031-610 .

With the objective of to avaluate the agronomic eficacy of differents insecticides in the control of *Anticarsia gemmatalis*, was instaled one experiment in Sertanópolis – Paraná – Brazil in Soybean. It was used nine treatments, with four repetitions each one, and the treatments established in randomized blocks; Rimon 10 EC (Novaluron) in the dosis of 7,5 and 10 g. i. a./ha; Rimon 10 EC (Novaluron) + Protege (*Baculovirus anticarsia*) in the dosis of 7,5 g.i.a./ha + 20g*/ha and 10 g.i.a./ha + 20g/ha. It was used also Match 5 EC (Lufenuron) in the dosis of 7,5 g. i. a. and 10 g. i. a. / ha; Match 5 EC (Lufenuron) + Protege in the dosis of 7,5 g. i. a. and 20 g. i. a. / ha; Match 5 EC (Lufenuron) + Protege in the dosis of 10 g. i. a. and 20 g. i. a. / ha; The last treatment was the check (without insecticide). The avaluations was done one before spraying (pre avaluation) and at the 05th; 09th and 16th days after spray, counting the number of short worms (< 1,5 cm) and big ones (> 1,5 cm), in the last avaluation was noted the leave damage in percentual. There weren't significant difference between the treatments for short worms until the 16th day after spray and the population decreased very fast. About the big worms, the population the check population decreased from 37 worms (05 DAS) to 02 worms (09 DAS) and to 0 (zero)(16 DAS). There were no statistic difference between the treatments, except for Lufenuron + Protege that the eficacy percentage was less than 80 %. On the field, after 16th DAS, there weren't worms, but the leafes showed a damage about 40% or more than this before the spray (old leafes) and in this avaluation there were four new complete leafes without any damage by *Anticarsia gemmatalis* getting a good control in that crop.

* Protege (*Baculovirus anticarsia*) : 2 x 10^9 Baculovirus polymers / g. Formulation PM.

Index Terms : Novaluron, Anticarsia gemmatalis, IGR, Baculovirus, Leafes damage

[2642] EFFECT OF THE CONTROL OF ARMY WORMS *SPODOPTERA FRUGIPERDA* IN CORN BY RIMON 10 EC (NOVALURON). 1999

M. Cassinelli[1] ; F. A. de Jesus [2] ; V. Tavela [3] & D. A. Fornarolli [4], [1,2,3,4] Research & Development Dept. Milenia Agro Ciências S/A – Londrina – Pr – Brazil.

It was avaluated the effect of the insecticide Rimon 10 EC (Novaluron) in Corn in Arapongas – PR for the control of Army worm *Spodoptera frugiperda*. There were used nine treatments with four repetitions by random. The treatments was Rimon 10 EC (Novaluron) in the dosis of 10 g.i.a / ha ; 15 g.i.a / ha and 20 g.i.a / ha ; Match 50 EC (Lufenuron) 15 g.i.a / ha with the volume of water of 150 liters / ha; and Rimon 10 EC (Novaluron) in the dosis of 10 g.i.a / ha ; 15 g.i.a / ha and 20 g.i.a / ha ; Match 50 EC (Lufenuron) 15 g.i.a / ha with the volume of water of 250 liters of water / ha; It was also sprayed one treatment without insecticide (the check). The number of plants with damage on its leafes was the mean aspect observed, and it was done in ten plants per repetition, in one meter in line, obtaining the total of 40 plants / treatment . This work showed that there were no difference between the volumes of 150 and 250 liters / ha, and a big difference in damage because in check it has a damage of 55% against 5% of damage in the Rimon 10 EC treatment (15 g.i.a / ha) in the 21th DAS (Days After Spraying). For Lufenuron the damage was 17 % in the dosis of 15 g.i.a / ha. There were no signifficance difference between the treatments but every treatments with difference against the check by Tukey 5% level.

[2643] EFFICACY OF CONTROL OF *ANTICARSIA GEMMATALIS* IN SOYBEAN BY RIMON 10 EC (NOVALURON) AND OTHER INSECTICIDES. 1999

M. Cassinelli[1] ; F. A. de Jesus [2] ; V. Tavela [3] & D. A. Fornarolli [4], [1,2,3,4] Research & Development Dept. Milenia Agro Ciências S/A – Londrina – Pr – Brazil.

With the objective to verify the eficacy of control of *Anticarsia gemmatalis* in soybean by Rimon 10 EC (Novaluron) and other insecticides was instaled an experiment in Arapongas – Pr – Brazil. It was used fourteen treatments : Rimon 10 EC (Novaluron) in the dosis of 7,5 g.i.a. / ha and 10 g.i.a. / ha; Match 5 EC (Lufenuron) in the dosis of 7,5 g.i.a. / ha and 10 g.i.a. / ha; Alsystin 250 PM (Triflumuron) in the dosis of 15 g.i.a. / ha and 30 g.i.a. / ha and Protege * (*Baculovirus anticarsia*) in the dosis of 20 g.p.c. / ha. It was used also the treatments with Rimon 10 EC ; Match 5 EC and Alsystin 250 PM, each one in the same dosis mixed with Protege * 20 g.p.c./ha. It was sprayed four repetitions in randomized blocks, and four avaluations, one pre avaluation before spray and at the 3 rd Day After Spray (DAS), 07 th and 13 th. In these avaluations was counted the number of short worms (< 1,5 cm) and big ones (> 1,5 cm), and, at the last avaluation was noted leaf damage in percentage. For short worms, at the 07 th DAS the percentage of control was over 90% for all the treatments, except for Protege. There was no significance difference between the treatments with or without Protege. At the 13 th the worms population gets down showing a control of 100%. About the big worms the control was about 100% at the 07 DAS. The lower leaf damage percentage was verified by Rimon 10 EC and Match 5 EC, without significant difference between both of then, and for this two treatments mixed with Protege, the results was very similar.
* Protege (*Baculovirus anticarsia*) : 2 x 10^9 Baculovirus polymers / g. Formulation PM.
Index terms : *Anticarsia gemmatalis*, Novaluron, soybean leaf damage, *Baculovirus anticarsia*

[2644] EVALUATION OF AGRONOMIC EFFICIENCY AND PRACTIBILITY OF INSECTICIDES ON COTTON WORM (*ALABAMA ARGILLACEA*) CONTROL ON COTTON CROP. 1999

M. Cassinelli [1], M. A. Valério [2] & F.A. de Jesus [3], [1,3] Research and Development Dept. of Milenia Agro Ciências - Londrina - PR - Brazil - 86.031-610 [2] Engineer and Rural Economy Dept. - Agronomy Faculty Foundation Luiz Meneghel - Bandeirantes - PR - Brazil - 86.360-000.

With the purpose to evaluate different insecticides efficiency on cotton worm (*Alabama argillacea*) control , it was setup a field trial in Bandeirantes city - PR, at "Fundação Faculdade de Agronomia Luiz Meneghel " experimental farm in Feb. 15th, 1999. It were used following insecticides and doses/ha: Rimon 100 CE (novaluron) 0,075 l c. p. and 0,100 l c. p.; Dimilin 250 PM (diflubenzuron) 060 kg c. p. and macht 50 CE (lufenuron) 0,150 l c. p. and 0,200 l c. p. It were evaluated: Caterpillar number (big ones > 1,5 cm; and little ones < 1,5cm). It was done a pre-counting and at 3, 7 and 11 days after applications (d.a.a.). Better results were given by after 05 d.a.a for little ones. Insecticide Rimon 100 CE, at dose 0,075 l/ha and 0,100 l/ha showed satisfying results as well as Dimilin 250 PM at dose 0,060 kg/ha. Match 50 CE at doses 0,150 and 0,200 l/ha showed good efficiency too. It were presented results of yield and leaves damage among different treatments and it had no significant statistics difference among insecticides and doses, however, all ones had significant difference with control.
Index terms : IGR, Cotton pests, IPM, *Alabama argillacea*

[2645] CONTROL OF *PHYLLOCNISTIS CITRELLA* (LEPIDOPTERA, GRACILLARIIDAE) BY THIAMETHOXAM IN CITRUS IN ARARUAMA CITY–RJ

P.C.R. Cassino[1,2]; P.R.R. Silva[1,3] ; O.R.F. Azevedo[1]; R. Silva-Filho[1] & M.A. Diodato[4], [1]Dept. de Entomologia e Fitopatologia, IB, Centro Integrado de Manejo de Pragas "Cincinnato Rory Gonçalves", UFRRJ, BR 465 Km 07, CEP 23.890-000, Seropédica, RJ, Brazil, E-mail: cimp@ufrrj.br, [2]E-mail:pr.cassino@uol.com.br; [3]E-mail: pramalho@fst.com.br; [4]Entomologia Florestal Universidade do Contestado, Canoinhas, SC, BR, E-mail:diodato@yahoo.com.br.

The citrus leaf miner, *Phyllocnistis citrella* was introduced in Brazil on March, 1996, and since then it has received a special attention because it attacks citrus, maily mainly orange, the most important exported fruit in Brazil. This study was designed to assess the efficacy of thiamethoxam (Actara 10 GR) in the control of *P. citrella*. The experiment was perfomed in a "Tahiti" true lime (Citrus orchard, in Araruama city located in the citrus-production area in the state of Rio de Janeiro,Brazil. A randomized block design was used with five treatments: Thiamethoxam (Actara 10 GR) at 0 (control), 50, 75 and 100g/plant, and aldicarb (Temik) at 130g/plant. Counts of live *P. citrella* larvae and pupae on the randomly select leaves were made prior to spraying and 15, 30, 45 and 60 days after application. Data were subjected to analysis of variance, and treatment means were separated using Duncan test with $P \leq 0.05$. The mean number of *P.citrella* larvae/pupae on the treated plants differed significantly from the control. No significant differences in the mean number of *P.citrella* were observed for Thiamethoxam and aldicarb; however, the former at 75 and 100g/plant tended to be more efficient in the control of this pest.
Index terms: *Phyllocnistis citrella; Citrus* sp ; Thiamethoxam; Actara 10 GR; Aldicarb

[2646] USE OF THIAMETHOXAM IN THE CONTROL DE *SELENASPIDUS ARTICULATUS* (HOMOPTERA:DIASPIDIDAE) AND EFFECT ON THE POPULATION OF THEIR NATIVE PREDATORS IN CITRUS IN SÃO VICENTE DE PAULO (ARARUAMA, RJ), BRAZIL

P.C.R. Cassino[1,2]; O.R.F. Azevedo[1]; R. Silva Filho[1]; P.R. R. Silva[1]; & M.A. Diodato[3], [1]Dept.de Entomologia e Fitopatologia, IB, UFRural – Centro de Manejo de Pragas "Cincinnato Rory Gonçalves", BR 465 Km 07, CEP 23.890-000, Seropédica – RJ, Brazil, E-mail: cimp@ufrrj.br. [2]E-mail:pr.cassino@uol.com.br, [3]Entomologia Florestal Universidade do Contestado, Canoinhas, SC, Brasil, E-mail diodato@yahoo.com.br.

From September to November, 1999, an experiment was performed (with aim) aiming to evaluate the action and selectivity of the insecticide ACTARA 10 GR on *S. articulatus* and (their) its natural enemies, in São Vicente de Paulo county (Araruama, RJ), located in the citrus producing-area in Brazil. The experiment area consisted of a plot of true lime trees, variety "Tahiti"; being evaluated 25 plants. The experimental design used was a randomized block with 5 treatments replicated 5 times. The treatments were: ACTARA 10 GR at 50, 75, 100 and 130g/plant, TEMIK at 130g/plant plus control. Evaluations were done 15, 30, 45, and 60 days after application. The data were subjeted to analysis of variance, and means were separated using Duncan's test ($P \leq 0.05$). ACTARA 10 GR at 75, 50 and 100g/plant was significantly different of the control. ACTARA GR 75g/plant was more efficient than standard (TEMIK) at 30 days after application, reducing in 40% the population density of *S. articulatus*. Concerning the natural enemies, the selectivity of the ACTARA 10 GR at 75g/plant was 20% for *Clyconeda sanguinea*, 30% for *Pentia egena*, and 100% for *Chrysoperla* sp. We also observed natural death of natural enemies.
Index terms; Thiametoxam – ACTARA 10 GR; Temik; *Selenaspidus articulatus*; *Cycloneda sanguinea*; *Pentilia egena*; *Chrysoperla* sp

[2647] USE OF INSECTICIDES FOR CONTROLLING THE BRAZILIAN TOMATO PINWORM AND THE DIAMONDBACK MOTH IN THE FEDERAL DISTRICT, BRAZIL: A CASE STUDY

M. Castelo Branco[1], Félix H. França[1], Maria A. Medeiros[1] & José G.T. Leal[2], [1]Embrapa Hortaliças, Caixa Postal 218, 70.359-970. Brasília, D.F. Brazil. e-mail: marina@cnph.embrapa.br ; [1] EMATER- DF. Núcleo Rural da Taquara.

In August 1999, at the "Núcleo Rural da Taquara", Federal District, tomato and brassica crops were severely damaged by the Brazilian Tomato Pinworm (*Tuta absoluta*) and the Diamondback Moth (*Plutella xylostella*). In that time growers related that they had been spraying insecticides one to seven times per week without any result in controlling the pests. It was observed that they had been using insecticides with the same active ingredient or insecticides of the same chemical group in scheme of "insecticide rotation". In the fields it was observed that there were crops with different ages and crop residues which allowed the pests to multiplicate continuously. Then it was decided that the first step to solve the problem would be to evaluate the efficacy of the recommended field rate of some insecticides in laboratory bioassays. So, two Brazilian Tomato Pinworm populations and one Diamondback Moth population were collected. The results showed that the Brazilian Tomato Pinworm populations and the Diamondback Moth population were highly susceptible to cartap and *Bacillus thuringiensis* respectively. Those insecticides annihilated the larvae of the two pests. On the other hand pyrethroid deltamethrin caused less than 5% of larval mortality of both pests. Acephate caused the mortality of only 2% of Brazilian Tomato Pinworm larvae, whereas 79% of Diamondback Moth larvae were destroyed by the insecticide. According to laboratory results it was recommended that the use of pyrethroid and organophosphorous compounds must be suspended immediately. Abamectin, cartap and insect growth regulators insecticides must be used to control the Brazilian Tomato Pinworm and *B. thuringiensis* and insect growth regulators must be employed to Diamondback Moth control. Other measures were recommended: a) insecticide rotation with insecticides of different chemical groups being sprayed during one insect generation; b) sprinkler irrigation to reduce egg and larval density; c) elimination of crop residues; d) avoidance of crops with different ages in the same field. One grower who adopt these recommendations controlled the Brazilian Tomato Pinworm and also managed to save his cauliflower field which he thought he would lost.

Index terms: *Plutella xylostella, Tuta absoluta*, insecticide resistance

[2648] THE FUTURE OF CODLING MOTH CONTROL WITH CONVENTIONAL INSECTICIDES, INSECT GROWTH REGULATORS AND MICROBIALS

P.J. Charmillot[1] & H. Riedl[2], [1]Swiss Federal Research Station for Plant Protection, Changins CH-1260 Nyon, Switzerland. E-mail: pierre-joseph.charmillot@rac.admin.ch [2]Oregon State Univ., 3005 Experiment Station Drive, Hood River, Oregon 97031, USA.

Organophosphate (OP) and other broad-spectrum insecticides have been the principal tools for codling moth, *Cydia pomonella*, control for more than four decades. Although OPs have lost some of their usefulness due to resistance and poor IPM fit, growers in many fruit-growing areas still rely on them for codling moth control for lack of suitable alternatives. Among the first alternatives to OP insecticides were the insect growth regulators (IGRs). Over the last 20 years, IGRs have gradually replaced the neurotoxic broad-spectrum insecticides for control of codling moth, particularly in Western Europe. One group of IGRs is the chitin synthesis inhibitors, which block the formation of chitin during moulting. Diflubenzuron was one of the first insecticides in this group to be widely used for codling moth control. Some chitin synthesis inhibitors are more effective against eggs; others are more effective on neonate larvae. A second group of IGRs is the juvenile hormone mimics such as fenoxycarb, which has only ovicidal activity against codling moth. A third group of IGRs is the ecdysone agonists which enhance the activity of the moulting hormone. Ecdysone agonists such as tebufenozide and methoxyfenozide induce a precocious lethal moult in neonate codling moth larvae and, in addition, have also ovicidal activity. Codling moth control with IGRs is highly dependent on the timing of treatments. IGRs are not systemic, are rain fast and are quite stable in sunlight. Some IGRs have a sterilizing effect on codling moth adults. Attracting male moths with pheromone and sterilizing them with IGRs has shown promise as a control method. With the increased use of IGRs in tree fruits, codling moth has recently developed resistance to IGRs in several European countries. Few microbials have so far found widespread use in codling moth control programs. However, the potential of granulosis virus (GV) for codling moth control is promising. One drawback is its short persistence due to rapid inactivation by UV light. GV is not suitable for curative control under high population density. GV is already widely used for codling moth control in organic orchards. In the future, its use for long-term population control may increase in combination with mating disruption or the 'attract and kill' technique. *Bacillus thuringiensis* (BT) based products have not been effective for codling moth control since neonate larvae ingest too little while entering fruit.

Index terms: *Cydia pomonella*, chemical control, IGR, microbials, granulosis virus, BT

[2649] STUDIES ON THE AGE STRUCTURE OF LIFE CYCLE AND CONTROL METHODS TO YELLOW STEMBORER (*SCIRPOPHAGA INCERTULAS* STAL) IN MEKONG DELTA, VIETAM

L.M.Chau, Cuulong Delta Rice Research Institute, Omon, Cantho, Vietnam.

The age structure of yellow stem borer and their relationships with weather and cropping pattern in Mekong delta were studied by period investigations and field trials to determine the options to solve the pest problem. In Minh Hai province, stem borer has developed 2-3 generations per year that figured by two high peaks in September and November. The fifth instars larva was dominant at booting and heading stages. That were main causes of the outbreak of YSB in . Analysis of climate data showed that the outbreak of stem borer in Minh Hai related to humidity and annual rainfall suitable for stem borer development. Lasting rains caused flooding in August and September made humidity increased suitable to YSB epidemic. Recorded data showed that the first larval generation of stem borer was not synchronized to sowing time and the aestivation of YSB in off-season was no clear. Therefore, the initial source of YSB inoculation may be coming from hibernated pupa in rice straw brought from field to home, ratoon rices, wild rices and the migration of YSB from modern varieties to local varieties. The natural enemy complex in rice field of Minh hai was few and non-effective , then it could not suppress the outbreak of YSB. In above conditions, YSB was most serious target insect in local rice area in Minh hai caused average yield loss of 17 - 28% different from place to place. Broadcasting of Regent 0.3G (15 kg /ha) at the high peak of larva was most effective to control YSB with the efficacy of 80-90%.

Index terms: instars, local rice, wild rices

[2650] INSECTICIDE SPRAYING TECHNIQUES FOR CONTROLLING THE DIAMOND BACK MOTH, *PLUTELLA XYLOSTELLA* ON CHINESE KALE

M. Chawanapong[1], J. Ek-Amnuay[1], D. Wechakit[1], R. Surakarn[1], A. Kongkanjana[1] & S. Impithuksa[2], [1] Div. of Entomology & Zoology, Dept. of Agriculture, Chatuchak, Bangkok 10900, Thailand, E-mail leemac @ doa.go.th; [2] Div. of Agricultural Toxic Substance, Dept. of Agriculture, Chatuchak, Bangkok 10900, Thailand.

Insect pest problem is the most important factor limiting chinese kale production in Thailand. Of insect pests, the diamond back moth (DBM), *Plutella xylostella* (Linnaeus) (Lepidoptera : Yponomeutidae), is by far the most destructive and widespread in the region. The larva of this insect feeds on practically all above ground parts of the plant and adversely affects yield and quality of the produce. Effective control of this pest is a must to get adequate yield. And the pesticide application technique is one of the crucial factors of this purpose. Study on the efficiency of two different spraying techniques, high volume (HV) and low volume (LV), for controlling the DBM on chinese kale grown in irrigated channel raised - bed, was conducted in the farmer plot at Nonthaburi province, the central part of Thailand during January - February 1999. The experiment was laid out in a randomized complete block design with 6 replications and 4 treatments. The plot size was 4.0 x 8.5 m. The DBM action threshold, 0.15 larvae per plant, and two recommended insecticides, chlorfenapyr (Rampage 10% SC) and abamectin (Vertimec 1.8% EC) with exactly the same amount of active ingredients per treatment, were used. First spray was done at 27 days after sowing when the DBM population was 35.4 larvae per 10 plants. During the application, a 5 x 10 m cotton screen was held down to minimize the effect of insecticide drift. The result indicated that the treatment appplied with LV, the motorised knapsack mistblower sprayer, at the application rate of 118.75 litres per ha gave the best control of DBM. This treatment also gave the highest marketable yield and income which were not statistically significant difference from the treatment sprayed with HV, the motorised high pressure pump sprayer, at the application rate of 681.25 litres per ha. Presently, this HV is a conventional application in the country.

Index terms : *Plutella xylostella*, DBM, LV, HV, chinese kale.

[2651] SUSCEPTIBLITY OF *LIRIOMYZA SATIVAE* (DIPTERA: AGROMYZIDAE) TO GREEN LEGUMOUS LEAF

W. L. Chen[1] & J. W. Du[2], [1]Department of Landscape and Environmental Science, Shanghai Jiao Tong University, Qixin Road 2678, Shanghai 201101, China, E-mail wenlchen@shac.edu.cn; [2] Laboratory of Insect Chemical Ecology, Shanghai Institute of Entomology, Chinese Academy of Science, Chongqin Road 225, Shanghai 200025. China, E-mail dujw@public1.sta.net.cn

The vegetable leafminer, Liriomyza sativae Blanchard , found in China since 1993, became a destructive insect to various vegetables, ornamental plants and forage crops. Major suitable host plants were belonged to Cucubitaccae, Solanceae and Leguminoseae. In this paper17 leguminous plants were tested to select trap crop in laboratory. The leafminer penetrated more holes and laid more eggs on American cowpea leaf than other crops, however, its response to American cowpea leaf was affected by sex, mating intervals and adult ages. In Petri dishes(18cm×2cm),female and male adult preferred green leaf to same moisten filter paper in size(2 cm diameters) at different mating intervals. There was different responsiveness to green leaf between female and male. The virgin female was more susceptible than virgin male significantly. After mating within an hour the female became most susceptible, and then gradually decreased. Surprisingly, the male became more susceptible than female 24 hours later. Time in reaching green leaf varied with female or male adult age. Those males and females emerged justly reach the leaf within 0.5 minute and 1.5 minutes, with one-hour-emerged females and males spending 3.5 and 2.6 minutes respectively.
Index terms: response, Liriomyza sativae, American cowpea,

[2652] INSECTICIDE EVALUATION TO CONTROL *AGROTIS IPSILON* (LEPIDOPTERA, NOCTUIDAE) IN TOBACCO

L. A. Chiaradia [U], J. M. Milanez[U] & C. R. V. Palma[U2], [U]CPPP/Epagri, Box 791, CEP 89801-970, Chapecó, SC, BR, E-mails: chiaradi@epagri.rct-sc.br and milanez@epagri.rct-sc.br; [U2] Bayer S.A.; E-mail: crpalma@viavale.com.br

Tobacco is cultivated in the South of Brazil by 140,000 agriculturist with 215,000 ha with production around 380,000 ton. *Agrotis ipsilon* cut the little plant after the transplant and cause low stand and produtivity. One experiment with randomized blocks and four replicates was installed to study the insecticide effect for the larval insect fase. The plot, 48 trees were conducted with six files, and 1,15 x 0,45 m between lines and tress, respectively. The treatments were constituted by following commercial insecticides (grams): 1) Confidor'S (420) (imidacloprid 50% + cyfluthrin 1%); 2) Confidor'S (500); 3) Confidor 700 GRDA (300) (imidacloprid 70%); 4) Orthene 750 BR (750) (acephate 75%); 5) Confidor'S (320); 6) Confidor'S (360); 7) Confidor'S (400); 8) Confidor'S (420); 9) Confidor'S (500); 10) Confidor'S (300) + Orthene 750 BR (600); and 11) control. Treatments one to three each trees was aspersioned with 14 ml of solution at the time of transplanting. Treatment four the trees were sprayed at the time of transplanting, 15 and 30 days after with 8,3 ml solution for time and tree. With the treatments five to ten, the trees were washed yet in the trays with 2 ml solution for little plant. After installment of the experiment were liberated eight caterpilars for plot that were previously collected for this finality. The evaluations were three, seven, 13 and 27 days after counting trees cut. Results showed that the treatments with Confidor'S (360, 420 and 500 g) applied in the trays, and Confidor'S (500 g) applied at the time of transplanting, and Confidor 700 GRDA (300 g) + Orthene 750 BR (600 g) applied at the trays had control across Abbott Test by 84,2%, 89,4%, 100,0%, 89,4% and 94,7%, respectively, in the evaluation 27 days after to install the experiment. Results showed also that the same inseticide dose were more efficients when applied in the trays.
Index terms: tobacco, pest, control.

[2653] PESTICIDE EVALUATION TO CONTROL *GYROPSYLLA SPEGAZZINIANA* (HEMIPTERA, PSYLLIDAE) IN PARAGUAY-TEA ORCHARD

L. A. Chiaradia [U], J. M. Milanez[U] & A. Peretto[U2], [U]CPPP/Epagri, Box 791, CEP 89801-970, Chapecó, SC, BR, E-mails: chiaradi@epagri.rct-sc.br and milanez@epagri.rct-sc.br; [U2]Hokko do Brasil Box 1.386, CEP 04063-003, São Paulo, SP, BR. E-mail: hokkobr@hokko.com.br

Paraguay-tea *Ilex paraguariensis* St. Hil. is cultivated in the South of Brazil in an approximate area of 20,000 ha with a production around 550,000 ton per year. Leaves and new branches of these trees are processed to prepare tea and other drinks. *Gyropsylla spegazziniana* (Hemiptera, Psyllidae) is a pest of this plant because from its laying in the buds arise a "blister" or "ampoule", a symptom in the new leaves, to ninfal protection. Leaves with symptoms fall after the adult forms emerge causing low productivity. This psyllid also difficult shoots grown by causing bad formation of the canopy in new trees. One experiment was installed to evaluate pesticide effects in this pest from November to December of 1998. The orchard was located in Guatambu West of Santa Catarina, Brazil and the trees were six years old, conducted with 2,5 x 4,0 m between trees had 1,4 m of height. The experimental unit was constituted for five trees pruned 30 days before, to favour the bud and pest infestation. The treatments, solution sprayed in the new branches and quantities of commercial products for 100 liters of water were: 150 g Evolution (acephate 97%); 200 g Evolution; 250 g Evolution; 250 g Orthene 750 BR (acephate 75%); 75 ml Cordial 100 (pyriproxifen 10%); and control. Evaluations were done seven, 14 and 20 days after spray by counting "blisters" with live insects on the terminal 20 cm of five branches, in the three central trees of each plot. Results showed that the acephate was the pesticide more efficient to control this pest until 14 days, with prominence for 250 g of Evolution/100 litres of water.
Index terms: paraguay-tea, psyllid , control, acephate.

[2654] AMELIORATIVE EFFECT OF NEEM AND OTHER BOTANICALS ON THE RESURGENCE OF RICE BROWN PLANTHOPPER, *NILAPARVATA LUGENS* AND ITS SYMBIONTS

K. Chozhan and S. Raguraman, Department of Agricultural Entomology, Agricultural college and Research Institute, Tamil Nadu Agricultural University, Madurai 625 104, India, Email: macdean@vsnl.com

Resurgence is a common phenomenon observed with rice brown planthopper, *Nilaparvata lugens* consequent to insecticidal applications. To ameliorate the resurgence inducing potential of fenthion (500 g ai/ha) and quinalphos (250 g ai/ha) two neem, *Azadirachta indica* A. Juss derivatives Neem seed kernal extract (NSKE) 5% and Neem oil (NO) 3% and three other botanicals, Palmarosa (*Cymbopogon martini* (Roxb.) watson) oil (PO) 0.05%, Notchi (*Vitex negundo* L.) leaf extract (NLE) 5% and Ipomea (*Ipomea carnea* Jacq.ssp.) leaf extract (ILE) 5% were mixed and evaluated in the laboratory. Conventional insecticides recorded a resurgence ratio of 14.12 and 11.04; amelioration with neem derivatives narrowed the resurgence ratio to 1.19 to 2.96 in NSKE and 0.98 to 2.69 in NO respectively. Similarly, the other botanicals effectively reduced the resurgence as ameliorants. The intracellular yeast like symbionts responsible for the assimilation of essential amino acids and lipids might be a reason for resurgence. The load of symbionts in ameliorated insecticides was 43×10^4 and 47×10^4 respectively in fenthion and quinalphos compared to 61×10^4 and 59×10^4 symbionts in unameliorated condition. The other botanicals could also exert a deleterious effect on the symbionts. It is concluded that effective amelioration of rice brown planthopper resurgence with botanicals would be a useful tool in rice pest management.
Index terms: Rice brown planthopper, resurgence – amelioration – symbionts – botanicals.

[2655] FRUIT PRODUCTION AND MATING DISRUPTION OF CODLING MOTH IN ARGENTINA

L. I. Cichón, INTA Alto Valle, Casilla de Correo 782, 8332 General Roca, Argentina. E-mail: lcichon@inta.gov.ar

The Rio Negro Valley is the main pome fruit growing area of Argentina. Apples and pears total near 1,300,000 tons with less that 1% being organic. *Cydia pomonella* is the key pest. It develops an average of three generations each year and occasionally may have a fourth one depending upon climatic conditions. The Mating Disruption Technique (MD) allowed us to produce fruit with a minimum of pest control through traditional pesticide applications, making Integrated Fruit Production (IFP) and Organic Production (OP) both possibles in our region. The aim of this study was to assess the long-term effects of the MD technique in pilot plots of pears and apples managed either organically or under the directions of IFP. In the IFP blocks regular organophosphates sprays dropped from more than 5 to less than 1 after 2 years of MD. Average codling moth damage in the fruit was less than 0.1% average. However in the organic plots, the situation was a little bit difficult since organic pesticides (botanical, biological and mineral insecticides) are less effective than synthetic insecticides and because of the dearth of alternative tools to control the pests. Percent damage varies from 0.2-5% depending upon climatic conditions. After two years it was possible to decrease the number of dispensers in the center of the plot up to 50% of the regular density. However in OP this approach was limited to blocks with less than 0.5% damage in the previous season and only in situations that guaranteed full pest control in the nearby orchards. In some orchards the use of the MD techniques caused the development of new insects which are being identified and monitored. The efficacy of different strategies to control these pests using Insect Growth Regulator and Mating Disruption was also determined.

Index terms: *Cydia pomonella*, Organic Production, Integrated Fruit Production, Pest Management, Tree Fruit.

[2656] MASS TRAPPING STRATEGY TO REDUCE MEDITERRANEAN FRUIT FLY (DIPTERA: TEPHRITIDAE) DAMAGE ON APPLES IN ISRAEL

H. Cohen[1] & B. Yuval[2], [1] Northern R&D Migal industrial area Kiriat Shemona P.O. Box 90000 Rosh Pina 12100 Israel, E-mail hc@golan.org.il.; [2] Department of Entomology Hebrew University P.O. Box.12 Rehovot 76100 Israel

The management and control of the Mediterranean fruit fly *Ceratitis capitata* (Wiedemann), is basically dependent on large-scale applications of bait sprays and on the use of the Sterile Insect Technique. The potential of using traps for suppressing medfly populations was tested in the past, but with rather poor success. Nevertheless, none of these methods, supply the desired aim of eradication of medfly. Over the last three years we have performed a number of field studies evaluating the perimeter trapping and the mass trapping strategies, as methods for the control of medfly. Both strategies were based upon dry traps (McPhail) baited with three component food-based synthetic attractant (putrescine, ammonium acetate and trimethylamine). Mass trapping strategy tests were conducted at two different apple orchards, within large plots (1-2 ha), maintaining the perimeter pattern with additional traps located within the plot. Fruit damage was estimated along the season at neighboring plots as well, treated with alternative treatments against medfly. Results from two of the most susceptible apple varieties are presented. The first apple plot resulted with 7% damaged fruit at harvest of the Molly variety, in comparison to 5% in a commercial plot sprayed with malathion + bait droplet sprays, and 13% in a third plot treated with "Sure-Dye" spray droplets. Estimated infestation in the second apple plot was 2% at harvest of the Galla variety, and as high as 15% at an adjacent plot sprayed partly with Spinosad droplet sprays. Average numbers of medfly females caught in dry traps, varied among peripheral and inner rows. In one of the sites captures in peripheral rows were significantly lower than in the inner rows most of the season (up to 0.1 and 0.5 females per trap per day respectively), whereas in the other site captures in the inner rows were significantly higher only at one check point. Average numbers of overall captures at that site were relatively higher throughout the season (many as: 1.1 and 4.2 females per trap per day respectively). Our results may provide a useful medfly management tool combined with other methods used in area wide integrated pest management, with some limitations such as cost effectiveness, and need for addressing biogeographical characteristics prior to applications on a commercial basis.

[2657] ONLINE APPLICATION SERVER FOR PHENOLOGY MODELS AND MAPS

L. Coop, W. Baiwa & M. Kogan, Integrated Plant Protection Center (IPPC), Oregon State University, Corvallis, OR 97331-8530, USA.

Phenology models and predictions are a vital element for most temperate zone IPM programs. A world-wide-web hosted system is described which provides online degree-day calculators, models and mapping calculators. A database of over 240 publicly available weather stations provide daily temperature and precipitation data from a 4-state region including Oregon, Washington, Idaho and Montana. We have developed a database of over 24 insect, disease, crop, and other phenology models linked to the weather database and to a custom degree-day calculator to deliver online phenology summaries, predictions, and graphs for individual weather site locations. With a capability to process user-uploadable temperature data, the same system is available to anywhere around the world that has internet access. Example models include development of codling moth, *Cydia pomonella*, corn earworm, *Helicoverpa zea*, fire blight of pear, *Erwinia amylovora*, and sweet corn, *Zea mays*. For online phenology maps, we integrate widely used PRISM climate maps with calculated degree-days using the GRASS geographic information system. Map types available online include current year, previous year, historical average, differences between current and previous year, and current deviations from average. Geographic extent includes all regions of Oregon. The spatial resolution is dependent upon the 4 KM/cell border PRISM temperature maps, which are available for the entire U. S. A. and for several other countries. This system is delivered from the website http://osu.orst.edu/dept/ippc/wea and is entirely supported by free, open source, publicly available software. The system is now serving a wide variety of agricultural decision making needs in the region.

Index terms: Degree-day, Delivery system, IPM, Internet, GIS

[2658] CONTROL OF *STERNECHUS SUBSIGNATUS* (COL.: CURCULIONIDAE) WITH INSECTICIDES APPLIED ON SOYBEAN PLANTS

I. C. Corso[1] & C. B. Hoffmann-Campo[1], [1]Embrapa Soja. P.O.Box 231. ZIP 86001-970, Londrina, Parana, Brazil. E-mail: corso@cnpso.embrapa.br

Sternechus subsignatus Böheman (Col.:Curculionidae), a stem borer gall maker, is a weevil that damage soybean plants by scraping stems and petioles, sometimes causing total loss of soybean fields. Aiming to test some insecticides and dosages for controling the weevil, two field experiments were carried out in 1998, in Maua da Serra and Pinhão, Parana State, Brazil. The experiment was in a randomized complete block design, with four replicates per treatment. The plots measured 4x8m and 6x7m, respectivelly for each location; plants were at the V_6 and V_3 growing stages. Treatments evaluated were: β-cyfluthrin, in the emulsifiable concentrate (EC) and flowable (FW) formulations (10 g a.i. ha^{-1}), ethophenprox (45g a.i. ha^{-1}), fipronil (32, 48 e 64g a.i. ha^{-1}), methamidophos (480g a.i. ha^{-1}), thiamethoxan (210g a.i. ha^{-1}) and a control (without spraying). Alive adults were sampled at 0, 2, 5 or 6, and 12 or 14 days after application (DAA) of the insecticides in 12m (Maua da Serra) and 5m (Pinhão) of soybean row. In this last site, the initial stand of healthy plants and the number of plants attacked by the insect were also evaluated. β-cyfluthrin FW, fipronil (at the 3 tested doses), methamidophos and thiamethoxan were efficient, reaching at least 80% of control until 5-6 DAA, in the first experiment. Fipronil (at the 3 doses) and thiamethoxan were also efficient in the second experiment. According the data, the insecticides fipronil and thiamethoxan showed a larger residual power for controling *S. subsignatus*, providing a lesser final number of attacked plants.

Index terms: Insecta; stem borer gall maker; chemical control; pesticides.

[2659] INSECTICIDE SELECTIVITY FOR PREDATORS AND PARASITOIDS OF SOYBEAN INSECT PESTS

I. C. Corso & D. L. Gazzoni, Centro Nacional de Pesquisa de Soja (CNPSo), Empresa Brasileira de Pesquisa Agropecuária (EMBRAPA), Caixa Postal 231, 86001-970 Londrina, PR, E-mail gazzoni@cnpso.embrapa.br.

With the purpose to evaluate the effect of several chemical and biological insecticides on the population of beneficial insects, a field experiment was carried out in the Londrina (Brazil) region, using a flat area on a grower soybean field. The experimental design used was the randomized block, with three replications, and the plots measured 100 x 100 m. Insecticides were applied in the beginning of January, when soybeans cv BR-16 reached the flowering stage, supposedly for the control of the velvetbean caterpillar. A second application was performed two months later, simulating the control of the stink bug population. Insecticides and rates (g ia.ha^{-1}) used (first/second application) were: 1. Endosulfan (175) / endosulfan (437); 2. Lambdacyalothrin (3,75) / lambdacyalothrin (7.5); 3. Monocrotophos (80) / monocrotophos (150); 4. *Baculovirus anticarsia* (20 g p.c.) / monocrotophos (100) + NaCl (0,5%); 5. Check. Insecticides were applied with a bar sprayer, delivering 180 l/ha. Four weekly samplings using the shock method were made on each plot, each one consisting of 16 m of soybean row. A broad spectrum insecticide was applied on the area to be sampled, where clothes were placed on the soil. After 15 minutes of the application, insects were collected, transferred to plastic bags and counted in the laboratory. During the last six weeks of the experiment, stink bugs eggs were collected in the field and reared in the laboratory, to observe the index of parasitism. The statistical analysis of the data revealed no significant differences between the predators or parasitoids population observed on the different treatments. Also no differences were observed on the hatching of parasitoids from the egg masses collected in the field, thus showing that either the insecticides had no impact on the beneficial population, or its population recovered quickly, thus preventing differences from being detected by the evaluation methodology used.

Index terms: parasitoids, predators, biological control,

[2660] INFLUENCE OF ZINC ON THE WHITEFLY, *BEMISIA TABACI*, IN BEAN (*PHASEOLUS VULGARIS*) PLANT

J.P.A. Couto & M.H. Calafiori, Agronomic Engineering Course. CREUPI. Postal Box 05. 13990-000 - Espírito Santo do Pinhal – SP – Brazil. E-mail: cpagrpin@rantac.com.br

Zinc is an important nutrient for the plant. It affects the new leaves production and it can influence the insect growth. This test was realized to observe the effect of zinc for the whitefly population on bean plant, variety Carioca 80, in field conditions, at experimental campus of Agronomic Engineering Course – CREUPI. All treatments were replicate 5 times in a randomized block design. The treatments were: A- control (without fertilizer); B- NPK (ammonium sulphate, simple superphosphate, potassium chloride); C- NPK + Zinc; D- NPK + 2 Zinc; E- NPK + 3 Zinc; F- Zinc. This nutrient was applied like zinc oxide. The plots were shaped by 4 rows of 5m of length. The fertilization was based on soil analysis. The evaluations were realized counting egg, nymph and adult of whitefly in one leaf/plant and 20 plants/plot. The results allowed to conclude: a) the greater number of eggs and adults was in the treatment without fertilizers and the smaller number was in the treatments with only zinc and triple dosage of zinc; b) there was smaller population of nymph in the lack of fertilizer and a greater population there was in the treatment with double and triple dosage of zinc; c) number of egg and adults decreased with the oldest bean plant and the nymph increase in this test period.

Index terms – zinc, bean, resistance, *Bemisia tabaci.*

[2661] BIO-CONTROL FOR NEW PESTS INVASIONS IN CALIFORNIA VINEYARDS: OBSCURE MEALYBUG AS A CASE EXAMPLE

K. M. Daane[1], A. Jani[1], M. Bianchi[2] & K. M. Weir[1], [1]Div. Insect Biology, Univ. of California, Berkeley, CA 94706, USA, daane@uckac.edu; [2] Univ. of California Cooperative Extension, 2156 Sierra Way, San Luis Obispo, CA 93401, USA.

During the past two decades, a number of new insect pests have disrupted well-established IPM programs California vineyards. These include the variegated leafhopper (*Erythroneura variabilis*), obscure mealybug (*Pseudococcus viburni*), vine mealybug (*Planococcus ficus*), and glassy-winged sharpshooter (*Homalodisca coagulata*). Chemical controls for any one of these pests can disrupt the well-established biological control of other pests. Here, we present research on the bio-control of the obscure mealybug, and discuss regional IPM practices needed to curtail future pest problems. During the 1990s, obscure mealybug pest status increased dramatically in the Central Coast wine grape regions, requiring 2-4 applications of synthetic insecticides. Fruit infestation rates of 70-90% were recorded. Initial research indicated (1) there were no effective natural enemies and (2) ant populations were significantly correlated to mealybug populations. In 1996, two encyrtid parasitoids were imported from Chile: *Leptomastix epona* and *Pseudaphycus flavidulus*. These parasitoid were released at five vineyard sites and, in 1996 and 1997, recoveries of both species were made after winter no-release periods. However, mealybug densities remained high at all study sites and percentage parasitism was low. Field observations indicated that bio-control would not be effective until ant populations were reduced. In 1998 and 1999, laboratory and field studies investigated the role of ant-tending on obscure mealybug and its parasitoids. Laboratory studies showed ants interfere with parasitoid oviposition and remove parasitized mummies. Ants are most disruptive against *L. epona*, which has a slower oviposition time, compared with *P. flavidulus*, and lays eggs singly. In commercial vineyards, plots were established to test releases of imported parasitoids into ant-tended and ant-excluded plots. Results show that mealybug densities dropped significantly in ant-excluded plots. Parasitism levels were low in all but one vineyard where there was good ant control, where percentage parasitism climbed to over 75% and remained there throughout the season. When ants were present, percentage parasitism was <25% and mealybug abundance remained high. Predatory beetles were found both in ant-tended and ant-excluded plots. Results suggest that to improve biological control of obscure mealybug, insecticide treatments must first be made for ant control. A comparison is made of the obscure mealybug pest status with other new pest associations in vineyards and, through this comparison, a call is made for more region-wide IPM programs to reduce the spread of current pests to new vine-growing regions in California and the introduction of new pests.

Index terms: *Pseudaphycus*, *Leptomastix*, *Pseudococcus*, ant-tending.

[2662] DEVELOPPING IPM COMPONENTS FOR THE CONTROL OF SORGHUM MAIN PESTS IN BURKINA FASO

D. Dakouo, G. Trouche & M. Ba, INERA, Station de Farako-ba, BP 910 Bobo-Dioulasso Burkina Faso, Fax 226 97 0159 email: ddakouo@fasonet.bf .

Sorghum is the main staple food crop in Burkina Faso (West Africa). It is grown by small scale farmers and subject to many constraints like insects and diseases. Stem borers and sorghum midge are the major insect pests causing yield losses. Yield losses can be reduced by efficient and sustainable control measures that farmers can afford. This paper gives the results of studies conducted over four consecutive years to develop IPM components for the control of stem borers and sorghum midge. These components rely on host plant resistance, pheromone trapping and use of biopesticides derived from plants. Crosses between sources of midge resistance and high yielding varieties gave promising lines with good level of resistance to sorghum midge. Twenty five out of forty F6 lines tested for yield, produced higher yield than the productive control. These lines were also tolerant to other biotic factors such as leaf diseases, sorghum head bugs and grain mold. Pheromone trapping of *Busseola fusca* which is the main stem borer species, was efficient to monitor pest population in research station as well as in farmer fields. Farmers were trained to handle pheromone trapping. Biopesticides derived from physic nut (*Jatrophas curcas*) and neem (*Azadirachta indica*) seed extracts gave promising results against stem borers as compared to control and organic synthetic insecticides. Prospects for use of these findings combined with cultural practices in IPM are outlined.

Index terms: *Busseola fusca*, *Stenodiplosis sorghicola*, pheromone trapping, *Jatrophas curcas, Azadirachta indica.*

[2663] THE ECOLOGY AND MANAGEMENT OF *HELICOVERPA ARMIGERA* IN SOUTHERN NSW, AUSTRALIA

S. J. Duffield[1] & M. L. Dillon[2], [1]CSIRO Entomology, PMB 3, Griffith, NSW 2680, AUSTRALIA, E-mail simon.duffield@ento.csiro.au; [2]CSIRO Entomology, Australian Cotton Research Institute, Wee Waa Road, Narrabri, NSW 2390, AUSTRALIA, E-mail martin.dillon@ento.csiro.au

Until relatively recently *Helicoverpa armigera* was regarded as a moderate, but not critical pest of summer grain crops in the irrigation areas of southern New South Wales, Australia. In recent years there has been a perceived increase in *Helicoverpa* pressure on summer crops. This has been reflected in an increase in yield losses on crops such as maize, and the increased reliance on chemical control options on crops such as soybean and sorghum. *Helicoverpa* are now regarded as the major pest of maize, sorghum, soybean, cotton and sweet corn, and a significant pest of lucerne, sunflower and tomato crops. Research conducted over the last three years has studied the ecology of the pest in the region to determine the causes of the problem. Populations have been monitored using field sampling, emergence cages and pheromone trapping. The population trends observed have been analysed using the *HE*licoverpa *A*rmigera and *P*unctigera *S*imulation (HEAPS) model to determine the importance of overwintering and immigration to regional population dynamics. The results indicate that the emergence of a local population overwintering as diapausing pupae under the previous season's crop residues is the main source of early season populations. Following the spring emergence, there are two successively larger generations. This within-season population build-up is driven by populations in untreated sequentially planted maize and results in severe pressure on all crops from the beginning of February onwards. The results are discussed in terms of the feasibility of introducing "regional" or "area-wide" management of the pest in the region.
Index terms: *Helicoverpa armigera*, HEAPS, overwintering, immigration, regional management.

[2664] INTERCLONAL VARIABILITY IN THE PERFORMANCE OF THREE APHIDS ON GRAIN LEGUME HOSTS IN WESTERN AUSTRALIA

O. R. Edwards, CSIRO Entomology, Private Bag No. 5, Wembley, WA 6913, Australia.

The wheatbelt of Western Australia (WA) exhibits a classic Mediterranean climate, with hot, dry summers and cool, wet winters. The principal crops grown during the winter season are cereals and more recently oilseeds, but legume crops are included in rotations both to renitrify the soil and as break crops for disease management. Narrow-leafed lupin, *Lupinus angustifolius*, has traditionally been the most common grain legume grown, but recently the area grown to pulses such as faba bean (*Vicia fabae*), field pea (*Pisum sativum*), chickpea (*Cicer arietinum*), and lentil (*Lens culinaris*) has been increasing. There are three key aphid pests of grain legumes in WA: the cowpea aphid (CPA), *Aphis craccivora*; the bluegreen aphid (BGA), *Acyrthosiphon kondoi*; and the green peach aphid (GPA), *Myzus persicae*. GPA is highly polyphagous as a species, though some populations have become specialised to feeding on a narrower range of hosts (host races). Adaptation to particular hosts has never been described for either CPA or BGA, though biotypes of the latter have been described capable of feeding on more resistant alfalfa (lucerne) lines. In WA, the three species are all anholocyclic, which could favour adaptation to particular host plants. This research was initiated to determine (1) which of the grain legumes currently grown in WA are suitable hosts for each pest aphid species, and (2) whether there is variation in the suitability of hosts among clones of each species. The suitability of narrow-leafed lupin and four pulses as hosts for each aphid species was determined by measuring mean relative growth rate (MRGR) and survivorship of nymphs over a period of 5 days. Thirty clones of each species collected from areas throughout the WA wheatbelt were tested independently. Five nymphs were tested per plant, and each clone/host plant combination was replicated six times. On average, CPA performed best on faba bean and lentil while both GPA and BGA performed best on lupin. Chickpea would not support any of the aphids tested. CPA clones showed the greatest level of interclonal variation in both survival and growth. There was significant variation in survival among CPA clones on chickpea and lupin, and significant variation in growth rate on faba bean, field pea, lentil and lupin. GPA clones showed significant variation in survival on field pea and lupin, but significant variation in growth rate only on lupin. The only significant variation among BGA clones was in survival on lentils. That CPA aphid showed the greatest level of intraspecific variation is surprising, since it was the only species with no previous record of this in the literature. The lack of variation in performance among GPA and BGA clones may be the result of low clonal diversity initially introduced into the WA wheatbelt.
Index terms: *Aphis craccivora*, *Myzus persicae*, *Acyrthosiphon kondoi*, clonal variation, host suitability

[2665] WIIEAT CROP PROTECTION BASED ON PLANT RESISTANCE AND BIOLOGICAL CONTROL IN EGYPT

A. H. El-Heneidy, G. S. Youssef & A. A. Attia, Agricultural Research Center, P. O. Box # 915, MAADI, CAIRO, EGYPT. E-mail: aheneidy@intouch.com.

Wheat is the most important cereal crop in Egypt. Aphids are major constraints to wheat production. Wheat yield loss due to aphid infestation was estimated by7-23 %. Laboratory and field trials were carried out at three different agro- ecosystems; Upper-, Middle- and Lower Egypt during the two successive winter growing seasons 1997/98 and 1998/99. Laboratory activities included: mass rearing of the two key aphid species; *Rhopalosiphum padi* L. and *Schizaphis graminum* R., screening for resistant cultivars and evaluating of some promised native and exotic parasitoid species. Field trials included: survey and evaluation of native bio-control agents associated with cereal aphid species, evaluation of some advanced wheat lines for aphid's resistance and grain yield, development of economic threshold (ET) and injury (□*EI) levels for key aphid species and evaluation of* promised native and exotic parasitoid species. Significant results were achieved. The survey revealed the presence of 14 species of parasitoids and 7 species and/or groups of predators. Ten wheat lines showed relative tolerance to aphids' infestation. Et and EI levels ranged between 3.9 – 6.3 and 6.8 – 9 aphids/plant, respectively. Three and two promising native and exotic parasitoid species were evaluated under field conditions at the three locations. Assessment of the contribution of all variables on the pest population as an IPM package has been evaluated.
Index terms: *Rhopalosiphum padi, Schizaphis graminum*, IPM

[2666] A JUVENOID- ORIENTED LEISA STRATEGY FOR PEST MANAGEMENT

M. T. El-Ibrashy, Department of Plant Protection, National Research Centre, Dokki, 12622 Cairo, Egypt

The lecture reviews the development of certain aromatic juvenoids proved to have specific chemical moieties as environmentally benign and viable alternatives to the toxic conventional insecticides. To test the juvenoid selectivity and bioactivities, we have succeeded to develop and practise some intriguing bioassays the most rewarding of which is the replacement juvenile hormone (JH)- therapy technique. This bioassay technique is based on surgical ablation of the corpora allata glands from several economically important insect pests of various taxa, due to whose inherent morphogenetic consequences we were able to determine the most efficacious juvenoids are those witch contain a phenoxy or pyridyl-oxy functionality in place of the methyl ester moiety of the JH molecules as well as those in wich phenyl ringe interbridge with oxygen atoms substitute for two or all the three isoprene units. Discussion is being made to advance and prospect new oportunities for bringing together the discipline of insect endocrinology and that of plaint protection for field application and preserving biodiversity within the law-external-input sustainable agriculture (LEISA) strategy. This is particularly essential if life is to be tolerable on our planet in the new Millennium.

[2667] TRAPPING OF TURNIP MOTH AND CARROT FLY FOR FORECASTING IN CARROT IPM

P. Esbjerg, Dept. of Ecology, Royal Vet. & Agric. Univ., Thorvaldsensvej 40, DK-1871 Frederiksberg C, Denmark.

Scientifically trap catches are always inferior to sampling based absolute estimates. In IPM trap trap catches are used for many insect pests for practical reasons but the establisment of proper control thresholds is often questionable. Already in the early start of Danish carrot IPM it proved necessary to base forecasting of attacks of carrot fly larvae, *Psila rosae,* and cutworms, *Agrotis segetum* on trapping. For carrot fly a system based on yellow sticky traps was developed in collaboration with partners from The International Organisation for Biological and Integrated Control / Western Palaearctic Region Section (IOBC/WPRS). For trapping of turnip moth a synthetic sex pheromone was developed in Schwiss, Danish, French, Hungarian –collaboration while further development of trap house and practical trap use has taken place in Denmark. Many routes to improve carrot fly trapping have been tried but with limited results. Despite weaknesses, e.g. a rather preliminary control threshold, the system has been successfully adopted in Denmark and several other countries. At an early stage the sex trapping of turnip moth for cutworm forecasting appeared more problematic as not even a slight direct relation between trap catches and subsequent attack levels could be established. However, systematic investigations of age specific mortalities and development rates supplemented with more than a decade of field registrations have lead to a strong narrowing of the inevitable gab between the relative estimate from trapping to the subsequent absolutely estimated damage. This has enabled establishment of a dynamic and reliable control threshold and also very precise timing of a minimum of treatments. For this reason the level of confidence and practical adoption is high. The experiences from the two trap based systems suggest a scientific rationale for development of trap based forecasting in IPM, particularly development of control thresholds, and a few simple rules related to implementation and practical sustainability.
Index terms: *Agrotis segetum*, *Psila rosae*, trapping, forecasting, IPM.

[2668] THE EFECTS OF DEPTH AND DSTRIBUTION OF LQUID INSECTICIDES FOR THE CONTROL OF MOUND TERMITES IN PASTURES (INSECTA: ISOPTERA)

M.A.M. Fadini[1], O. DeSouza[2], C.J. Fanton[2], [1]Empresa de Pesquisa Agropecuária de Minas Gerais, caixa postal 33, 37780-000 - Caldas - MG - BRAZIL, E-mail: fadini@pcs.matrix.com.br; [2] Dept. de Biologia Animal, Univ. Fed. de Viçosa, 36571-000 - Viçosa - MG - BRAZIL.

The termites could be pests in agriculture, forest, urban and grasses system. In particular, in grasses, mound termites are important for reduced the value of farm, because the mounds give a damaged aspect to the farm. In generally, mound termite control is done through the chemical and biological control. The efficacy of two insecticide applying devices was tested for the control of mound termites (*Cornitermes* sp; *Isoptera*: Termitidae) using liquid formulation (Imidacloprid), in Poços de Caldas region, Minas Gerais State, Brazil (21°47' S; 46°34' W; alt. 1.186m). Both devices were funnels constructed so as to differ only in the depth and distribution of the liquid within the termite nest. One of the devices was a standard funnel, whereas the other presented a longer tube perforated along its extension and closed in the outer end. Termites in mounds treated with the long funnel died faster than termites treated with the short funnel. It seems that the depth and distribution of the insecticide within termite nest was crucial for the efficacy of the control. We therefore recommend that controlmethods of termite in mounds should favor the use of applying devices which distribute better the insecticide within the nest.
Index terms: *Cornitermes*, Imidacloprid, pest management

[2669] LOSS EVALUATION OF WHEAT LEAF MINER *SYRINGOPAIS TEMPERATELLA* IN KHUZESTAN PROVINCE

P. A. Fard[2], Entomology Dept. College of Agriculture Univ. of Tehran, Karaj Iran 31584 E-mail:pafard@chamran.ut.ac.ir.

Due to the importance of wheat production in the country, prevention and control of pests is of vital importance. Therefore, this study has been conducted with five treatments at drought conditions to evaluate the efficacy of control measures. The treatments are: I) one-time plowing; II) two-time plowing; III) burning of stubble; and IV) Dorsban insecticide. However, the percentage of infestation of wheat plants and the number of larvae per plant indicate that the best results are obtained in treatment III with (zero) infestation as compared with 100% infestation and 7-11 larvae per plant. In treatments I, II, and IV the infestation rates have been around 96%, 70%, and 50%, respectively.
Wheat-Dorsban-Infestation

[2670] INTRODUCTION-PART 1: CHALLENGES AND OPPORTUNITIES FOR PEST MANAGEMENT OF *BEMISIA* IN THE NEW CENTURY

O. A. Fernandes[1], S. E. Naranjo[2], P. C. Ellsworth[3] & M.R.V. Oliveira[4], [1]Dept. Fitossanidade, FCAV/UNESP, Rod. Paulo D. Castellane km 5, 14870-000 Jaboticabal-SP, Brazil, E.mail: oafernan@fcav.unesp.br; [2]USDA-ARS, 4135 E. Broadway Rd, Phoenix, AZ 85040, USA, E.mail snaranjo@ix.netcom.com; [3]Dept. Entomology, University of Arizona, Maricopa Agricultural Center, Maricopa, AZ 85239, USA, E.mail: peterell@ag.arizona.edu; [4]CENARGEN/EMBRAPA, C. Postal 02372, CEP 70849-970, Brasilia-DF, Brazil, E.mail: vilarin@cenargen.embrapa.br

The *Bemisia* complex (*B. tabaci and B. argentifolii*) are important pests of many field and vegetable crops throughout the subtropics and tropics of the world. In the past decade there has been a rapid expansion of these pests and associated crop damage throughout many regions of the world. This symposium will highlight the myriad of pest management research and implementation efforts targeting *Bemisia* worldwide. The speakers represent a broad cross-section of the affected countries covering a broad array of research areas. The full-day symposium is split over two sessions of the congress (Session 14: Integrated Pest Management and Session 2: Agricultural Entomology). Part I of this symposium will focus on 1) history and current status of *Bemisia* from a worldwide perspective, 2) the complex issue of systematics and the current status of pest nomenclature, 3) insecticides and resistance management, 4) biological control with predators, parasitoids and pathogens, 5) physical and behavioral control, and 6) emerging technologies for pest management in the new century.
Index terms: *Bemisia tabaci*, *Bemisia argentifolii*, biological control, systematics, insecticides, physical and behavioral control

[2671] MELON RESPONSE TO SILVERLEAF WHITEFLY INJURY

O. A. Fernandes & F. A. S. B. Medeiros, Dept. Fitossanidade, FCAV/UNESP, Rod. Carlos Tonanni km 5, 14870-000 Jaboticabal, SP, Brazil, Email: oafernan@fcav.unesp.br

Melons (cultivar Gold Mine) were cultivated in 8-m^3 saran fabric cages (anti-aphid screen). After emergence, only two plants were kept per cage. Silverleaf whiteflies (SW) were caught from cultivated melons and released inside those cages according to the following treatments: 1. No SW; 2. SW throughout all melon developing stages; 3. SW kept until blooming (ca. 35 d after emergence); 4. SW released after blooming; 5. Chemical control. Two and ten SW adults were released per leaf in two consecutive experiments carried out in the Brazilian northeastern region. SW were released twice inside cages when plants presented at least four fully developed leaves. Thiamethoxan was sprayed once to control SW on both treatments 3 and 5. Randomized Complete Blocks with four replications was the experimental design adopted. All nymphs and adults were scouted from ten leaves per cage on a weekly basis. The overall infestation was analyzed considering the insect-day index. After harvesting, qualitative traits of fruits such as weight, colour, packing classification, pulp stiffness, sugar (total soluble solids), pH, and ascorbic acid content were analyzed. In general, treatments did not affect fruit quality although there was a significantly reduction in ascorbic acid content considering the infestation of both nymphs and adults as insect-day index. The reduction of ascorbic acid is aproximately 2.5% for every 100 insect-day. Also, an infestation of up to 10 insects per leaf seems to be adequate for decision making because some fruits started to present sooty mold on fruit skin and this is undesirable for commercialization.

Index terms: *Bemisia tabaci*; *Bemisia argentifolii*; damage; fruit quality

[2672] BIOLOGY OF IMMATURE *CHRYSOPERLA EXTERNA* PREDATOR FED WITH *SCHIZAPHIS GRAMINUM* APHIDS REARED ON RESISTANT, MODERATELY RESISTANT AND SUSCEPTIBLE SORGHUM GENOTYPES

L. K. Figueira[1,A], F. M. Lara[1] & I. Cruz[2], [1]Universidade Estadual Paulista, Departamento de Fitossanidade, Via de acesso Prof. Paulo D. Castellane, s/n. Jaboticabal, SP, Brasil, 14.870-000, [2]CNPMS/ EMBRAPA, C. Postal 151, Sete Lagoas, MG, Brasil, 35.701-970. [A]Scholarship and Financial Support from Fundação de Amparo à Pesquisa do Estado de São Paulo).

Studies were conducted in laboratory at temperature of 25 ± 1°C, 70 ± 10% RH and 12 hours of photoperiod. A completely randomized design was used in this study with four genotypes: GR 11111 and TX 430 x GR (resistants), GB 3B (moderately resistant) and BR 007B (suscetible) and twenty replications. Recently hatched larvae were confined individually in 8.5 x 2.5 cm glass vials and fed with aphids (3-6 days old) reared on different genotypes. The duration of the larval and pupal stages were not influenced by genotypes offered to aphids, except for the prepupal stage. The average of the development of the first, second and third instars, larval, pupal and larvae to adult took 4.07, 3.06, 4.29, 11.45, 7.60, and 23.30 days, respectively. Aphids reared on GR 11111 genotype were responsible for the higher duration of the prepupal stage, 4.89 days, distinguished from chrysopids fed with aphids reared on other genotypes, with duration of 3.98 days. The percentages of predator survival for the larvae at adult stage were 75.00, 80.00, 90.00, and 100.00% when fed with aphids reared on genotypes GR 11111, TX 430 x GR, GB 3B e BR 007B, respectively. The average sexual ratio found was 0.46. These results indicate that biological control and plant resistance could be compatible and complementary strategies in integrated control of *S. graminum* in sorghum, standing out the genotypes TX 430 x GR e GB 3B as the most promising in interaction of resistance with *C. externa* predator.

Index terms: biological control, Chrysopidae, greenbug, host plant resistance.

[2673] EFFECTS OF SORGHUM GENOTYPES RESISTANCE TO *SCHIZAPHIS GRAMINUM* (RONDANI) ON *CHRYSOPERLA EXTERNA* (HAGEN) FECUNDITY

L. K. Figueira[1,A], F. M. Lara[1] & J. M. Waquil[2], [1]UNIVERSIDADE ESTADUAL PAULISTA, DEPARTAMENTO DE FITOSSANIDADE, VIA DE ACESSO PROF. PAULO D. CASTELLANE, S/N. JABOTICABAL, SP, BRASIL, 14.870-000, [2]CNPMS/ EMBRAPA, C. POSTAL 151, SETE LAGOAS, MG, BRASIL, 35.701-970. [A]SCHOLARSHIP AND FINANCIAL SUPPORT FROM FUNDAÇÃO DE AMPARO À PESQUISA DO ESTADO DE SÃO PAULO.

The present study was aimed to evaluate the influence of resistant sorghum genotypes (GR 11111, TX 430 x GR), moderately resistant (GB 3B), and susceptible (BR 007B) offered to *S. graminum* aphids on biology of *C. externa* adults fed during immature phase these aphids at laboratory conditions (25 ± 1°C, 70 ± 10% RH and photoperiod of 12h). There were six replications of each treatment in a completely randomized design. A replicate consisted of an adult couple of *C. externa* that was placed in cage with 10 cm of diameter and 10 cm of height and provided with a vial of water and fed with honey and yeast (1:1). The pairs were checked daily for oviposition, and eggs were counted during the first thirty days after emergence. The averages of preoviposition period and effective period of oviposition were 4.86 and 22.72 days, respectively, with no difference among genotypes used to fed *S. graminum*. The oviposition period was the only parameter affected by genotype, being the average of genotype GR 11111 (20.00 days) lower than other genotypes (25.00, 24.33, and 25.33 in genotypes TX 430 x GR, GB 3B and BR 007B, respectively). The averages daily and total production of eggs were 17.49 and 414.69 eggs/female, respectively. The percentage of unstalked eggs varied depending on used genotypes, from 7.53 to 18.83%. These results showed that the genotypes TX 430 x GR and GB 3B were the most promising when it is expected a positive interaction between the natural enemy and plant resistance.

Index terms: biological control, Chysopidae, greenbug, host plant resistance

[2674] STRATEGY MANAGEMENT OF *SPODOPTERA FRUGIPERDA* THROUGH SELECTIVITY OF INSECTICIDE

M. L. C. Figueiredo[1] & I. Cruz[1], Embrapa Milho e Sorgo, Caixa Postal 151, 35700-970 Sete Lagoas, MG, Brasil. E-mail: lude@cnpms.embrapa.br.

Spodoptera frugiperda is the main pest of maize in America. Its control is based mainly on chemical pesticides, usually of broad spectrum, causing a disturb in the ecosystem by the elimination of natural enemies. Conservation of these biological control agents can be achieved by the use of selectivity. This work was conducted to determine the effect of different chemical group used to control the pest over some of its natural enemies. Adults of the predator *Doru luteipes*, pupae of the larval parasitoid *Campoletis flavicincta*, eggs of *S. frugiperda* parasitized by *Telenomus remus* and eggs of *Anagasta kuehniella* parasitized by *Trichogramma pretiosum* were sprayed using a sprayer connected to a rolling mat (CO_2 pressure, quick jet 110.04 nozzle, work pressure of 3,1 Kgf/cm^2 and 158 l/ha). It was used a complete randomized design with six replications. A selectivity index was computed based on survivorship: 1, survivorship from 0 to 25%; 2, from 26 to 50; 3, from 51 to 75 and 4 over 76% de survivorship. The overall survivorship within pyrethroid group was 82.9% and within physiological insecticides, 82.6%. Greater adverse impact on the natural enemies was observed within carbamates and organophosphates, with average survivorship of 69,5 e 61,1%, respectively. Considering each natural enemy, the predator *D. luteipes* (86,6% survivorship) presented the greatest tolerance to the chemical pesticides, following by *C. flavicincta* (81,9%). The survivorship of the egg parasitoids, *T. pretiosum* and *T. remus* was 67,4 e 61,8%, respectively. Considering the selectivity index, pyrethroid and physiological insecticide were classified under category 4 and carbamates and organophosphates under category 3.

Index terms: selectivity, *Trichogramma pretiosum*, *Telenomus remus*, *Doru luteipes*, *Campoletis flavicincta*

[2675] ANALYSIS OF RESIDUES OF SULFLURAMIDA IN GRASS AND SOIL AS WELL AS EFFICIENCY OF THE PRODUCT "MIREX-S MAX®" IN THE CONTROL OF *ATTA CAPIGUARA* GONÇALVES, 1944 (HYMENOPTERA: FORMICIDAE)

L. C. Forti[1], V. M. Ramos[1] & A. P. P. Andrade[1], [1]Dept. de Produção Vegetal, Faculdade de Ciências Agronômicas, UNESP, Campus de Botucatu, P. O. Box 237, S.P, 18603-970, Brasil, E-mail luizforti@fca.unesp.br.

The present study implanted in pasture areas of Santo Antônio Farm, Pirajuí-SP, had for objective to evaluate the efficiency and the levels of residues of Sulfluramid, in grass and soil samples found around and on the nests of *Atta capiguara*, treated with the commercial product Mirex-S Max®, a toxic bait formulated with attractive substrate (orange pulp and vegetal oil), added with 0.3% of the active principle Sulfluramid. A similar study has already been accomplished for *Atta capiguara* with toxic baits containing the active principle dodecachlor. In the accomplishment of this experiment, 10 nests of *Atta capiguara* were used receiving the application of the commercial product Mirex-S Max® in the recommended dose for the control (10 g/m²), 05 of them were randomly chosen to compose the soil and grass samples to be analyzed, one of the nests being the witness. For the evaluation, the collection of the samples was made at the 20th and the 200th day after the application of the product. The soil samples were collected in 10 points of the area of each nest in a depth of 30 cm, and mixed in plastic bags for later removal of approximately 1kg of soil, forming one sample composed of each nest. The grass samples were collected on 5 of the 10 sampled points and were similarly mixed in plastic bags to make up 1kg of sample composed of the area of each nest. Those samples were baled properly and frozen at -18ºC in a freezer, staying in that temperature until the moment of the analyses-accomplished in the TASQA Laboratory Analytic Services Ltd., where all the residue study was accomplished using a validated methodology for this active principle. In the analyses, Sulfluramid was extracted through organic solvent and recovery studies were driven in the level of concentration of 0.1 mg/kg, whose obtained results were of 112.0% for the grass and 85.9% for the soil. The used detection limit was of 0.1 mg/kg and for quantification 0.03 mg/kg, where residues of Sulfluramid were not found in none of the soil and grass samples, so much in the samples collected at the 20th as well as in those collected at 200th day after the application of the product. The mortality of the nests was evaluated at 200th day after the application of the product; 90% of efficiency was obtained.

Index terms: sulfluramid, residue, control, leaf-cutting ants

[2676] CITRUS LEAFHOPPER IPM IN AUSTRALIA - ALTERNATIVE HOSTS FOR ENHANCEMENT OF MYMARID EGG PARASITOIDS?

C.G. Freebairn & D. Smith, Department of Primary Industries, Maroochy Research Station, PO Box 5083, SCMC Nambour, Australia, 4560. E-mail: Freebac@prose.qld.dpi.gov.au

Empoasca smithi is a major pest of the valuable early varieties Imperial mandarin & Navel orange, and in bad years also of the later Ellendale mandarin. Adults attack green mature and ripening fruit in autumn when flush growth, on which they breed from spring through autumn, hardens off. Dispersing adults from nearby non-target varieties such as Ellendale, Hickson & Murcott mandarins can cause up to 40% damage between monitoring visits. Uncontrolled infestations can destroy 100% of fruit. The mymarid *Stethynium* sp. can parasitise up to 100% of eggs and if undisrupted by organophosphates can control citrus leafhopper (CLH). However, insecticides are often required for adequate control, particularly in mid-autumn when dispersing adults arrive in susceptible varieties. Endosulfan at 30ml/100L in 5-6,000 L/ha is very effective, but reapplication 10-14 days later is required to kill nymphs hatching from eggs. Dimethoate and methidathion also become ineffective 3-7 days post-application and are disruptive of IPM. Buprofezin, soon to be registered, is effective and IPM compatible. Imidacloprid, efficacious for 21 days as a foliar spray but IPM disruptive, shows potential as a drench application. CLH in nature breeds on a range of hosts including castor oil (CO), *Ricinus communis* (our lab. host); *Solanum nigrum*; *Celtis sinensis*; *Cestrum* sp. and *Ficus coronata*. On castor oil on river banks the lucerne leafhopper *Austroasca alfalfae* usually predominates. *Stethynium* sp. is found here with *Anagrus* sp., which is widespread but rare in citrus. When released into an orchard in transplanted CO, *Anagrus* sp. established, controlled CLH within months but then returned to its usual rare state. CO transplants were attractive to CLH even when citrus flush was present - all but the oldest leaves are suitable for CLH oviposition and development. Thus CO planted in or near orchards may enhance parasitoid efficacy by providing inter-flush stability for *Stethynium* sp. and by increasing the contribution of *Anagrus* sp. It also may have potential to distract adults from fruit when flush declines in autumn. *C. sinensis* is similarly attractive to CLH, though perhaps less suitable for breeding. It also hosts an unidentified leafhopper. *Stethynium* sp. has been recovered from yellow traps and from a few leafhopper eggs, probably of CLH. Incorporating either CO or *C. sinensis* into citriculture may be problematic as neither is suitable for inter-row cultivation. Recent work in lucerne, *Medicago sativa*, which is far more amenable to inter-row cultivation, suggests that it may be the major source of *Anagrus* sp. - probably from *A. alfalfae* &/or *A. viridigrisea* eggs - and thus the key to future insecticide free IPM of citrus leafhopper in Australia.

Index terms: *Empoasca smithi*, *Stethynium* sp., *Anagrus* sp., *Ricinus communis*, *Celtis sinensis*.

[2677] FIELD TRIALS WITH PREMISE (IMIDACLOPRID) TERMITICIDE FOR CONTROLLING FORMOSAN SUBTERRANEAN TERMITES IN TREES IN NEW ORLEANS, LOUISIANA

E. D. Freytag[1] & J. H. Cink[2], [1]New Orleans Mosquito & Termite Control Board, 6601 South Shore Harbor Blvd., New Orleans, LA 70126, USA, E-mail: efreytag@usa.net; [2]Bayer Agriculture Division, Bayer Corporation, 8400 Hawthorn Road, Kansas City, MO 64120, USA, E-mail: jim.cink.b.@bayer.com.

The Formosan subterranean termite (FST), *Coptotermes formosanus* Shiraki, is considered one of the most destructive pests of wooden structures in the United States in areas where it has become established. In New Orleans, the FST is also the most destructive pest of trees, causing approximately $6,000,000 in damage per year. The FST attacks the heartwood of living trees, which leads to weakening of the internal structure. Field trials were conducted in 1998 to determine the efficacy of Premise (imidacloprid) termiticide to control FST infestations in growing mature shade and ornamental trees. A 0.05% Premise solution (expanded to a 15:1 foam:water ratio) was injected into the tree cavities of infested trees using a 15.5 L foaming machine via 1.27 cm access holes. A total of 25 trees were treated, 15 trees were treated with Premise and 10 trees, serving as controls, were treated with water and foam only. Active sites on the exterior of the trees were tagged and used as pre and post-treatment monitors. The data in 1998 indicate that the treatment reduced the positive trees to an average of 28.4% compared to 85.0% in the untreated controls. The number of active monitoring sites in the treated trees was reduced to an average of 6.7%, while in the untreated controls 40.8% of the monitoring sites remained positive. In 1999, 67.5% of the untreated controls were positive with 40.8% of the monitoring sites active, while in the treated trees 14.7% of the trees were positive and only 3.4% of the monitoring sites were active. Inspection of the trees in Spring 2000 revealed that 87.5% of the untreated controls were positive with 50.7% of the monitoring sites active, while in the treated trees 35.7% of the trees were positve with termites active in 11.8% of the monitoring sites. Some of the activity noted in 2000 was from termites attacking the tree from the soil and were not found to be infesting inside the Premise treated tree. The voids or galleries of treated trees with active observation sites were inspected with a flexible endoscope, but no termites were inside the tree as compared to the untreated controls. This may indicate that re-infestation may be occurring in or on the treated tree. The soil around the trees was not treated with Premise. The data indicate that Premise foam injections inside trees significantly reduced or eliminated the FST activity.

Index terms: *Coptotermes formosanus*, foaming machine, access holes, monitoring sites, flexible endoscope, galleries.

[2678] THERMAL IMAGING FOR THE DETECTION OF SUBTERRANEAN TERMITES AND DAMAGE

E. D. Freytag[1], C. J. Leonard[1], & R. F. Melia[2], [1]New Orleans Mosquito & Termite Control Board, 6601 South Shore Harbor Blvd., New Orleans, LA 70126, USA, E-mail: efreytag@usa.net; [2]Real-Time Thermal Imaging, L.L.C., 32 Clevner Dr., Kenner, LA, 70065.

Formosan subterranean termites (FST), Coptotermes formosanus Shiraki, and the native subterranean termites, Reticulitermes spp., are the most destructive pests of wooden structures in the United States. It is estimated that between $1 to $2 billion dollars are spent each year in the detection, treatment and replacement of damaged wood as a result of termite infestations. Perhaps the most important step prior to initiating treatment procedures is the inspection of the structure to determine the extent of the damage and whether active termites are present. Detection equipment, such as moisture meters, acoustical devices, miniaturized flexible boroscopes and other devices have been available for many years but are too limiting or laborious to use. The infrared, or thermal imaging system, is current technology that has been recently developed for the detection of live termites and damage. Emitted thermal imaging systems using 7-12 □*m infrared range is* used to detect damage, termite activity, moisture and insulation problems in houses and commercial buildings. Because subterranean termites maintain their colonies and galleries at constant temperature and moisture levels, difference between ambient temperature and actual termite activity show up as warm or cool areas with distinctive patterns. Damaged wood, condensation or water leaks, and missing insulation were visible to the thermal sensor but required specialized training to be properly identified. The thermal sensor is capable of detecting temperature differences of 0.017 °C, which are rendered as two-dimensional images in 264 shades of gray. The images were captured on tape with a Hi8 mm video camcorder. Because the human eye is only capable of discerning 64 shades of gray, specialized software is used to enhance subtle differences by rendering them in color. The images are analyzed for particular patterns and are printed for use in the field.

Index terms: Coptotermes formosanus, Reticulетermes spp., acoustical devices, boroscopes, infrared, emitted thermal imaging

[2679] TRANSGENIC PLANTS; AN ENVIRONMENTALLY-FRIENDLY METHOD OF PEST CONTROL?

A. M. R. Gatehouse[1] & J. A. Gatehouse[2], 1 Agric. & Environmental Science, Univ of Newcastle, Newcastle NE1 7RU, UK. 2 Dept Biological Sciences, Univ. of Durham, Durham DH1 3LE, UK.

With a projected increase in world population of 9-10 billion over the next four decades, an immediate priority for agriculture is to achieve maximum production of food and other products. Unfortunately the price for achieving such levels can be too high, with irreversible depletion or destruction of the natural environment making certain agricultural practices unattainable in the longer term. Whilst pesticides are very effective in combating the immediate problem of insect attack on crops, and have been responsible for dramatic yield increases in crops subject to serious pest problems, non-specific pesticides are harmful to beneficial organisms including predators and parasitoids of those target pest species. In response to public concerns, the agrochemical industry has introduced a number of less harmful and less persistent pesticides. The emergence of technologies that have allowed plants to be stably transformed with foreign genes has been timely, with the commercial introduction in 1996 in US of crops expressing genes encoding the insecticidal □-endotoxin from *Bacillus thuringiensis*. Although not as yet a commercial reality, other strategies for engineering crops to give endogenous resistance to insect pests, such as the use of plant-derived genes encoding defensive proteins (enzyme inhibitors and lectins), genes encoding other insecticidal proteins, and novel solutions such as manipulating plant secondary metabolism, are actively being pursued. Combinations of these and other emerging transgene-based crop protection methods will increase both the range and durability of resistance. To avoid the possibility of pests becoming resistant to transgenic insect-resistant crops, and for a variety of other reasons, deployment of transgenic insect-resistant crops is taking place as part of a recommended stratgey of integrated pest management (IPM); consequently, the engineered crops must be compatible with the other components of IPM. Thus ideally, genes expressed in transgenic plants for control of pest species should at the same time produce no directly deleterious effects on beneficial insects (predators and parasitoids) which play an important role in biological control. Inevitably, the removal of the host or prey for beneficial insects will be deleterious, but any toxic effect of the transgene product will decrease the viability of biological control. It may also indicate that widespread use of transgenic crops could have undesirable ecological consequences, such as global reductions in beneficial insect populations; however, it is important that the effects of such crops on beneficial organisms are compared with the effects of current agricultural practices. This paper will discuss the role of GM crops in agricultural systems and their potential environmental impact on natural enemies of insect pests, and will consider both the deployment of Bt expressing crops, and those expressing a range of plant-derived genes.

[2680] EFFECT OF INSECT RESISTANT AND SUSCEPTIBLE GENOTYPES ON SURVIVAL AND INSTAR LENGTH OF *NEZARA VIRIDULA* (HETEROPTERA:PENTATOMIDAE)

D. L. Gazzoni[1] & E. D. M. Oliveira[2], [1]Centro Nacional de Pesquisa de Soja (CNPSo), Empresa Brasileira de Pesquisa Agropecuária (EMBRAPA), Caixa Postal 231, 86001-970 Londrina, PR, E-mail gazzoni@cnpso.embrapa.br; [2]Universidade Estadual de Londrina, Departamento de Agronomia, Caixa Postal 6001, Londrina, PR, 86051-970, Brasil. E-mail: emerson@cnpso.embrapa.br

Two laboratory tests were conducted aiming to evaluate the survival and length of instars of *Nezara viridula* nymphs, feeding on susceptible and resistant soybean genotypes, represented by commercial varieties from Brazil and USA, and breeding lines from the Brazilian breeding programme. Immediately after the oviposition, the insects were placed in Petri dishes containing fresh pods of the tested genotypes. The pods were changed each other day, during the whole experiment. Insects were daily observed to record survival and length of the instars. High mortality of first instar nymphs was observed when insects fed on the line BRT92-10644 or the cultivars IAC-17 and IAC-100. Stink bug nymphs fed on BRT92-10868, BRT92-10644 or 'Crocket', in both tests and 'Lamar' in one of the tests, had nymphal stage extended when compared to the control. Extended cycle and high mortality of bugs indicate that BRT92-10644 is not an adequate food source for stink bugs.

Index terms: stink bugs, plant resistance, insect biology.

[2681] FIELD EVALUATION OF SOYBEAN INSECT RESISTANT LINES

D. L. Gazzoni[1] & G. Martins[2], [1]Centro Nacional de Pesquisa de Soja (CNPSo), Empresa Brasileira de Pesquisa Agropecuária (EMBRAPA), Caixa Postal 231, 86001-970 Londrina, PR, E-mail gazzoni@cnpso.embrapa.br; [2]Undergraduate student, Universidade Estadual de Londrina.

Aiming to evaluate the reaction of soybean lines to the attack of the complex of stink bugs, 67 genotypes, divided in three experiments by cycle (early, medium and late) were investigated. Due to the higher number of lines, the early genotypes group was divided into two experiments. Plots consisted of 4 rows of 4m of soybean each one. For evaluation the stink bugs population (medium and large size nymphs from 3rd – 5th instar and adults), soybean yield, seed quality and agronomic treats. Insect population sampling started when soybeans reached the R_1 growing stage, by using the beat cloth method, with four samples per plot taken once a week. When the population approached the decision levels, the frequency was increased to two samples/week. When the stink bug population reached 8 insects/sample (twice the presently recommended economic damage level), an application of endosulfan at 525g ai/ha was performed. At the end of the cycle two meters of the two central rows of each plot were harvested for evaluation. No lines with simultaneous high productivity and high seed quality were observed. The breeding lines BRQ 93-357, BRT 91-14888 and BRT 91-13431 showed improved seed quality and reduced stink bugs population, thus requiring less insecticide application, and were recommended for backcross to improve agronomic treats.

Index terms: stink bugs, host plant resistance, seed quality.

[2682] EXPERIMENTAL VARIABILITY OF SOYBEAN BENEFITIAL INSECTS SAMPLING METHODS

D. L. Gazzoni[1], L C. Corso[1] & P. C. Francovig[2], [1]Centro Nacional de Pesquisa de Soja (CNPSo), Empresa Brasileira de Pesquisa Agropecuária (EMBRAPA), Caixa Postal 231, 86001-970 Londrina, PR, E-mail gazzoni@cnpso.embrapa.br; [2]Undergraduate student, Universidade Estadual de Londrina.

The shock insect sampling method is derived from the beat cloth method, and was developed to overcome the low performance of the latest on sampling small and easy flying insects, like parasitoids of the orders Diptera and Hymenoptera, and to a less extent, predators of the orders Coleoptera and Hemiptera. Instead of beating soybeans to displace insects, supposedly falling onto the beat cloth, a potent and broad spectrum insecticide is applied on a very high rate. The logic is that insects are quickly affected by the insecticide, preventing them from leaving the area, and being killed in minutes, thus falling straight direct to the cloth placed in the soil, between the soybean rows. The cloths were examined 15 minutes after the insecticide application, and the insects transferred to labeled plastic bags for laboratory counting. To compare results obtained by sampling insects with the beat cloth, the shock and the sweep net methods, 5 experiments were set up in Londrina-PR, Brazil. Results indicated that the number of predators collected by both shock and beat cloth are similar, but the shock method extracted a consistently higher number of species of the orders Diptera and Hymenoptera. The experimental data variability, as measured by a binomial model obtained from the dispersion of standard deviation in each sampling date, demonstrated that the shock method has a consistent lower variability index. The sweep net extracted less insects and presented the highest dispersion of the standard deviations. These results can easily been explained due to the less disturbing procedures for insect sampling, on comparing either sweep net or beat cloth to the shock method, as plants are not even touched or approached, because insecticide is applied with a bar sprayer long enough to avoid walking close to the sampling area.

Index terms: parasitoids, predators, shock sampling method, beat cloth, sweep net.

[2683] EFFECT OF COMBINED EFFECT OF HPR AND INSECTICIDE ON SOYBEAN PESTS

D. L. Gazzoni, Centro Nacional de Pesquisa de Soja (CNPSo), Empresa Brasileira de Pesquisa Agropecuária (EMBRAPA), Caixa Postal 231, 86001-970 Londrina, PR, E-mail gazzoni@cnpso.embrapa.br.

In order to study the effect of combined effect of host plant resistance and insecticide application on the survival of the velvetbean caterpillar (VBC) *Anticarsia gemmatalis*, five experiments were set up on the Embrapa Soja entomology laboratory (Londrina-PR). Fresh leaflets of the uppermost completely developed leaves of BR-16 (susceptible) and IAC-100 (resistant) commercial varieties were collected in the field each other day, being sterilized in the laboratory and conserved on the refrigerator at ± 5° C. A set of gerbox were prepared with filter paper in the bottom. At the beginning of the investigation, only one box was used for each variety, in order to avoid the bias effect of stressing larvae by either rearing them apart from one another, and also by manipulating them during the early stages. Inside each box a soybean leaflet, with its petiole involved with humid cotton ball, was placed besides a chart with ca. 50 two days old *A. gemmatalis* eggs. After egg hatching, the larvae were observed daily, data regarding survival and development were recorded, and food supplied whenever necessary, but not later than the second day. During the experiment, boxes containing the larvae were maintained on a BOD chamber regulated for 27° C ±1°C, average air humidity on the range of 70-80%, and photo phase of 14h light:10h dark, simulating the summer conditions for the Londrina region. When the larvae reached the 3rd instar, 10 larvae were maintained in boxes, containing a soybean leaflet of the same variety they were been reared on. When the larvae changed to the 6th instar (about 50 mm long) they were individually isolated on single boxes, using only 30 boxes for each variety. Discs measuring 10 cm^2 were cut from the soybean leaflets. Discs received an application of 25µl of five different rates of endosulfan, each other rate doubling the insecticide concentration, plus the check where the discs received only distilled water. On the first day three discs were placed in each box, and they were replaced whenever necessary, according to observations made twice a day. On one of the assessments, data regarding insect survival were recorded. Non consumed discs or part of them were collected and measured, to establish the exact amount of food the insects ingested. Evaluations were made during the whole sixth instar (up to 96 h) and also the adult hatching from the pupa was observed. Results indicated that larval mortality increases progressively along the evaluation time during the 6th instar, showing a delayed effect of mortality factors (insecticide or plant resistance associated compounds). In all experiments the larval mortality observed on *A. gemmatalis* feeding on the resistant IAC-100 variety, indicating that a synergism or interaction occurs between the two mortality factors, probably due to higher insecticide susceptibility of larvae stressed by feeding inadequate food present on resistant variety.

Index terms: *Anticarsia gemmatalis*, IAC-100, interaction of mortality factors.

[2684] AN EVALUATION OF THE BRAZILIAN SOY-IPM PROGRAMME

D. L. Gazzoni, Centro Nacional de Pesquisa de Soja (CNPSo), Empresa Brasileira de Pesquisa Agropecuária (EMBRAPA), Caixa Postal 231, 86001-970 Londrina, PR, E-mail gazzoni@cnpso.embrapa.br.

During the early 1970s, a survey demonstrated that insecticides were the exclusive soybean pest control method. An average of 6 applications/season were made, using very high toxic and environmentaly hazardous insecticides, and also at far higher rates than needed. To address this situation a Soybean Integrated Pest Management program (Soy-IPM) was designed, validated and implemented in Brazil, starting in 1975. The process represented an interaction between R & D institutions (Universities, Research Institutes), Extension and Technical Assistance Institutions (Former EMBRATER system, Cooperatives, Private Offices, NGOs), leaded by Embrapa Soja. Early studies and implementation were set up simultaneously at Parana and Rio Grande do Sul states, followed by quick spreading to all over the Brazilian soybean cultivated region. The peak for IPM adoption (ca. 70%) happened during the 1982/83 growing season, after intensive integrated efforts to expand the program. Nowadays, an adoption index of 40% was observed from the surveys made at the grower level. Financial accumulated returns for the last 25 years are estimated to vary from conservative US$750 million to in excess of US$4 billions, according to calculation methodology. The gross value of harvested Brazilian soybean for the last season, at the farm level, was US$4.7 billions. The accumulated EMBRAPA's overall budget for the last 25 yr ranked bellow US$6 billions, and these figures are very useful to establish the cost/benefit ratio for the Soy-IPM. A recent survey made with official and private technical assistant professionals showed that biological control of velvetbean caterpillar is estimated to be used on 10% of Paraná State soybean farms, while use of the mixture of sodium chloride plus insecticide to control soybean stink bugs reaches almost 25% of the soybean area, in the same state. This last technique, developed by Embrapa, allows the reduction of the insecticide rate by 50%, with the same effects observed on the pests when the insecticides are applied at the full rate. For the control of stink bugs, Soy-IPM users applied once a season against 1.4 applications for non adopters. As for the control of the VBC non-users applied 1.8 sprayings/seasons against 0.6 sprayings for the Soy-IPM users. Endosulfan and monocrotophos represented 37% of the insecticide used to control VBC and 73,5 of the pesticides applied for stink bug control.

Index terms: Integrated Pest Management, soybean pests, biological control.

[2685] DAMAGE LEVELS OF STINK BUGS ON SEED PRODUCTION OF SOYBEAN VARIETIES

D. L. Gazzoni[1] & A. Nakamura[2], [1]Centro Nacional de Pesquisa de Soja (CNPSo), Empresa Brasileira de Pesquisa Agropecuária (EMBRAPA), Caixa Postal 231, 86001-970 Londrina, PR, E-mail gazzoni@cnpso.embrapa.br; [2]Undergraduate student, Universidade Estadual de Londrina.

A field experiment was conducted during the 1995/96 soybean growing season with the goal of evaluating the effect of different populations size of the stink bug complex (mainly *Euschistus heros*, *Piezodorus guildinii* and *Nezara viridula*) on the yield, seed quality and the most important agronomic treats of three soybeans commercial varieties, EMBRAPA 4, EMBRAPA 48 e BR-36. The stik populations were considered to be up to two and four specimens per soybean meter of row, in addition to natural insect population. The plots measured ca. 1 ha each, and were replicated three times using a random block design. The insect samplings started when soybeans reached the R_1 growing stage, and were performed weekly, increased to twice/week when the established insect limit levels for the treatments where approached. To maintain the desired up to two and four specimens levels, an insecticide application using endosulfan at 525 g ai/ha was performed once the population reached the established levels. At the end of the cycle, 4 m of row of soybeans were harvested in six different locations inside each plot. The overall stink bug average population for the whole season was 2.1/m of soybean row, more than twice the recommended 1/m of row. Statistical differences were observed only between variety yields and for the amount of punctures on the seeds, as evaluated by the tetrazolium test. Results indicated that the tested levels of the stink bug complex population did not affect the soybean yield or the quality in terms of visual quality, vigor and emergency indexes, or the most important agronomic treats. It was concluded that the present economic damage level of 1 stink bug per meter of soybean row for seed production is conservative and incorporates a large safety margin to avoid negative impacts on yield or quality of soybean.

Index terms: seed quality, soybean yield, action levels.

[2686] VARIABILITY OF SOYBEAN INSECT SAMPLING METHODS

D. L. Gazzoni & I. C. Corso, Centro Nacional de Pesquisa de Soja (CNPSo), Empresa Brasileira de Pesquisa Agropecuária (EMBRAPA), Caixa Postal 231, 86001-970 Londrina, PR, E-mail gazzoni@cnpso.embrapa.br.

The beat cloth is the official recommended methodology for sampling soybean insects pests, both for experimental purposes or for insect population assessment on soybean fields where Insect Pest Management Programs are carried out. The shock method was develop from the beat cloth by substituting the plants beat and shaking by the application of a powerful and broad spectrum insecticide at high rates, aiming to quickly kill all insects on the sampling area. Dead insects are collected on a cloth placed on the soil, between soybean rows. The two sampling methods plus the sweep net were compared in a set of five experiments set up in the Londrina (Brazil) region. The sampled area was similar for all the methods, and collected insects were placed on plastic bags and transferred to the Embrapa Soja entomology laboratory for counting. Results indicated that the beat cloth and the shock methods are equivalent for sampling the VBC, *Anticarsia gemmatalis* and also for the main stink bugs that attack soybeans, while the sweep net consistently collected less insects. The time required for sampling a given area was not different when using beat cloth or the shock method, while the time needed for evaluation of the samples under laboratory conditions was reduced in 30-50% as compared to the beat cloth or the net. The variability of the samplings by each method was measured by using an indicator index with binomial distribution, obtained from the plotting of the number of each species of insects collected on each sampling date. Results indicated a significantly higher variability when using the sweep net, for all the considered insects. Beat cloth and the shock method showed equivalent variability for *A. gemmatalis*, but estimates for stink bugs samplings were more precise when using the shock method.

Index terms: beat cloth, shock method, soybean insects.

[2687] EVALUATION OF SOYBEAN LINES WITH PARENTALS BACKGROUND RESISTANT TO STINK BUGS

D. L. Gazzoni[1] & R. Sambugaro[2], [1]Centro Nacional de Pesquisa de Soja (CNPSo), Empresa Brasileira de Pesquisa Agropecuária (EMBRAPA), Caixa Postal 231, 86001-970 Londrina, PR, E-mail gazzoni@cnpso.embrapa.br; [2]Undergraduate student, Universidade Estadual de Londrina.

During the 1996 soybean season four field experiments were conducted aiming to compare 82 soybean genotypes from the Embrapa Soja stink bug resistance program. The lines were divided by its cycle (early, medium and late), and the early maturity group was also divided in two experiments, due to the high number of entries. Soybeans were sowed on late November on plots of 4 m of four soybean rows, replicated four times. Stink bugs were sampled weekly using the beat cloth method, starting when each line reached the R_1 growing stage, and large nymphs (>5 mm) and adults were counted. An application of endosulfan at 525 g ai/ha was performed on each plot whose stink bug population surpassed 4 specimens per meter of row (twice the recommended EDL). For higher precision of the pest control, samplings during the insect peak population were made twice a week. At the end of the soybean cycle, 2 m of each central row of the plots were harvested to evaluate yield, seed quality and agronomic treats. No differences for foliar retention were found on maturity groups N and O, but on the M group the standard varieties showed significant higher retention than the breeding lines, and the line BRQ94-7318 was the only to loose all the leaves and without green stems. This line produced 3145 kg/ha, and the highest indexes for vigour and germination were associated to this line. The genotype BRQ94-9455 showed the lowest index of damaged seeds, and also the smallest seed weight, a treat considered associated to resistance to stink bugs. On the N group the line BRQ94-2937 showed an index of 55% of no damaged seeds, yielding 4274 kg/ha. On the O group, BRQ94-13431 presented the highest yield (3051 kg/ha), the highest index of no damaged seeds (55%) and the lowest index of damaged seeds (3%). These lines were recommended for further evaluation on the breeding program.
Index terms: HPR, seed quality, breeding lines.

[2688] A PROPOSAL FOR ERADICATING FRUIT FLIES FROM WESTERN PERU

D. L. Gazzoni, Centro Nacional de Pesquisa de Soja (CNPSo), Empresa Brasileira de Pesquisa Agropecuária (EMBRAPA), Caixa Postal 231, 86001-970 Londrina, PR, E-mail gazzoni@cnpso.embrapa.br.

Western Peru is characterized by arid conditions observed along the 1.500 km of the country coast. Soils are sandy and precipitation is almost absent during all year. Sources of water for irrigation are underground water or rivers formed by unfreezing snow and ice on the top of the Andes. There are about 52 of these rivers running East-West, forming valleys were crops are grown. Climatic conditions are not favorable for the majority of pests, and along with the intense solar radiation, adequate temperature, and the vicinity of seaports make the geographical location ideal for international trade. However, several species of fruit flies are endemic to the region, according to surveys made by Peruvian and foreign investigators. The flies survive on small orchards, domestic single fruit plants, ornamental species and native species present in oasis and along the river valleys. The situation was considered ideal for a fruit fly eradication programme, because the affected area is a strip ca. 1500km long (North – South) to 30 – 100 km (East – West). Limits are Chile on South, which is a pest free area, and a small border joint program previously existed to protect the Chilean border; the Andes on East, with mountains ranging from 4 – 6,000 m high, a natural barrier for the flies; the Pacific at West and Equator on North. The proposal comprised a five year program, aiming to achieve advances of 300 km each year of pest free areas, starting from South to North. Transit control barriers were planned to be located on the Panamericana Road, the only long range road running North – South, and on roads coming from the East, to avoid contaminated products entering the area. Barriers were to move yearly to follow the advancement of the pest free zone. Other regulatory measures were also proposed to protect the free area. A comprehensive programme including a survey for the identification of the fruit fly dominant species, its hosts and damages was designed. Proposed fly control measures included fly population monitoring, cultural practices, fly trapping and destruction, affected fruit destruction, biological control, chemical control and the releasing of male sterile specimens along the area. The project was submitted to an international development bank to fund the programme.
Index terms: Pest free area, biological control, sterile male technique.

[2689] MANAGING THE BOLL WEEVIL ON COTTON IN PARAGUAY

D. L. Gazzoni, Centro Nacional de Pesquisa de Soja (CNPSo), Empresa Brasileira de Pesquisa Agropecuária (EMBRAPA), Caixa Postal 231, 86001-970 Londrina, PR, E-mail gazzoni@cnpso.embrapa.br.

The introduction of *Anthonomus grandis* (bicudo) into Brazilian cotton areas represented a serious constraint for cotton growers, who faced increasing costs and reduced yield and quality. In several producing regions, growers moved to other crops with higher pay-off, and in the northeastern area of the country the cotton was almost wiped out. Paraguay has a long border with Brazil, next to the cotton producing area, including a dry frontier, where an intense movement of plants and reproductive parts exists without official control. Cotton is considered a cash crop for the majority of the small Paraguayan growers (campesinos), that usually plant corn, rice, beans, some vegetables, cassava and fruits and also raise milk cows, pigs and hens for the family consumption. Cotton is traded by the local merchants (acopios) to make the necessary money to buy agricultural inputs, and is almost always the unique source of income for the growers. In this situation, more than economical, the social importance of cotton made it imperative to implement an Integrated Pest Management Program to create the necessary conditions for the grower to continue planting cotton, thus avoiding the migration to metropolitan areas and increasing poverty. The program was designed with the Paraguayan Government support and was partially funded by an international development bank. A network was designed involving key researchers from National Research Institutes, and the Extension System was reformulated and funded to give the technical support for the program. A comprehensive Integrated Pest Management Program was proposed including cultural practices (early planting, stimulation of rapid plant growth), selection of early maturity varieties, A scouting program was designed to accomplish the pest population, and chemical insecticides were recommended to be used with less impact to the environment, specially to beneficials. Recommendation was to perform an insecticide application when 10% of the squares were punctured. Cotton plants rests and debris should be destroyed, according to the regulatory measures issued by the Plant Protection Department. Also an official program was established to stimulate growers to adopt the IPM program, including the on season and off season proposed measures. Cotton IPM adopters thoroughly following the recommendations, as evaluated by the Government Inspectors received special funding conditions and free cotton seeds.
Index terms: *Anthonomus grandis*, IPM, chemical control.

[2690] QUARANTINE INTELLIGENCE, A NEW APPROACH TO REDUCE THE RISK OF INTRODUCTION OF QUARANTINE PESTS

D. L. Gazzoni, Centro Nacional de Pesquisa de Soja (CNPSo), Empresa Brasileira de Pesquisa Agropecuária (EMBRAPA), Caixa Postal 231, 86001-970 Londrina, PR, E-mail gazzoni@cnpso.embrapa.br.

A proposal was made to the Brazilian Plant Protection Authority, to address the risk of introduction of quarantine pests. After the creation of the World Trade Organization (WTO) in 1994, and the increasing liberalization of the consequent international trade, the diversification of trade partners and the continuous escalating amount of agricultural products traded proportionally increased the risk of a quarantine pest entering a formerly free area, despite the official quarantine barriers and inspection procedures to protect the country entry points. Besides the enhancement of these systems, and the set up of a comprehensive surveillance system aiming to early detection of newly introduced pests, the need for strategic plans was considered. The program was denominated by quarantine intelligence and comprised the prospecting of the possible pest hazards and risk analysis from the standpoint of the likelihood of its introduction and establishment in the country, and the damages the pest could cause to the affected crops. Once it was decided which pests constituted the highest risk of introduction for the next five years, and for the most important Brazilian crops, an official officer was assigned to be the "repository" of all necessary information for a given number of quarantine pests. All important literature should be reviewed, the conditions of the pest on the origin and other affected area should be assessed and the set of possible control measures established. Recommendations for the quarantine, inspection and surveillance systems should be issued, with special attention for the detection of the considered pests. Contingency plans should be developed to form a quarantine emergency ready-to-use procedures, including all technical, legislative and regulatory ones. The Authority budget must allocate every year a reasonable provision of funds to be used just in case a new pest is to be detected. Plans and information should be continuously updated in order to be easily put into action when necessary.
Index terms: Surveillance, inspection, emergency procedures.

[2691] BIOLOGICAL CONTROL AS AN OPPORTUNITY FOR SMALL BUSINESS

D. L. Gazzoni, Centro Nacional de Pesquisa de Soja (CNPSo), Empresa Brasileira de Pesquisa Agropecuária (EMBRAPA), Caixa Postal 231, 86001-970 Londrina, PR, E-mail gazzoni@cnpso.embrapa.br.

Unlike chemical insecticides, which are supported by a background of expertise, technology, marketing strategy and other conditions for its expansion, biological control does not constitute a big business and does not attract major investors. Most of the time, biological control is associated with handcraft procedures or official institutes subsidized programmes. Following a request of an international development bank, interested in developing a model for stimulating the biological control techniques, and creating new small business opportunities, a program was designed to be implemented as a pilot area in Peru. Financial and credit support, the need for networking and association of the involved small businessmen, the development of rearing, processing, packaging, transportation, quality control and program evaluation were detailed. Training and technical asistance programs were outlined, and a reference laboratory was set up. Instructions on how to initiate a business were prepared to be used by the interested people. Recommendations were made for the necessary government actions, using the Plant Protection Authority, the University System and the Research Institutes. The program contemplated an initial group of ca. 100 interested people, dedicated to the production and selling of parasitoids, specially of the genus *Trichogramma*, entomopathogenic baculoviruses and fungi.
Index terms: *Trichogramma*, baculovirus, entomopathogens.

[2692] A MODELING APPROACH TO IDENTIFY WEAKNESSES AND STRENGHTENING PLANT PROTECTION SYSTEMS

D. L. Gazzoni, Centro Nacional de Pesquisa de Soja (CNPSo), Empresa Brasileira de Pesquisa Agropecuária (EMBRAPA), Caixa Postal 231, 86001-970 Londrina, PR, E-mail gazzoni@cnpso.embrapa.br.

With the creation of the World Trade Organization, comprising all the most important countries for the international market, a set of rules were approved to help implementing the concept of free trade. With the elimination of trade barriers, and the reduction on importation taxes, the new environment shifted its paradigm to new parameters. In the agricultural sector, the Sanitary and Phytosanitary Measures Agreement (SPS) introduced the directives for the rules to be observed on national legislation, and for the international trade. Importing countries are getting very strict regarding the compliance of the international standards or its own regulations, once harmonized with the SPS agreement. These considerations made the Plant Protection Authorities important players of each country International Trade Policy, and the delivery of its service is ever-increasing demanded by the private sector. The need for more services, timely and of improved quality, and the international accreditation of the certification sets a key issue the adherence of the Sanitary Organizations to high standards of performance. A new methodology was developed and implemented to help Plant Protection Systems to identify weaknesses, need for improving existing programs and for the implementation of new ones. Modeling the "real world", including international and local market with all the possible actors along the production chain, from agricultural inputs to the table help identifying the potential clients of the system. Then exercising the modeling of the sub-systems that composes the Sanitary System provide a tool for identifying the real need for the present services, its standard of quality and its contribution for enhancing the country competitiveness on the international market. Systems should necessarily include its starting points (source of information or request), the processes and the necessary tools, the outputs and its users. Links between the subsystem composing a major system should be evaluated, and also the links of the consolidated system to the "real world" model should be exercised to define the priorities for improving the sanitary services delivery.
Index terms: plant health, sanitary systems, international trade.

[2693] MONITORING AGRICULTURAL PESTS THROUGH AN IMPROVED SURVEILLANCE SYSTEM

D. L. Gazzoni, Centro Nacional de Pesquisa de Soja (CNPSo), Empresa Brasileira de Pesquisa Agropecuária (EMBRAPA), Caixa Postal 231, 86001-970 Londrina, PR, E-mail gazzoni@cnpso.embrapa.br.

Quarantine pests are a serious treat to agricultural systems, and the main reason for the continuous strengthening of Plant Protection Systems. The Systems are likely composed of permanent or transitory sub-systems as Quarantine (Plant Inspection, Post-Entry Quarantine, Treatment facilities), Plant Pest Surveillance and Traceback, Laboratory complex, Sanitary Education, Research and Extension. Each one of the sub-systems plays a major role to make the whole system be an important tool to the fulfillment of the overall mission of protecting the consumer health and the production environment. The perfect integration and operation of the sub-system will end with improved sanitary services and international accreditation for the organization among the international trade players, international sanitary organizations and other countries Plant Protection Official Services. The major role of a Surveillance sub-system is to provide means for early detection of newly introduced quarantine pests, as well as make a complete and permanent follow up of the country or region pest status dynamic. The improvement of the Colombian Surveillance System was proposed as a programme for medium term implementation, with the financial support of an international development bank. According to the logical model, the Plant Protection System is responsible for the plans, receive, process, evaluate, consolidate and keep record of all data. The regional level coordination mechanisms were identified and implemented to use all possible source of information like growers, pesticide distributors, processors, transporters, laboratories, inspectors, agronomists and other extension professionals from public or private sector, among others. Professional associations were used to establish the links to the professionals, in order to fill out enquiry forms regarding pest status. An active surveillance system was also designed as a pro-active process in order to make systematic surveys four times a year by official inspectors, by randomly assigning specific number of farms and sampling points to be scouted, using different forms of insect sampling, including tools and sampling devices, besides plant examination. Suspicious insect forms (eggs, larvae, pupa or adults) or plant damages must be sent to the official laboratories for identification. Gathered data are first consolidated at the region level and then sent to Nationwide Coordination for final consolidation, processing an recording. Frequent reports are to be produced and distributed to users, a database for risk analysis was implemented and will be permanently updated. The surveillance system was designed to incorporate a trace back system designed to have process and information available to allow tracing a sanitary problem, either a pest or a residue contamination, to its source. Index terms: pest survey, traceback, database.

[2694] BIOLOGICALLY BASED NEW APPROACH FOR INTEGRATED PEST MANAGEMENT OF CORN KEY PESTS IN MIDDLE EGYPT

M. F. Gergis, Plant Protection Research Inst.7, Nady El-Sayied Street Dokki, Giza 12311, Egypt. E-mail: aahakaa@yahoo.com.

This paper summarizes the shift in the paradigms concerning the most fruitful and dominant pathways to effectively and durably cope with pests harmful in agriculture i.e., Corn key pests. The dominant trend for the foreseeable future is to seek solutions through an in depth understanding of biological mechanisms and relationships. New biologically based Integrated Pest Management encompasses a multi-component multi-tactic approach to crop protection strategy i.e. using the bacterial Endo toxins sprays alone or in alternative applications of the natural product "Bioneem" and *Trichiogramma* release for Corn key pests in Middle Egypt. Large scale trials were carried out in Beni Mazar district, Minia Governorate; Middle Egypt to evaluate certain biological approaches so as to select the most promising approach for effective management of the most destructive pests of Corn. Prediction and simulation models were estimated for the key pests and used for optimum timing of application. Results, indicated that biological control deserves more attention as an environmentally safe, long lasting, sustainable method of control

[2695] INFLUENCE OF COTTON NITROGEN FERTILITY ON COTTON APHID, *APHIS GOSSYPII*, POPULATION DYNAMICS IN CALIFORNIA

L. D. Godfrey[1], J. J. Cisneros[1], K. E. Keillor[1], & R. B. Hutmacher[2], [1] Department of Entomology, Univ. of California, Davis, CA 95616 USA, E-mail ldgodfrey@ucdavis.edu; [2] Department of Agronomy and Range Science, Univ. of California-Davis, Shafter, CA 93263 USA

The cotton aphid, *Aphis gossypii* Glover, has developed into a key pest of cotton in California during the 1990's. Lint yield losses as high as 3.5%, in spite of management efforts, were recorded in 1995 and 1997. An analysis of the cotton production system revealed that agronomic inputs, including nitrogen rates, have been increased during the last ~15 years. Studies were conducted to examine the interaction between nitrogen levels and specific aspects of cotton aphid biology; understanding the effects of cultural control measures on aphid populations is important for incorporating these tools into robust IPM programs. Laboratory and small plot field studies showed that high levels of nitrogen can increase aphid populations. For instance in 1997, aphid levels peaked at ~300 per leaf in plots fertilized with 200 lbs./A nitrogen compared with a peak of 75 aphids per leaf in plots with 50 lbs./A nitrogen. In addition, insecticide bioassays showed that cotton aphids feeding on plants exposed to the high nitrogen rate, compared with the low nitrogen rate, had significantly induced tolerance levels to insecticide representatives from carbamate, organophosphate, organochlorine, chloronicotinyl, and pyrethroid classes. Aphid levels were monitored in seven large plot grower field studies with four differential nitrogen regimes (50 to 200 lbs./A nitrogen) in 1999. There was consistently a trend for more aphids in the 200 lbs./A nitrogen treatment compared with the 50 lb./A treatment with a 3-4X range across the treatments. Detailed studies on cotton aphid population dynamics showed that generation times of aphids, from a laboratory colony placed into field cages, ranged from 12.3 to 9.3 days and the number of offspring per adult averaged 1.7 and 5.3 under 20 and 250 lbs./A nitrogen regimes, respectively. A negative effect of potassium on aphid fitness was also seen. Finally, the interaction between nitrogen rate and pyrethroid insecticide application was studies with a naturally-occurring aphid population. At the onset of aphid build-up, application of either a pyrethroid insecticide (Capture®) or a chloronicotinyl insecticide (Provado®) or no insecticide was superimposed. At 3 weeks following the insecticide application, in the untreated plots, aphid numbers increased slightly across the increasing nitrogen levels (10.9 to 24.8 aphids per leaf from 20 to 200 lbs./A nitrogen). Provado controlled the infestation as expected based on its activity spectrum. At 0 to 100 lbs./A nitrogen, the aphid population was 50-75% higher in the Capture-treated plots compared with untreated. However, at 150 and 200 lbs./A nitrogen, there were 3 and 4 times, respectively, more aphids in the Capture plots compared with the untreated.

Index terms: Cultural control, insecticide resistance, fertilization

[2696] CONSTRAINTS FACED BY THE GREENHOUSE VEGETABLES GROWERS USING BUMBLEBEES TO POLLINATION

M. C. Godinho[1], E. Figueiredo[2] & F. Amaro[3], [1]Escola Superior Agrária de Viseu,, Campus Politécnico, 2500 Viseu ceugodinho@isa.utl.pt ; [2]Instituto Superior de Agronomia, Departamento de Protecção das Plantas e Fitoecologia, Tapada da Ajuda, 1349-017 Lisboa, elisalacerda@isa.utl.pt ; [3]Instituto Nacional de Investigação Agrária, Estação Agronómica Nacional, DEESA, Quinta do Marquês, 2780 Oeiras fernandamaro@isa.utl.pt

Recent studies in Portugal with greenhouse vegetable growers did identify the existence of some which easily adopt the use of bumblebees. It was suggested that this attitude could correspond to an intermediate process of adoption for less aggressive technologies for the environmental such as integrated pest management strategies. In order to test hypotheses concerning the restrictions in the adoption of the related technologies, a study in two phases was developed in the greenhouses producers of the Oeste region: (i) grower's characterisation in function of the adopted crop protection strategy; (ii) technician profiles definition for those growers selected from the first sampling. This characterisation was carried through growers' surveys: 200 in the first phase and 60 in the second phase. This last sample was defines according to (i) pest control strategies: traditional chemical control, conditioned chemical control, IPM and crop protection in organic agriculture; and (ii) the crop: tomato, lettuce and greenbeans. Conditioned protection (restricted chemical sprays caused by bumblebees releases) was included in the present study to identify social-economical restrictions faced by the growers in the adoption of new crop protection technologies. In the universe of the 60 selected growers, 10 are producers that they bought *Bombus terrestris* hives to improve productions in greenhouse tomato crops. All the inquired ones stated that changes in crop protection strategy were necessary to preserve the bumblebees. However, more than 50% of those only diminish the number of sprays and/or modify the active ingredient during the permanence of the hive. Those producers did not show any major change of attitude towards the use of pesticides before introducing the hive nor in other crops where they did not use pollinators. Furthermore when those growers need to spray more aggressive products for any pest or disease they chose to close and/or remove the hive for another place. However, some surveyed growers did reveal an attitude for pesticides' change for to the new techniques adoption.

Index terms: protected crops, IPM, sociological survey, *Bombus terrestris*

[2697] MANAGEMENT OF THE BANANA WEEVIL *COSMOPOLITES SORDIDUS* (COLEOPTERA:CURCULIONIDAE) IN BANANA-BASED CROPPING SYSTEMS IN NTUNGAMO, UGANDA

C. S. Gold[1], S. H. O. Okech[1] & W. K. Tushemereirwe[2], [1]International Inst. of Tropical Agric. – ESARC, P.O. Box 7878, Kampala, Uganda. [2]Kawanda Agric. Research Inst., P.O. Box 7065, Kampala, Uganda.

The banana weevil, reduced management levels and loss of soil fertility have been implicated in the decline and disappearance of highland banana in its traditional production areas in Uganda. It has been hypothesized that these constraints are linked. Therefore, banana weevil control and soil-enhancement have been addressed in the context of integrated production and pest management, using surveys, farmer meetings and farmer participatory research. In Ntungamo district, highland banana is produced by small-scale farmers with limited resources. The majority of these farmers depend on cultural practices for pest management. These methods are labor-intensive and of uncertain benefit. The banana weevil is a "k-selected" insect with long life span, low fecundity and slow population buildup. Greatest problems occur in ratoon crops. In a survey of 50 farms, weevil populations ranged from 1600-149000/ha, while rhizome damage scores varied from 1-19%. Crop sanitation appeared to have had the greatest effect in reducing weevil populations and damage. Desuckering and weeding were also negatively associated with weevil populations, while mulching increased weevil numbers. Farmer participatory research was undertaken to evaluate pseudostem trapping and soil fertility management techniques (mulch, farmyard manure, soil and water conservation contour bunds). Intensive trapping provided a net reduction in weevil populations by 38% in one year. However, few farmers had the labor or materials to carry out this level of trapping. In addition, trapping appeared to have less impact on farms with low management levels or surrounded by plantations with high weevil incidence. Twenty-one farmers tested the effects of the soil fertility improvement practices. Implementation of sanitation, weeding and desuckering doubled yields in less than 4 years, while addition of contour bunds or mulches each nearly tripled yields. At the same time, weevil populations were reduced by 50%, while rhizome damage was lowered from 4.6% to 1.5%.

Key words: cultural practices, highland banana, trapping

[2698] APPLIED RESEARCH WITH THE BWACT TO DETERMINE USE METHODS FOR THE PARAGUAYAN NATIONAL COTTON PROGRAM

V. Gómez López, National Agronomic Institute, Ministry of Agriculture, Asunción, Paraguay. E-mail: vgomez@highway.com.py

The control methods for the boll weevil (*Anthonomus grandis*) in Paraguay have been substantially improved since development of a technology that is more adapted to the biology and environment of the pest and the Paraguayan system of cotton production. The major benefit of this technology is that it prevents economically damaging populations during the first 100 days of the crop. A pheromonal based product, the Boll Weevil Attract and Control Tube (BWACT) is a key component to the "national boll weevil program" that is part of the National Plan to Reactivate Cotton (NPRC). During the last three cotton crops the National Agronomic Institute (NAI) has conducted applied field and laboratory research with the BWACT to maximize the efficacy of the technology. In 1999, several studies were conducted to evaluate the performance characteristics of the BWACTs. The objectives of these studies were to define: 1 - Field life efficacy of BWACTs. BWACTs carried over for one year were compared to recently manufactured BWACT. 2 - Position BWACTs in the field border. Studies at the end of the crop were conducted to ascertain if BWACTs positioned near over-wintering sites would attract more weevils than the "down wind" positions. 3 - Best time to install at the end of the crop. Studies were conducted with installations at 50% boll opening and at stalk destruction to determine which has the most impact on the boll weevil population. Based on the field results obtained under the conditions of Paraguay, we conclude the following points: 1 - The study comparing the efficacy of BWACTs carried over from the previous crop year, stored in field warehouses, illustrated that the BWACTs maintained their effectiveness and are acceptable for use. These results validated the manufacturers "shelf life" claim of 18 months. The study confirmed that "carry over" BWACTs may be used in the following crop. 2 - With the installation of BWACTs at the end of the crop, weevil attraction was increased by 48%, when BWACTs were installed next to over wintering sites. 3 - The study to determine the best time for BWACT installation at the end of crop illustrates that the installation at stalk destruction removed 82% more weevils than installations at 50% boll opening. However, this study will continue during the 2000/2001 crop to collect more relevant information. Results from the above tests will be presented.

Index terms: *Anthonomus grandis*, boll weevil control, BWACT

[2699] VELVETBEAN CATERPILLAR CONTROL WITH AIR AND TERRESTRIAL APPLICATIONS OF ITS NUCLEAR POLYHEDROSIS VIRUS (NPV)

S. A. Gomez[1] & D. L. Gazzoni[2], [1]Embrapa Centro Oeste, C. Postal 446, Dourados-MS; [2]Centro Nacional de Pesquisa de Soja (CNPSo), Empresa Brasileira de Pesquisa Agropecuária (EMBRAPA), Caixa Postal 231, 86001-970 Londrina, PR, E-mail gazzoni@cnpso.embrapa.br.

Six experiments and three pilot fields were carried out at Dourados, Mato Grosso do Sul State, Brazil, aiming on controlling *Anticarsia gemmatalis* Hübner, 1818 (Lepidoptera: Noctuidae) larvae through air and land applications of its nuclear polyhedrosis virus (Ag NPV). One hundred larval equivalents (LE) of Ag NPV were applied, using soybean oil, sugar cane molasses and water as vehicles, with an Ipanema® spraying plane equipped with Micronair® nozzles. The oil (5,5 and 5 ℓ ha^{-1}) and molasses (10 ℓ ha^{-1}) preparations yielded 75-89 % and 79-96% control, respectively. The use of aqueous formulation (3 ℓ ha^{-1}), did not provide good control, but 15, 20 and 25 ℓ ha^{-1} were effective (81-90 %). Fifty LE applied by plane at 3 ℓ ha^{-1} or by a tractor propelled atomizer (15 ℓ ha^{-1}) was inefficient. Fifty LE applied with a bar sprayer (134 and 150 ℓ ha^{-1}) provided 87-98 % control. When applied by plane (15, 20 and 25 ℓ ha^{-1}) the control was 92-98 %. Air applications of 50 LE using soybean oil (5 ℓ ha^{-1}) and sugar cane molasses (10 ℓ ha^{-1}) were efficient, providing 86-88% and 99% control, respectively. The results obtained from the pilot fields were similar to the ones obtained with the experiments.
Index terms: *Baculovirus anticarsia, Anticarsia gemmatalis*, biological control.

[2700] DIAGRAM OF ELEMENTS AGROCLIMATYCALS IN PEST MANAGEMENT

J. Gonçalves, Eng. agronomo, Pmv-semmam-Vitória- ES jjuca_br@yahoo.com jjorgebr@uol.com.br

In study of pest management, the exactly moment of pest control is function cycle of insect, vegetable and others cases of type applicative control; is important cycle of nature enemy; of motive economics aspects. The agroclimatycals elements are influenced of the cited cycles. Studys showing wich fenology, SFI index, is importants in calculation of PMI, and to be conditioned on meteorologycals elements. Tthis article show diagram of connection into wheather, vegetable and insect

[2701] INTEGRATED PEST MANAGEMENT OF SCARABS IN NORTH AMERICA

P. S. Grewal[1] , A. M. Koppenhoffer[2] & M. G. Klein[3], [1] Ohio State University, 1680 Madison Ave., Wooster, OH 44691, USA; [2] Rutgers University, New Brunswick, NJ 08903, USA; [3]USDA, Agric. Res. Serv., 1680 Madison Ave., Wooster, OH 44691, USA.

Scarabs are a major pest in North America infesting turfgrass, ornamental nursery stock, sugarcane, corn, and sweet potato. Most species are univoltine, but some species have two to three year life cycles. The IPM of scarabs begins with the monitoring of adult beetles using light/pheromone traps. Cultural practices, such as reduction in the frequency of irrigation at the time of peak flight activity help reduce egg survival. The newly hatched grub larvae are the targets of the recently registered pesticides, imidacloprid and halofenozide. Both insecticides provide 90-100% control of the most common Japanese beetle, *Popillia japonica* grubs when applied at the first and second instar stage, but are not effective against the third/last instars. Our research indicates, that there is a strong synergism between entomopathogenic nematodes and imidacloprid against third instar scarabs of several species. Field tests indicate that the application of one-third rate of imidacloprid in combination with one-half the nematode standard rate would provide acceptable curative grub control in turfgrass. In another project, we have discovered that there is synergism between fungal endophytes of grasses and entomopathogenic nematodes against *P. japonica* grubs. Synergism between the milky disease pathogen, *Paenibacillus popillae* and entomopathogenic nematodes has also been demonstrated by other researchers. Therefore, there are good prospects for the development of biologically-based IPM approach for scarabs in North America.
Index terms: Scarabaeidae, *Popillia*, IPM, Imidacloprid, halofenozide, entomopathogenic nematodes, fungal endophytes, synergism

[2702] INFLUENCE OF LIBERTY LINK IRRIGATED RICE TECHNOLOGY ON *ORYZOPHAGUS ORYZAE* (COLEOPTERA: CURCULIONIDAE)

A. D. Grützmacher[1], R. Luzzardi[2], J. L. M. Coimbra[2], F. P. Giolo[1] & R. de Azevedo[1], [1]Dept. de Fitossanidade da FAEM/UFPel, P. O. Box 354, CEP 96.010-900, Pelotas, RS, Brazil, E-mail: adgrutzm@ufpel.tche.br; [2]Aventis CropScience Brasil Ltda, Unidade Experimental do Arroz (Aventis), Rodovia BR 471, Km 449, Rio Grande, RS, Brazil.

Aiming to obtain informations about biotechnology applied to agriculture, in the 1999-2000 crop, an experiment was done to evaluate some aspects of Liberty Link irrigated rice technology in Brazil, which may become a new tool for rice crop. Increase in yield and a more sustainability of the use of rice low lands is possibly through the control of red rice and other weeds when the plants are growing. This technology involves the use of plants genetically modified (GM) with the gene bar, isolated from the soil actinomycete *Streptomyces hygroscopicus,* which codes for the production of the enzyme phosphinothricin-acetyl-transerase that acetils free NH_2 radicals of the total herbicide Glufosinate-Ammonium (GA) and its derivates, turning them inactive and becoming selective when used in GM plants. To evaluate the agronomical and environmental biosafety in the use of the transgenic/herbicide technology, its effects on entomofauna on irrigated rice was studied on the population of rice water weevil *Oryzophagus oryzae*, a very important pest. The field experiment was done under biosafety conditions, approved by CTNBio. One transformation event (GM rice – ABR-15) was evaluated in comparision with their non transformed parent (NT) BR-IRGA 410 (resistant to *O. oryzae*). Plot size was 10 m^2 (5 x 2 m) in a randomized block with four replications and nine treatments (GM rice without herbicide, five GM rices sprayed with 400 to 700 g of GA.ha^{-1}, one with standard herbicide treatment - Facet 0.5 kg and Propanil 36% 5.0 l. ha^{-1}, one NT rice sprayed with standard herbicide and one NT rice sprayed with GA 700 g.ha^{-1}). Flood irrigation was done after sprays, at 20 days after sowing. Larvae counting was done 30 days after irrigation. Two soil and roots samples were collected in each plot, with the help of a PVC pipe section with a diameter of 10 cm and 20 cm length. The results were submited to analysis of variance and the averages compared by Tukey test at 5% probability level. Numeric numbers for larvae (X) were transformed with the equation square root X+0,50. No influence of treatments was observed on the larvae population of *O. oryzae,* demonstrating that the expression of bar gene is specific and without activity on the non target organism studied.
Index terms: *Oryza sativa*, rice water weevil, genetically modified plants.

[2703] STRATEGY OF SEED TREATMENT FOR RATIONALIZATION OF CHEMICAL CONTROL OF *ORYZOPHAGUS ORYZAE* ON FLOODED RICE

A. D. Grützmacher[1], J. F. da S. Martins[2], U. S. da Cunha[1], R. de Azevedo[1] & E. A. Pan[2], [1]Dept. de Fitossanidade, FAEM/UFPel, P. O. Box 354, 96.010-900, Pelotas, RS, Brazil, E-mail: adgrutzm@ufpel.tche.br; [2]Embrapa Clima Temperado, P. O. Box 403, 96.001-970, Pelotas, RS, Brazil.

Oryzophagus oryzae (Coleoptera: Curculionidae) is one of the most harmful insect species on flooded rice in Brazil. Commonly the insect is known by rice water weevil. The adults attack the leaves, but are the larvae that cause the main damages to the culture. To avoid yield losses, the granulated insecticide carbofuran has been applied around 20 days after flood (DAF) irrigation for larvae control. In spite of product efficiency, there are restrictions to its use due to high cost and fear of environmental pollution. There are informations that seed treatment (ST) with chemical insecticides reduces drastically larval population of *O. oryzae*. Besides, ST controls soil pests that do occur before flooding, making possible to reduce sowing density by 30%. Therefore there is a cost reduction by reduction in the amount of seeds and insecticide added to the field, consequently reducing the risk of environmental damage. A randomized block experiment, with four replications was done in the 1999-2000 crop, at Embrapa Clima Temperado, to evaluate the efficiency of insecticide ST on the control of *O. oryzae*. The ten treatments were: ST with thiamethoxam (Cruiser 700 WS) at 50, 75, 100 and 125 g a.i./100 kg of seeds; fipronil (Standak 250 FS) at 25, 37.5, 50 and 62.5 g a.i./100 kg of seeds; carbofuran (Furadan 100 G) 750 g a.i./ha, applied in the irrigation water and a check without treatment. Plots consisted of 10 rows of plants of cultivar BRS Chuí with 4.0 m long, 0.20 cm between rows, enclosed in earth walls to avoid contamination among treatments. Carbofuran was applied at 20 DAF and larvae were counted at 25 and 40 DAF. Sampling consisted of four cilindric volumes (8.5 cm high and 10 cm diameter) of soil and roots, collected from each plot. Until 40 DAF all TS with Cruiser and Standak reduced significantly the larval population of *O. oryzae* in comparision to check. However, the lowest dose of Cruiser (50 g a.i./100 kg of seeds) didn't reach the level of efficiency of the standard insecticide. Considering the obtained results, there is a potential to reduce up to 50% the dosage of Cruiser (140 g a.i./100 kg of seeds) and up to 60% the dosage of Standak (62.5 g a.i./100 kg of seeds) registered for the control of *O. oryzae*, maintaining the high efficiency. In this way the characteristics of residues and efficiency of the insecticides thiamethoxam and fipronil make them an excellent tool for integrated pest management on irrigated rice.
Index terms: *Oryza sativa*, rice water weevil, preventive chemical control method.

[2704] EFFECTS OF INSECTICIDE THIAMETHOXAM ON *STERNECHUS SUBSIGNATUS* (COL., CURCULIONIDAE) IN SOYBEAN

J. V. C. Guedes[1], R. F. Giordani[1] & R. C. Borin[1], [1]Departament of Crop Protection, Santa Maria Federal University, 97105 900, Camobi, Santa Maria, RS, Brazil, E-mail jvcguede@carpa.ciagri.usp.br.

The soybean weevil *Sternechus subsignatus* (Boheman, 1836) (Coleoptera: Curculionidae) causes a relevant economic loss to soybean crops and determines the use of the chemical control which is ineffective in most of the cases. This study evaluated toxicity effects of Thiamethoxam on adults of *S. subsignatus* in the seed treatments and leaf-spray system. This experiment was conducted in the experimental area of the Crop Protection Department of the Federal University of Santa Maria in Rio Grande do Sul State - Brazil. The trial was carried out in screen-cages (1.0 x 1.0 x 1.0 m) made from a metallic structure, with three insects in each cage. A plot, which is equivalent to a cage, was arranged in a randomized complete block design with three replications. The treatments Cruiser 700WS at 0.105 kg (AI)/ha and 0.210 kg (AI)/ha (ST - seed treatments in mixed plastic bag); Actara 25 WG at 0.037 kg (AI)/ha and 0.075 kg (AI)/ha; Conquest 48 SC (Thiamethoxam + Prophenophos) at 0.288 kg (AI)/ha were used. Tamaron BR (Metamidophos) at 0.288 kg (AI)/ha was used as standard and water as control. The treatments were applied in the soybean stage v_3 by using a CO_2 pressurized sprayer at a rate of 200 liters/ha with cone nozzles. The toxicity was evaluated on the insect population at 4, 7, 10, and 14 days after treatment (DAT). The agronomic efficiency (over 80%) was quantified by Abbott (1925), and the Tukey Test (0,05) was used for means comparisons. There were not significant differences among the treatments after 3 days. At 7 DAT, Actara 25 WG at 0.075 kg (AI)/ha was more effective on the reduction of the pest population. At 10 and 14 DAT, all of the treatments differed with the untreated plots except Cruiser 700 WS at 0.105 kg (AI)/ha. These results showed high agronomic efficiency of Thiamethoxam on adult *S. subsignatus*. At 14 DAT, however, only Actara 25 WG at 0.037 kg and 0.075 kg (AI)/ha and the standard showed agronomic efficiency for *S. subsignatus*. Thus, it may be recommended for the control of this pest in southern Brazil.
Index terms: soybean weevil, *Sternechus subsignatus*

[2705] PHYSIOLOGICALLY-BASED TRITROPHIC METAPOPULATION MODELS IN IPM

A. P. Gutierrez[1] & J. Baumgärtner[2], [1] Ecosystems Science,151 Hilgard Hall, Univ. California, Berkeley, CA, USA 94720, [2]ICIPE, Nairobi, Kenya

The physiological basis for poikilothermic development is explained, and the principles are applied to the local dynamics of physiologically structured populations. Metapopulation dynamics are explored using a physiologically based tritrophic model of the African cassava food web. The interacting species are cassava, cassava mealybug and its natural enemies (two parasitoids, a coccinellid predator and a fungal pathogen), and the cassava greenmite and its natural enemies (two predators and a fungal pathogen). The metapopulation model is based on a single patch age-structured population dynamics model reported by Gutierrez *et al.* (1988b, 1993). The same model simulates the mass-number dynamics of each plant or animal species in each patch and the movement of animals between patches. Movement is based on species specific supply-demand relations. The pathogen mortality rate is a simple function of rainfall intensity. The within patch species composition, their initial densities, and the initial values of edaphic variables may be assigned stochastically. Sensitivity, graphical and multiple linear regression analyses are used to summarize the effects of spatial and resource heterogeneity on species dynamics. Important plant level effects on higher trophic levels are demonstrated, and recommendations are made as to the appropriate model for different ecological studies.
Index terms: cassava, mealybugs, metabolic pool, number and mass dynamics, metapopulation dynamics, mites, parasitoids, predators, stochastic simulation.

[2706] CONTROL EFFECTS TO THRIPS AND APHIDS USING FOAMED SURFACTANT ON FLOWERS AND VEGETABLES IN GREENHOUSE

M. Hatsukade, H. Hiromori & T. Nakamichi, Department of Applied Entomology, Faculty of Agriculture, Shizuoka University, Ohya, Shizuoka 422-8529, Japan, E-mail abmhatu@ipc.shizuoka.ac.jp.

Thrips, aphids and whiteflies are important insect pests of flowers and vegetables in greenhouse. Especially, thrips such as westren flower thrips,*Flankliniella occidentalis* cause considerable damages in a wide range of agricultural crops by feeding on leaves and fruits, laying eggs in the bud and transmitting diseases. Currently, repeated application of pesticide is only effective method that reduces populations to acceptable levels. However, these methods cause development of insect resistance. In laboratory trials, we treated many surfactant solutions to *F. occidentalis* and Silwet L-77® indicated the highest mortality. We compared with the foamed surfactant made by a forming machine and remained surfactant solution. Foam treatment showed more control effects to *F. occidentalis*. Because the foamed surfactant kept long time on the plants and *F. occidentalis* were trapped into foam. Furthermore, foamed surfactant at low concentration (exp. 0.1%) resulted high mortality to *F. occidentalis* . From these results, foamed surfactant indicated beneficial control method to *F. occidentalis*. We assayed insecticidal activity of foamed surfactant to thrips, aphids and whiteflies in greenhouse. The foamed surfactant treatment indicated most useful method to these pests. We have already taken out a patent on the use of foamed surfactant to control insect pests.
Index terms: *Flankliniella occidentalis*, aphid, whitefly, foaming

[2707] PLANT RESISTANCE TO INSECTS IN GLOBAL IPM PROGRAMS

E. A. Heinrichs, Dept. of Entomology, University of Nebraska, Lincoln, NE 68583-0816, USA, E-mail eheinrichs2@unl.edu.

The importance of insect pests as constraints to food production and the role of pest resistance as a component in mitigating the world's food crisis are discussed. Resistant cultivars are sought as a major tactic in the development of IPM strategies and have been shown to be compatible with biological, chemical and cultural control tactics. The integration of insect resistant cultivars with other pest management tactics is an important component of farmer IPM training and has contributed to crop pest management strategies that are environmentally and economically acceptable. Insect pest resistant cultivars are being successfully utilized, in varying degrees, as a major component in the management of crop pest complexes throughout the world. The status of the development of insect resistant varieties and their deployment in IPM programs in various regions of the world is discussed. Of the various food crops, rice resistance to insects has had a highly significant impact. The most successful cultivars have resistance to the major stresses in an area and have high yield stability. These cultivars have characteristics that farmers desire and grain quality that is consumer acceptable. There still are numerous pests that attack the major food crops of the world for which resistant cultivars are not yet commercially available. Biotechnology techniques are being used to solve breeding constraints that have prevented the development and use of host plant resistance as a tactic in the integrated management of crop insect pests. Transgenic cultivars of some crops are being commercially grown.
Index terms: biotechnology, crop cultivars, insects, plant resistance to insects, plant breeding, integrated pest management

[2708] COMPARISONS OF INSECTICIDE EFFICACY AGAINST *HELICOVERPA ARMIGERA* IN CONVENTIONAL VERSUS TRANSGENIC COTTON

J. W. Holloway, A. Schlack & H. T. Dang, NSW Agriculture, Australian Cotton Research Institute, Narrabri, NSW, Australia, 2390, E-mail jonathanh@mv.pi.csiro.au.

Transgenic cotton with resistance to insect pests can still require treatment with supplemental insecticides, for instance during periods of poor expression of the transgene. The interaction with the transgene component may effect the efficacy of the supplemental insecticide. Replicated split-plot field trials have compared the efficacy of a range of insecticides against *Helicoverpa* species in conventional versus transgenic Ingard cotton expressing *Bacillus thuringiensis* Cry1Ac delta endotoxin. Repeated foliar applications of the following insecticides were made to conventional and transgenic cotton throughout the growing season; contact poisons (deltamethrin and methomyl), stomach poisons (thiodicarb, spinosad, chlorfenapyr, emamectin benzoate, indoxacarb and methoxyfenozide), biological insecticides (foliar Bt's azidirachtin and NPV virus) along with untreated controls. Field counts of *Helicoverpa* larvae indicate that the efficacy of insecticides against *Helicoverpa* species is not always equal in conventional and transgenic cotton. For the contact poisons and some of the stomach poisons studied, additive mortality of *Helicoverpa* larvae occurs throughout the season (transgenic Bt + insecticide). Importantly, the improved efficacy of these insecticides is maintained at the end of the season when expression of Bt in the transgenic plants alone is insufficient to control *Helicoverpa* larvae. These results suggest that in transgenic Ingard crops, reduced rates of some insecticides may provide adequate supplemental control of *Helicoverpa* larvae or equivalent control to full rates of the same insecticides in conventional crops. This finding was not consistent for for all groups of insecticides - the efficacy of other insecticides appears to be reduced in Ingard crops compared with conventional crops, particularly later in the season. These treatment differences may be masked early in the season when expression of Cry1Ac delta endotoxin in the transgenic plants alone is sufficient to control *Helicoverpa* larvae. Changes in efficacy are unexpected, but may be due to sub-lethal effects of transgenic Cry1Ac delta endotoxin including alterations in the feeding, movement or distribution patterns of *Helicoverpa* larvae within the transgenic crop in a way that changes their exposure, uptake and susceptibility to foliar applied insecticides. The implications of these results for the selection, rate and cost of insecticides for supplemental control of *Helicoverpa* species in transgenic Ingard cotton are discussed.
Index terms: Bollworm, Cry1Ac, management.

[2709] POTENTIAL OF JUVENOIDS IN BAIT TECHNOLOGY FOR THE MANAGEMENT OF SUBTERRANEAN TERMITES (ISOPTERA) – LABORATORY AND FIELD STUDIES WITH A CARBAMATE DERIVATIVE (W-328)

I. Hrdy[1], J. Kuldova[1], Z. Wimmer[1], M. Lenz[2] & P. V. Gleeson[2], [1]Inst. Organic Chemistry & Biochemistry, Academy of Science, Flemingovo 2, Praha 16610, Czech Republic; [2]CSIRO Entomology, GPO Box 1700, Canberra ACT 2601, Australia, E-mail Michael.Lenz@ento.csiro.au.

Developmental pathways in termites are influenced by hormones, including juvenile hormone (JH). The effects of JH can be mimicked with synthetic compounds, called insect growth regulators or juvenoids. Juvenoids induce the formation of excessive soldiers in a termite colony that may disrupt the social balance of the colony and ultimately cause its demise. In the laboratory, ethyl N-{2-{4-[(2-ethylenedioxycyclohexyl)methyl]phenoxy}ethyl} carbamate (W-328), triggered even at the low dose of 0.005% the development of excessive numbers of presoldiers and worker-soldier intercastes in groups of *Reticulitermes santonensis, R. flaviceps* and groups and entire young colonies of *Coptotermes formosanus*. Termites consumed wood impregnated with W-328 solutions of up to 0.5%. To date only one field study has shown an increase in soldier proportions and a decline in foraging activities following exposure to the juvenoid fenoxycarb (Jones 1988). The potential of the juvenoid W-328 as a component in a bait system was evaluated with the Australian mound-building species *Coptotermes lacteus*. W-328 induced the formation of large numbers of presoldiers and soldiers in several worker and nymph instars. An increase in soldier numbers at bait stations, within a few weeks after feeding on baits, gave the first indication of major events in the colony, *i.e.* a shift in caste proportions. Depending on the dose, exposure to W-328 resulted in significant caste imbalances, but in most cases in loss of reproductives and young and, in several instances, colony death. The responsiveness of nymphs of *Coptotermes* to the juvenoid indicates that should some members of the colony survive the treatment, the production of alates or replacement reproductives is impaired if not prevented. These results demonstrate for the first time that elimination of field colonies of termites with juvenoids is possible. W-328 clearly has potential as active ingredient in bait technology for termite management.
Jones, S.C. 1988. Internat. Res. Group Wood Preservation, Doc. No. IRG/WP/1376, 11pp.
Acknowledgment: This research was partially supported by the Grant Agency of the Czech Republic, project GACR 522/97/016.
Index terms: *Reticulitermes*, *Coptotermes*, field colonies, insect growth regulators.

[2710] TWO YEARS OF AREAWIDE MATING DISRUPTION APPLICATION FOR SUCCESSFUL CONTROL OF ORIENTAL FRUIT MOTH *GRAPHOLITA MOLESTA (LEPIDOPTERA: TORTRICIDAE)* IN VICTORIA, AUSTRALIA

A. L. Il'ichev, P. H. Jerie & M. S. Hossain, Inst. of Sustainable Irrigated Agriculture, P.O.Box 1, Tatura, Victoria 3616, Australia.

Mating disruption (MD) is now a corner stone of Integrated Pest Management (IPM) in Australian orchards. MD has been used for many years to control Oriental Fruit Moth (OFM) - *Grapholita molesta* in the Goulburn-Murray valley (GMV) region of Victoria, but from the early 1990s fruit and shoot tip damage increased in some peach blocks with MD. Farmers reported that more damage occurred on the borders of peach blocks near fruit blocks with traditional chemical spray program (TCSP). The migration of mated OFM females for oviposition could be one of the factors leading to the edge failure of MD in peach blocks. The Areawide Mating Disruption (AWMD) strategy has been applied to improve the protection of orchards against migration, edge damage and hot spots of OFM. The AWMD experiment started in the 1997-98 season, when the area over 800 hectares of 18 orchards in the GMV, Victoria was saturated with OFM sex pheromone and continued in the 1998-99 season in the expanded area over 1,100 hectares of 40 orchards in the same region. MD dispensers called "Isomate OFM Plus" and later "Isomate OFM Rosso" (Shin-Etsu Chemical, Biocontrol Ltd.) were applied to all fruit trees including not only peaches and nectarines where growers used to apply MD, but also pears, apples, apricots and plums in which MD was not normally used in Victoria. Such a large area was used to overcome any edge damage effects and migration of mated OFM females. The initial level of OFM population in the 1996-97 season, before the application of the AWMD experiment, was measured. More than 230 (1-st season) and 250 (2-nd season) food traps for OFM monitoring were used in the AWMD, as well as shoot tip and fruit damage assessments were made. After the first year of AWMD application the monitoring results showed a significant reduction of OFM population within experimental area and in hot spots with the medium (5-10 moths/week/trap) level of infestation. The edge damage in the MD peach blocks was reduced when surrounding pears were treated with MD compared to pears with TCSP. These results indicated that the AWMD approach worked effectively and was able to control medium level hot spots after the first year and high level hot spots (more than 20 moth/week/trap) after second year of application. The AWMD experiments in the first year helped growers to reduce the use of chemical sprays against OFM by half and in the second year, most of the growers did not spray against OFM at all. The application of AWMD during 2 consecutive seasons demonstrated an outstanding success in OFM control and will be discussed.
Index terms: Grapholita molesta, Areawide Mating Disruption, IPM.

[2711] ECB (*OSTRINIA NUBILALIS*) AND WCR (*DIABROTICA VIRGIFERA VIRGIFERA*) IN EAST SLAVONIA (CROATIA)

M. Ivezi ć[1], *E. Raspudi ć*[1] *& D. Džoi ć*[2], [1]Univ. of J.J. Strossmayer in Osijek, Faculty of Agriculture, P.O.Box 719, 31000 Osijek,Croatia mivezic@suncokret.pfos.hr ; [2] Ministry of Agriculture and Forestry, Ul. Grada Vukovara 78, 10000 Zagreb, Croatia.

European corn borer (*Ostrinia nubilalis*) is one of the most economic important corn pest on in Croatia. ECB is present every year with no such low intensity of attack and its control is not implemented. Attack of ECB was 59 % in the last eight years. In 1998 attack was 55 %, and in 1999, 68% on the territory of Slavonia. Some domestic varieties showed good results such as investigations of tolerant hybrids to ECB, but these investigations should be continued. Experiments of bilogical control were done by Biobit XL (*Bacillus thuringiensis*) too, and attack of ECB was decreased by 46%. The second pest Western corn rootworm (*Diabrotica virgifera virgifera*) was found in Croatia in 1995 in Bošnjaci village in east Slavonia. Since then, the pest has been present and spreaded every year. During 1998 and 1999 the investigation of this pest was carried out in the Osijek and Gunja area , close to the border with Jugoslavia where this pest was discovered in 1992 for the first time in Europe. Pheromone traps – CsalomonN and yelow stick trap were used for monitoring. The first adult was found in Osijek area on 3rd of July and the last one on 26th of September 1998. Majority of the pest was captured at the end of July and beginning of August. Adults per one trap were 87 average during the monitoring period at Osijek territory. The first adult was cought at Gunja locality on 8th of July and the last one on the 30th of September 1998. In 1999 the first adult was found on 29th of June and the last one on the 4th of October at the same locality. Pheromone traps were better and about 94 % adults was captured by these method compared to the yelow stick. During 1999 at Gunja locality 1376 adults were captured and calculated to the number of plants it amounted 0,59 imago per plant. The roots were compared too, but the number of larvae were not so significane. The injured simptoms on the corn plant were very rear. In Croatia this is the new corn pest and should be monitored in the east of our country to prevent their spreading to the west region.

Index terms: corn, infestation, tolerant hybrids, biological control, pheromone traps

[2712] INTEGRATED PEST MANAGEMENT PROGRAM USING MATING DISRUPTOR IN JAPANESE PEAR ORCHARDS

H. Izawa[1], K. Fujii[2] & H.Watanabe[1], [1]Tottori Horticultural Experiment Station, Daiei, Tottori 689-2221, Japan, E-mail engeishiken@pref.tottori.jp; [2]Tohaku Agricultural Extension Office, Tohaku, Tottori 689-2301, Japan.

Pest insects of Japanese pear had been conventionally controlled by pesticides. In recent years, however, consumers' concerns about residues of insecticides in foods and environment became stronger, and the reduction of spraying agrochemicals was desired. Thus, we examined alternative control methods to establish the integrated pest management program in Japanese pear orchards. We selected one orchard with conventional controls (hereafter, referred to as the conventional orchard) and two orchards with the alternative controls (referred to as the IPM orchards). We sprayed pesticides and acaricides 14 times a year in the conventional orchard, while we used mating disruptors and reduced the application of chemicals to less than 7 times a year in the IPM orchards. The mating disruptors, which contain four kinds of sex pheromones for lepidopterous moths, are arranged in orchards at the rate of 1800 tubes per ha. The occurrence of both pest insects and their native natural enemies (mainly predators) were investigated through 1996 to 1999. As a result, *Homona magnanima* , *Adoxaphyes honmai* and *Carposina niponensis* scarcely occurred in the IPM orchards. In addition, the application of insecticides for spider mites and aphids was less than once through a year in the IPM orchards, though two or three applications per year for such the pests were needed in the conventional orchard. It was considered that predators of spider mites and aphids were conserved because of less spraying of agrochemicals in the IPM orchards. On the other hand, the minor insect pests, *Eumeta iaponica, Ascotis selenaria* and *Euprctis spp.* tended to increase in the IPM orchards. These pest insects, however, could be easily controlled by spraying selective insecticides once or twice a year complementarily. Weeds on the orchards are known as the source places where spider mites propagate. So we examined whether the migration of spider mites from weeds to pear trees was inhibited by applying the herbicide, bialaphos, in the IPM orchards. As a result, the application of the herbicide in April to early June could delay the occurrence of spider mites on trees, and made less application of acaricides possible. Therefore, we concluded that the IPM program in Japanese pear orchards can be implemented by integrating the mating disruptor, selective insecticides and herbicides.

Index terms: native natural enemy, selective insecticide, herbicide

[2713] CAN THIAMETHOXAM BE ASSOCIATED TO STINKBUG PREDATOR *PODISUS NIGRISPINUS* NYMPHS IN A COTTON PEST MANAGEMENT PROGRAM ?

J.B. Torres[1], C.S.A. Silva[1] & W.S. Evangelista Junior[1], [1]Fitossanidade, Univ. Fed. Rural de Pernambuco, Av. Dom Manoel de Medeiros S/N, Dois Irmãos 52171-900 Recife, PE. E-mail: jorge@nelore.npde.ufrpe.br.

Integrated pest management (IPM) program needs continuous development aiming to combine pest control practices. However, most IPM programs are limited by incompatibility between chemical and biological methods. Thus, this work investigated the impact of the systemic insecticide Thiamethoxam (TH) used for cotton pests control on the stinkbug predator *Podisus nigrispinus* (Heteroptera Pentatomidae) nymphs in laboratory, in an open sided greenhouse and in field conditions. In lab six concentrations of TH was studied in residual and ingestion tests. In open sided greenhouse and field conditions TH was used at 0.5, 1.0, 2.0 and 4.0 mg (AI) per plant applied in 20 ml water drenched at the base of each plant. Based on the LC_{90} TH is about 217.6 and 1435.2 times more toxic by ingestion than by residual contact to 2nd- and 5th-instar of *P. nigrispinus*, respectively. *P. nigrispinus* 2nd-instar kept on treated cotton leaves with 1.0 to 4.0 mg (AI) of TH per plant in open sided greenhouse had lower longevity than those on untreated plants up to day 52 after application. However, nymphs kept on plant treated with 0.5 mg (AI) of TH showed after 42 days similar survival to untreated plants. Eggs, nymphs and pupae of the whitefly were averaged per sampled cotton leaf at 11, 20, 28, 40, 54, 64 and 74 days after insecticide application. TH and the standard insecticide showed significant control in relation untreated plants and TH at 0.5 mg (AI) per plant after 40 days. Adult population was higher on untreated plants over time ranging from 5 to 7.5 witheflies per leaf. In field, 9 days after application all TH concentrations affected longevity of *P. nigrispinus* nymphs compared to untreated plants. However, these bug showed similar longevity 27 days after application of this insecticide between plant treated with 0.5, 1.0 and 2.0 mg (AI) and untreated plants. In field, immature of the whitefly in untreated and treated plants had low density failing to show differences between treatments. Plots treated with TH at 2 and 4 mg (AI) per plant contained aphid population lower than 10% at day 61 of crop age while untreated plants and 0.5 mg of TH showed infestation of 68.7 and 31.2%, respectively. These findings suggest that 27 days after TH application at rates of 0.5, 1.0 and 2.0 mg (AI) per plant in field did not affect *P. nigrispinus* nymphs and with whitefly and aphid control at concentration above 1.0 mg (AI) per plant. On the other hand, in open sided greenhouse TH concentration above 1.0 mg (AI) per plant can affect nymphs of the *P. nigrispinus* up to 52 days after application.

Index terms: Asopinae, biological control, cotton pest, insecticide systemic.

[2714] CONTROL OF POTATO LEAFHOPPER *EMPOASCA KRAEMERI* (HEMIPTERA:CICADELLIDAE) WITH THIAMETHOXAM ON COWPEA

J.V. Oliveira[1], M.P.L. Lima[1], M.E.C. Gonçalves[1], P.R. Machado[1] & M.A.A. Mattos[1], [1]Fitossanidade, Univ. Fed. Rural de Pernambuco, Av. Dom Manoel de Medeiros s/n, Dois Irmãos 52171-900 Recife, PE. E-mail: jvolivei@elogica.com.br.

This research was carried out at the Luiz Jorge da Gama Wanderley Experimental Station, Empresa Pernambucana de Pesquisa Agropecuária, in Vitória de Santo Antão, PE. The objective was to test the insecticide thiamethoxam for controling *Empoasca kraemeri* nymphs on cowpea by using seed treatment (Cruiser 700 WS – 150 g/kg of seeds), seed treatment + spraying (Actara 250 WG – 150 g c.p./ha), spraying in comparison to monocrotophos pattern (Agrophos – 1,0 l c.p./ha), and control. Seeds of the cowpea cultivar Sempre Verde were sowed in a 1,0x0,5m spacing, and the plants irrigated through sprinkling. The plot area was $30m^2$ and composed by four rows with lateral ones used as borders. A randomized design was adopted with five treatments and four replications. The insecticide sprayings with a 20 liters costal spray gun took place at 24, 46, and 60 days after sowing. Before each spraying samples of *E. kraemeri* nymphs were observed under leaf bottom side of 42 trifoliate leaves per plot. At 24 and 46 days after sowing it was observed a black aphid, *Aphis craccivora*, infestation followed by a larval, pupal and, adult incidence of the ladybird, *Cycloneda sanguinea* (Coleoptera: Coccinellidae). The insecticide efficiency was measured from nymphal counting data at 46 and 60 days by using Abbott's formula. The following efficiency percentages were obtained: 44.4 and 26.2% for thiametoxam + seed treatment; 94.4 and 97.2% for seed treatment + spraying; 64.8 and 100% for thiametoxam spraying and 61.1, and 93.1% for monocrotophos spraying at 46 and 60 days after sowing, respectively.

Index terms: Insecticide, *Vigna unguiculata*, leafhopper

[2715] THE EFFICACY OF CERTAIN AQUEOUS PLANT EXTRACTS FROM GUILAN PROVINCE AGAINST ELM LEAF BEETLE *XANTHOGALEAROCELLA LUTEOLA* (COL; CHRYSOMELLIDAE)

J. Jalali [1], A. Arbab [1], K. Etebari [1] & A. Aliakbar [2], [1]Dept. of Plant Protection, College of Agriculture, Univ. of Guilan. IRAN, 41335-3179 [2]Dept. of Chemistry, Faculty of Science, Univ. of Guilan.

Insceticidal effect of certain weeds of Guilan flora, Iran, like *Artemisia annua* and *Sumbucus ebulus* on first and third instar larvae, pupa and adults of elm leaf beetle was investigated in laboratory condition. The plants were shade dried and water distilled. The oil was separated out with diethyl ether and ultimately the ether part was evaporated in a rotatory evaporator. The concentrate was diluted in acetone and the concentrations 1,5,and 10 percent made. Every concentration considered as a treatment with three replicates of 10 insects each. Two controls used one with acetone and another without any treatment for comparisons. Mortality rate was calculated and verified based on Abbot's formula(1925).The data were subjected to statistical analysis (Irristat).The results are indicative of the maximum effect by 10% concentration and that there is no difference between the different stages treated nor between the extracts in the said concentrations. The first larval instar was highly susceptible and therefore showed 100% mortality in all the concentrations. The adult insect also exhibited 100% mortality in all the treatments except 1% of *Sumbucus*. The least mortality (3.3-2.7 and 10-4.7 percent) was observed with 1 and 5% concentrations of *Sumbucus*. The *Artemisia anuua* extract with 91.31% shows a higher mortality rate compared to 77.11% of *Sumbucus*. However, there is no difference between the extracts used.

Index terms: *Artemisia annua* ; *Sumbucus ebulus; Xanthogalearocella luteola*

[2716] DEVELOPMENTAL RATE ISOMORPHY IN INSECTS AND MITES

V. Jarošík[1], *A. Honěk*[2] & A. F. G. Dixon[3], [1]*Dept. of Zoology, Charles Univ., Viničná* 7, CZ 128 44 Prague 2, the Czech Republic, E-mail jarosik@mbox.cesnet.cz; [2]Res. Inst. of *Crop Production, Drnovská 507, CZ 161 06 Prague 6 – Ruzyně, the Czech Republic,* E-mail honek@hb.vurv.cz; [3]Univ. of East Anglia, School of Biological Sciences, Norwich NR4 7TJ, United Kingdom, E-mail a.f.dixon@uea.ac.uk

When the proportion of total developmental time spent in a particular developmental stage does not change with temperature an organism shows "rate isomorphy". This is only the case if the lower developmental threshold is the same for all developmental stages. In this study the incidence of rate isomorphy in 7 species of mites and 341 species from 11 insect orders (some represented by several populations) was determined. Whether a species shows rate isomorphy or not was determined over a range of temperatures where the relationship between the rate of development and temperature is linear. Proportion of total developmental time spent in a particular stage was plotted against temperature and the existence of rate isomorphy inferred from a zero change in proportion. Rate isomorphy was detected in 241 (56 %) of 427 populations. In the rest of the cases rate isomorphy was violated by deviations in the proportion of time spent in a stage by an average of less than 0.05% at the mean of the range of temperatures of all the data sets (11 ^{0}C). The violations occurred most frequently at the extremes of the linear phase, which is attributed to methodical biases, mortality at low temperatures, or too coarse an estimate of developmental time at high temperatures. Consequently, in most insect and mite species, all the developmental stages appear to have the same population-specific lower developmental threshold. The existence of rate isomorphy could be of great practical importance, e.g. in the timing of life-history events and in determining pre-adult thermal requirements. An awareness of its existence can also save a lot of experimental work. This is especially important in the use of temperature/development data in pest management. There are also indications that it may act as a phylogenetic constraint.

Index terms: Thermal requirements, lower developmental threshold, life-history characteristics, modelling developmental rates.

[2717] EVALUATION OF INSECTICIDES, IN LABORATORY, AGAINST THE VELVETBEAN CATERPILLAR *ANTICARSIA GEMMATALIS* (LEPIDOPTERA:NOCTUIDAE) IN SOY BEAN

T. Jocys[1], J.M.F. dos Santos[1], A. P. Takematsu[1] & A.J.T. dos Santos[2], [1]. Instituto Biológico, Centro de Sanidade Vegetal, Av. Conselheiro Rodrigues Alves, 1252, Vila Mariana, CEP 04014-002 São Paulo, Brasil. E-mail jocys@biologico.br [2]. PLANTEC. Rua Filipe Bandeira, 34. CEP 02126-020, São Paulo, SP

The velvetbean caterpillar is a pest of great economical importance, because the defoliation causes sensitive decrease in the production of grains. To verify the sensibility of these caterpillars the some insecticides, it was carried out, at laboratory of the Instituto Biológico, an experiment between the months of April and May of 1999. A completely randomized design was used, with 8 treatments and 8 replicates. Each replicate was formed by a petri dish with the bottom covered with treated soy leaves, in the which 5 second and third stages caterpillars were placed . For the spraying equipment rain simulator* was used, with nuzzle TT 110/01, with expense of 200 liters of water. The treatments in g or mL i.a./ha were: 1. deltamethrin 5,0; 2. ethofenprox 10,0; 3. ethofenprox 12,5; 4. ethopenprox 15,0; 5. endosulfan 122,5; 6. lufenuron 11,25; 7. nin extract (Ninkol) 5000; 8. control- without treatment. After 24 hours it was made the evaluation of the mortality. The treatments 1, 2, 3, 4 and 5 caused same mortality or above 90%. Only the treatments 6, 7 and 8 were not efficient. The treatment 7 (Ninkol) caused an increase of consumption of leaves for the caterpillars. The equipment rain simulator* was shown effective for laboratory tests. * Patent was required.

Index terms: *Anticarsia gemmatalis*, insecticides, control, soy bean

[2718] DEVELOPMENT OF TOMATO FRUITS IN PAPER BAGS (*LYCOPERSICON ESCULENTUM*) FOR PEST CONTROL AND PESTICIDE REDUCTION

A. L. Jordão & O. Nakano, Univ. São Paulo (USP), Superior School Agriculture "Luiz de Queiroz" (ESALQ), Entomology, Phytopathology and Agricultural Zoology Depart., Entomology Sector, C.P. 9, 13418-900 - Piracicaba (SP), E-mail aljordao@carpa.ciagri.usp.br

Experiments were carried out to reduce the application of insecticides during the cultivation of tomatoes, *Lycopersicon esculentum*, by the use of bags for protection of the fruits. Efficiency of the use of paper bags was evaluated in bunches of tomatoes harvested in combination wise insect repellents which control the pest agents *Neoleucinodes elegantalis*, *Helicoverpa zea* and *Tuta absoluta*. Bags were made from wax paper due to its specific characteristics of resistance, permeability, flexibility, availability in the market and low cost. The repellents used in combination with the paper bags were of two types, deodorant tablets and garlic cloves, which were cut in approximately 90 mm^3 pieces. Five treatments were designed: paper bags carrying deodorant tablets, paper bags with garlic cloves, paper bags containing no repellent at all, control without repellent and standard or chemical control with the insecticide Methamidophos. Efficiency of the use of paper bags and the repellents used for control of pests under study was verified by the number of caterpillars found on the fruits. Fruits protected in wax-paper bags and the ones exposed directly to Methamidophos during application were compared with the maximum tolerable residue amount allowed by federal laws. Another aspect considered was fruit quality which was evaluated by fruit characteristics of colour, firmness, pH, titratable acidity, soluble solids and the relation between soluble solids/titratable acidity. In addition, the costs of the method in use here with wax-paper bags were evaluated in comparison to the conventional chemical control. Results obtained revealed that the use of paper bags reduced the number of caterpillars of *N. elegantalis* and *H. zea* per fruit. Residue analysis carried out during application showed that the fruits out of bags presented six times higher levels than the maximum tolerable ones; while the fruits in paper bags showed three times lower levels than the maximum. It was found that the use of paper bags for tomato fruits protection does not alter the characteristics analysed in the fruits. Considering the costs, the method of tomato fruits kept in paper bags during cultivation required more financial investment in the beginning. However, it tends to be recovered by the sale in the market since the product will be of greater value for consumers. Results presented here may encourage the increment of the production of tomatoes cultivated under conditions which will guarantee the approval by official agricultural inspection organisations responsible for controlling crop quality.

Index terms: *Neoleucinodes elegantalis*, *Helicoverpa zea*, *Tuta absoluta*, fruit protection in paper bags.

[2719] MINING THE DATA OF A PEST MANAGEMENT COMPANY: IMPROVEMENTS TO TUBER FLEA BEETLE AND GREEN PEACH APHID IPM OF CANADIAN POTATOES

J. T. Kabaluk[1] & R.S. Vernon[1], [1]Agriculture and Agri-Food Canada, P.O. Box 1000, Agassiz, B.C. V0M 1A0, Canada, E-mail: kabalukt@em.agr.ca

Insect monitoring data supplied by a professional integrated pest management (IPM) company included weekly counts of numerous pest and beneficial insects in more than 100 potato plantings in each of four years. Data for two pest insects, tuber flea beetle (*Epitrix tuberis*) and green peach aphid (*Myzus persicae*), were analyzed using geographic information systems (GIS) software and conventional statistical methods for the purpose of gaining knowledge of the insects population characteristics so to improve the operational efficiency of the company. For tuber flea beetles, the effects of crop rotation were examined by overlay analysis using GIS software. Analysis revealed a significant linear increase in F1 beetle populations in field edge and interior samples with an increase in the number of consecutive years the crop was planted to potatoes. The frequency of sampling days in which overwintered and F1 beetles exceeded threshold levels in interior regions of unrotated fields was twice as great as for rotated fields. In general, the consequence of not practicing crop rotation was assessed to be a 6.4 – 9.5% increase in the potato-growing area requiring insecticidal control of tuber flea beetles. The results emphasized the importance of crop rotation for beetle control. Knowing which fields have and have not been rotated can assist IPM companies in prioritizing monitoring activities early in the season. For the green peach aphid, analysis of four years of data (one year with abnormally high aphid levels) revealed that none of the potato fields studied exceeded the normal aphid threshold level (10 aphids/triplet) until the tenth week of monitoring, which occurred between July 9 and 15. No differences in aphid levels were detected between edge and interior samples, suggesting that sample means could be regarded as randomly distributed throughout the field. When comparing per triplet aphid counts (normally used in monitoring aphids) with a binomial sampling system (presence or absence of aphids), per triplet counts best correlated with the proportion of triplets exceeding three aphids (R^2=85%). These findings indicate that aphid monitoring can be delayed and sampling reduced by either abandoning edge or interior samples, or by replacing the assessment of the threshold using per triplet counts with enumeration of the proportion of triplets exceeding three aphids.
Index terms: *Epitrix tuberis, Myzus persicae*, Integrated Pest Management, Geographic Information Systems, potato.

[2720] INTEGRATED PEST MANAGEMENT OF MAJOR INSECT PESTS UTILIZING APHID RESISITANT VARIETY AND NATURAL ENEMIES ON GREENHOUSE MELON

T. Kashio[1], T.Kitamura[1] & S. Toda[2], 1Kurume Branch, National Res. Inst. of Vegetables, Ornamental Plants and Tea, 1823 Kurume Fukuoka, 839-8503, Japan, E-mail kashio@nivot-krm.affrc.go.jp; 2Fruit Tree Res. Station, Kumamoto Prefectual Agricultural Res. Center, 2566 Matsubase Kumamoto, 869-0524, Japan.

The development of integrated pests management (IPM) for the major insects pests, cotton aphid *Aphis gossypii*, silverleaf whitefly *Bemisia argentifolii*, twospotted spidermite *Tetranychus urticae* and melon thrips *Thrips palmi*, utializing natural enemies such as *Chrysoperla carnea*, *Encarsia formosa*, *Phytoseiulus persimilis*, *Orius sauteri* is expected, in Japan. However, there is one problem. When all insect pests are to be controlled by utilizing only natural enemies, multiple species of natural enemies need to be released many times respectively. In the actual cultivational usage, the control expense will be very high. Therefore, an attempt at successfully using IPM program for major insect pests, utilizing the aphid resistant variety of melon combined with natural enemies, was conducted with the purpose of reducing the number of released times or released quantities. In this study, the population development of cotton aphid on resistant variety (Kurume No.5), which was bred in our institute and a common variety (Earl's Seinu Natsu II; non-resistant) were compared to greenhouse melon cultivated from the spring to summer seasons. And, the IPM programs combined four species of natural enemies, *C. carnea*, *E. formosa*, *P. persimilis*, and *O. sauteri* with a resistant variety and a common variety for the major insect pests, which were tested in the same conditions. Aphid populations on the resistant variety were controlled from 1/3rd to 1/4th of the density as compared with the ones on the common variety. Also, silverleaf whitefly populations were slightly lower on the resistant variety when compared with the ones on the common variety. When the larva of *C. carnea* were released onto the cotton aphid, five times every two weeks since the aphids population started to increase on the common variety, the aphid populations were effectively controlled to a low density, and this result was less than economic injury level. Control effect on the resistant variety was more efficient than on the common ones under the same releasing conditions. These results indicate that it will be possible to reduce the number of releasing times and released quantities substantially. High effects of control were obtained by the two times release of *P. persimilis* onto spider mite as well as by the one time release of *O. sauteri* onto melon thrips for the resistant and common variety with no difference in test results. Good whitefly control resulted when the four times release method of *E. formosa* was used on the whitefly early growth stage of population.
Index terms: melon, aphid resistant variety, IPM, natural enemy

[2721] EFFECTIVENESS OF VINYL FILM THAT COMPLETELY ABSORBS ULTRAVIOLET REGION SPECTRUM FOR IPM IN GREENHOUSE CULTIVATION

A. Kawai, Lab. of Entomology, Natl. Res. Inst. of Vegetables, Ornamental Plants and Tea, Ano, Mie 514-2392, JAPAN, E-mail tpest@nivot.affrc.go.jp

Vinyl film that completely absorbs ultraviolet region spectrum (UVA) is used as the covering materal of plastic greenhouse. In the plastic greenhouse covered with UVA, occurrence of several diseases become smaller and plant grows more than that covered with common agricultural vinyl film (CA). Injury of several pests, i.e. thrips, aphids, whitefly, are also smaller in the greenhouse covered with UVA, but the mechanism of the reduction of the injury is unknown. To examine the mechanism of the reduction of injury of *Thrips palmi*, cucumber plants were cultivated in a greenhouse covered with UVA and that covered with CA. Female adults were released in both greenhouses, and the population growth and the movement of the adults was examined. The populations increased in the same manner in both greenhouses. The dispersal of the adults released was limited and occurred only along with the rows in both greenhouses. Dispersal and flight in the greenhouse covered with UVA were more limited than those in the greenhouse covered with CA. Immigration into the greenhouse covered with UVA was also less than that covered with CA. Elimination of ultraviolet region spectrum does not affect the population growth of *Thrips palmi* but it decreases the immigration into the greenhouse. Decrease of immigration brings the decrease of injury in the greenhouse covered with UVA. To examine the effect of UVA to the biological control of *Trialeurodes vaporariorum* by *Encarsia formosa*, tomato plants were cultivated in plastic greenhouses covered with two types of vinyl film and *T. vaporariorum* and *E. formosa* were released in both greenhouses. The population of *T. vaporariorum* fluctuated in the same manner in both greenhouses, and *E. formosa* well controlled *T. vaporariorum* in both greenhouses. Dispersal of *E. formosa* in the greenhouse covered with UVA were less than those in the greenhouse covered with CA. Elimination of ultraviolet region spectrum does not affect the biological control of *T. vaporariorum* by *E. formosa*, but it decreases the dispersal in the greenhouse. UVA is a beneficial material for the IPM in greenhouse cultivation because of the reduction of disease and insect pests, but we have to pay attention to the decrease of dispersal of natural enemies in the greenhouses covered with UVA.
Index terms: *Thrips palmi, Encarsia formosa, Trialeurodes vaporariorum*, immigration, dispersal.

[2722] CALCIUM SILICATE APPLICATION ENHANCES RESISTANCE OF SUGARCANE TO THE STALK BORER *ELDANA SACCHARINA*

M.G. Keeping[1] & J.H. Meyer[1], [1]S. African Sugar Assoc. Experiment Stn., P. Bag X02, Mt. Edgecombe 4300, RSA.

The African sugarcane stalk-borer, *Eldana saccharina* (Lepidoptera: Pyralidae), is the most important pest in sugarcane in South Africa. Resistant varieties can reduce the impact of the pest, but additional measures that enhance plant resistance deserve consideration. Six commercial varieties of sugarcane were treated with calcium silicate to investigate the effect of assimilated silicon on host-plant resistance to *E. saccharina*. A replicated split-plot trial was established in a shade house using cane planted in pots containing river sand. Two treatment levels of calcium silicate (2500 kg/ha and 5000 kg/ha or *ca.* 400 and 500 kg/ha of pure silicon, respectively) were applied at planting and again at six months. Controls received no calcium silicate. Leachate and leaf samples taken from all treatments confirmed that silicon levels in the growing medium and the plant itself were in accordance with applied treatment levels. The plants were artificially infested with *E. saccharina* eggs at 9.5 months and the trial was harvested six weeks later to record *E. saccharina* larval and pupal numbers and mass (borer performance) and borer damage (stalk length and number of stalk internodes bored). Silicon application significantly reduced borer performance and damage (ANOVA; min. F value=5.1; $p<0.05$), in particular between controls and the higher (5000 kg/ha) silicon treatment level, where borer mass was reduced by 19.8% and borer damage by 33.7%. Values for the 2500 kg/ha treatment were intermediate between controls and the higher treatment. The interaction between variety and silicon treatment was non-significant when varieties were examined individually in the analysis. However, the interaction was significant ($F=3.6$; $p<0.05$) for number of stalk internodes bored when combined results from two susceptible and two resistant varieties were compared in the ANOVA. The ameliorating effect of silicon on resistance was greater for susceptible than for resistant varieties. Results indicate that calcium silicate application in the field may achieve a substantial increase in resistance of sugarcane to *E. saccharina* attack. As the effect of silicon on resistance was greater for susceptible (high sucrose content) varieties, this may permit planting of such varieties in rain-fed (as opposed to irrigated) areas, where the risk of borer attack is greater.
Index terms: Lepidoptera, Pyralidae, pest, silicon

[2723] TEMPERATURE-DEPENDENT DEVELOPMENTS OF *CARPOSINA SASAKII* (LEPIDOPTERA: CARPOSINIDAE) AND ITS STAGE EMERGENCE MODELS

D.-S. Kim[1], J.-H. Lee[2] & M.-S. Yiem[1], [1]Div. of Horticultural Environment, National Horticultural Research Institute, RDA, Suwon 440-310, Korea; [2]Entomology Program, School of Agricultural Biotechnology, Seoul National University, Suwon 441-744, Korea, E-mail jh7leeQplaza.snu.ac.kr.

Carposina sasakii Matsumura (Lepidoptera: Carposinidae) is the most destructive insect pest of fruit trees such as apple, peach, and pear in Korea. Insecticide sprays have no control effects against *C. sasakii* larvae once they bore into fruits. Thus, timing spray before larval entrance is critical for successful control of *C. sasakii*. In Korea, 2-3 chemical sprays with ≈10d interval are common from mid-June for the first generation control of *C. sasakii*. Then, growers usually choose the first spray time based on their experience. Under this circumstance, a predictive model of its seasonal phenology would significantly improve the *C. sasakii* control program. Predicting the seasonal occurrence of *C. sasakii* requires quantification of the relationship between its stage development and temperature. The objective of this study was to quantify development of *C. sasakii* in relation to temperature and to establish the emergence model for using management of *C. sasakii*. The development times of *C. sasakii* decreased with increasing temperature up to 32□ in eggs, up to 28□ in larvae, and up to 30□ in pupae. The estimated low-threshold temperatures were 11.0, 9.4, and 10.3□ for eggs, larvae, and pupae, respectively. The thermal constants (mean ± SD) of eggs, larvae, and pupae were 104.1 ± 4.78, 272.8 ± 11.31, and 188.0 ±12.20DD, respectively. The stage emergence models of *C. sasakii*, that simulate the number of individuals shifted from a stage to the next stage, were constructed using the modified Sharpe and DeMichele model and the two-parameter Weibull function. In field validation, a degree-day model for the prediction of egg hatch time showed the bias of <1d in predicting between prediction and observation. The stage emergence models predicted the patterns of *C. sasakii* stage emergences in the field relatively well. Factors causing some discrepancy between prediction and observation in *C. sasakii* stage emergence patterns were discussed. Also, the established stage emergence models should be useful in building a *C. sasakii* population model.

[2724] THE VARIETY DIFFERENCES IN DAMAGE OF STRAWBERRY FRUITS BY WESTERN FLOWER THRIPS

T. Kitamura & T. Kashio, Kurume Branch, National Research Inst. Of Vegetable, Ornamental Plants and Tea, 1823 Miimachi Kurume-city Fukuoka-Pref., 839-8503, Japan, E-mail toskit@nivot-krm.affrc.go.jp

Western flower thrips *Frankliniella occidentalis* (PERGANDE) is one of the most important insect pests of the greenhouse crops worldwide. In Japan, it was in 1990 that the thrips first occurred, and it has been a serious pest not only for flowers and vegetables but also for strawberries. This thrips infestation was one reason for increasing the quantity of insecticide usage, and because this thrips developed resistance to many insecticides. In this study, we investigated the variety differences in the characteristics of strawberries damaged by the thrips in order to obtain rudimentary knowledge on the breeding of the resistant varieties of strawberries against the thrips. The damage differences of fruits among 14 strawberry varieties were examined in a plastic greenhouse. In Japanese domestic varieties, there was little difference in the ratio of the thrips infestation. But there is a great difference in the proportion of damaged fruit. The percentage of damaged "Toyonoka" fruit which is mainly cultivated in Western Japan was the lowest (18.9%), "Nyohou" - in Eastern Japan - was 63.7% and "Aiberry" was the highest (82.4%) among sampled varieties. On the other hand, in varieties of West European countries, the number of thrips infestations of "Darline" and "White cater" is higher than that of "Robinson", "Cesena" and "Siletz". The proportion of damaged fruits of "Cesena" was the highest, "Robinson" was next highest and "Siletz" was comparatively low, though there was not so much difference as that of Japanese domestic varieties. Then we investigated features of the strawberry fruit damage in order to clarify the cause of the difference in damage. Strawberry damage by the thrips is classified as whiting exciple around achenes, losing gloss and discoloration to reddish brown injured parts. In order to examine the microstructure of the surface of the strawberry fruit, we observed injured parts of the fruits surface with a scanning electron microscope. According to our observation of "Toyonoka", there were feeding holes whose diameter was ca 1 μm in the injured part of the exciple and achene of the fruit, and the number of holes was ca 8000. It was a factor occurring in malformed fruits that injured achene didn't develop. Comparing this result with the observation of other varieties will be discussed.

Index terms: *Frankliniella occidentalis*, strawberry, fruit damage, variety difference

[2725] THE MANAGEMENT OF SAN JOSE SCALE (*QUADRASPIDIOTUS PERNICIOSUS* COMST.): USE OF PHEROMONE TRAPS AND TEMPERATURE MODEL FOR TIMING OF CONTROL

F. Kocourek, Department of Entomology, Research Institute of Crop Production, Drnovská 507, 16106 Prague, Czech Republic, E.mail kocourek@hb.vurv.cz.

The aim of the paper was to establish a method for timing of control of San Jose scale (SJS) using pheromone traps and temperature model for timing of control. The model supposes that the occurence of males in pheromone traps indicates the time of mating. The length of the period from mating to appearance of first crawlers may be estimated by the method using temperature sumation. The monitoring was conducted at two localities in South Moravia and at one locality in North Bohemia in 1996 and 1999. Funnel traps lined with Bird Tanglefoot adhesive were used. Three pheromone components were tested. The combination of the two specific sexual attractant components used is most effective for trapping SJS males. The method of SJS presence monitoring by means of pheromone traps is highly sensitive. It makes it possible to confirm the presence of the pest in orchards even at very low population densities. Two SJS generations were recorded at the orchards under investigation even in cold years. Sum of effective temperatures 770 day degrees (above the development threshold of 7.3 °C) was calculated as difference between the emergence dates for males of the first and the second generations. This sum was necessary for the development of the summer generation of SJS. The maximum weekly catches of males of the overwintering generation were 5 to 50 individuals. The maximum catches of summer generation males in orchards with economically harmful occurrence were 500 to 1,100 individuals. In apple orchards, catches of more than 100 males during a week indicate the risk of a significant damage in the next year. The date on which the first generation crawlers start to migrate can be determined according to the sum of effective temperatures of 400 day degrees above 7.3 °C, accumulated from the date on which the first males have been found in the pheromone traps. The date indicates the optimum period for timing of insecticide application. In orchards where insecticides were applied against the crawlers population density of SJS decreased and the damage to fruits was eliminated.

[2726] MODE OF ACTION AND CHARACTARISTICS OF A NOVEL INSECT PEST CONTROL AGENT, CHROMAFENOZIDE

S. Kodama[1], T. Toya, T. Watanabe, M. Yanagi, A. Masui[□], R. Ichinose[□], S. Yokoi[□], S. Niimi[□], Y. Tamagawa[□] & K. Tanaka[□], [1]Agro and Fine Chemical Division, Nippon Kayaku Company Ltd. 11-2 1-chome, Fujimi, Chiyoda-ku, Tokyo 102-8172, Japan, E-mail nk-agro@magical3.egg.or.jp; [2]Agro and Fine Chemical Research Laboratories, Nippon Kayaku Company Ltd. 225-1 Koshikiya, Ageo-si, Saitama-ken 362-0064, Japan; [3]Agroscience Research Laboratories, Sankyo Company Ltd. 1041 Yasu Yasu-cho, Yasu-gun, Shiga-ken 520-2342, Japan

Chromafenozide, ANS-118 in code number, which we found through the research study of dibenzoylhydrazines with ecdysone mimic action, has excellent efficacy against serious lepidopterous pests on vegetables, fruit trees, rice, ornamentals and other crops. In a luciferase reporter gene assay which is regulated by ecdysteroid response element, chromafenozide exhibited the transaction activity in the same manner as 20-hydroxyecdysone and ponasterone A. In biological studies, chromafenozide shows unique characteristics as follows: 1) Excellent efficacy against lepidopterous larva, such as *Tortricidae*, *Pyraridae*, *Noctuidae*, and other families, 2) Less damage of crops compared to other IGRs due to stop feeding with quick induction of molting symptom, 3) No cross resistance to other insecticides of different mode of actions, 4) High level of safety against beneficials, as well as predators, parasitoids and pollinators. Chromafenozide with the above profiles can be compatible to IPM program and environmental conservative agriculture.

Index terms: chromafenozide, ecdysone, IPM

[2727] INTRODUCTION TO THE SYMPOSIUM: PERSPECTIVES IN ECOTHEORY AND INTEGRATED PEST MANAGEMENT

M. Kogan & P. C. Jepson, Integrated Plant Protection Center and Dept. of Entomology, Oregon State University, Corvallis, OR 97331-8530. USA.

Effective pest management has been built upon a sound ecological foundation from its earliest days. Pest management scientists were among the first to recognize the need to conduct research on a scale that matched the population processes of pest and beneficial species. The concept of the agroecosystem predates many of the recent advances in large-scale ecology and has helped to inform the current debate in the ecological literature. The cross talk between theoretical ecologists and pest management scientists has always been dynamic but, from time to time, there is a need to evaluate the ways in which ecological theory is exploited in pest control, and to review the lessons that ecologists can learn from pest management. The contribution of ecological theory to IPM was explored in 1984, at a meeting of the Entomological Society of America. This led to a book (Kogan 1986) that has been widely used by researchers, students and professionals, worldwide. Our objective in this symposium is to capture some of the new themes in both pest management and ecology that have emerged in the intervening period and to provide and updated assessment of the role that basic ecology plays in the development of rational and sustainable pest management practices. Recent developments in ecology include the emergence of molecular ecology, acknowledgement of the importance of spatial scale in population biology, advances in our understanding of multi-trophic level interactions, conservation ecology and biodiversity. In pest management, developments include the advent of transgenic crops, advances in our understanding of the ecological impacts of agricultural practices, particularly pesticide use, risk assessment of biocontrol agents and their impact on biodiversity, and the emergence of conservation biological control practices. We will explore these themes, and others, and examine their significance and potential impact for the future development of pest management.

[2728] TECHNICAL AND ECONOMICAL FEASIBILITY OF ERADICATING THE CODLING MOTH FROM THE BRAZILIAN APPLE GROWING AREA

A. Kovaleski[1], J.F.S. Protas[2] & R. L. Sugayama[3], [1]Embrapa Uva e Vinho, Estação Experimental de Vacaria. CP 177, CEP 95.200-000, Vacaria, RS, adalecio@cnpuv.embrapa.br, [2]Embrapa Uva e Vinho, Bento Gonçalves, RS, [3]Univ. de São Paulo, São Paulo, SP, Brazil.

Cydia pomonella is one of the major pests of apple in most countries where it occurs. Detection trapping has been conducted since the early 1980's in urban areas and commercial orchards in Brazil. The first males were caught in 1991 in the urban area of Vacaria, RS. Detection was followed by the implementation of a program of the Ministry of Agriculture to delimitate its distribution. Two major apple growing areas of the country (Fraiburgo and São Joaquim) are pest-free. Neverthless, the urban areas of Caxias do Sul, Vacaria, Bom Jesus, and Lages are affected. Commercial orchards pest-free in all cities. Maintenance of this status is desirable from quarentenary and economical standpoints. In this work, we discuss the feasibility of an eradication program, comparing the costs of two methods with the potential losses due to pest establishment. (1) Eradication of host plants in the urban area of affected cities: this alternative is a double-edged sword, as the lack of fruits would presumably accelerate dispersal to commercial orchards. Estimated cost for this alternative is 761.323 USD. (2) Male anihilation technique (MAT): this method led to a significant decrease in the population of the codling moth in a pilot project in Vacaria (97/98). Costs associated with this alternative would sum 3.742.824 USD, along four years of eradication actions. In the case of suspension of the eradication efforts, the pest would colonize and become established in commercial orchards. That would be favored by the decrease in the number of insecticide sprays against other pests (Tortricidae, Tephritidae), observed in the scenario of Integrated Fruit Production. With basis on the perspective of expansion of the cultivated area, 3.177.540 USD would be spent to chemically control the pest only in the year of 2014. Additional costs associated with chemical control are of ecological concern, as well as restrictions due to the residues present in the fruits. The adoption of pheromone-based control methods would cost 9.885.680 USD in the same year. In both cases, economic losses due to direct damage by the pest in the orchard would sum 3.968.942 USD considering 1% of damage. Eradication of the codling moth is cost effective and technically feasible. Implementation of rigorous inspection services in the points of entry of fresh fruits would help to prevent further introduction events. Also, internal quarantine barriers would be necessary to prevent spread of the pest to uninfested areas. Other methods (SIT, egg parasitoids) could be useful to supplement the mortality caused by the male anihilation technique but no evaluation of their costs has been conducted yet.

Index terms: *Cydia pomonella*, eradication, male anihilation technique, Tortricidae.

[2729] DETERMINATION OF EGGS OF STORED PRODUCT BEETLES (*COLEOPTERA: SILVANIDAE, CUCUJIDAE*) ACCORDING TO THEIR EXTERNAL MORPHOLOGY

Z. Kucerová, V. Stejskal & M. Jokeš, Dept. of Stored Product Pest Control, Res. Inst. of Crop Production, Drnovská 507, CZ-161 06 Prague 6, Czech Republic, E-mail kucerova@hb.vurv.cz

Food industry and agricultural management need to identify stored product pests of any developmental stage for proper decisions in pest control and also for quarantine purposes. Identification keys are available for adults and larvae but not for eggs, in spite of the fact that infested commodities frequently contain only eggs. The present work deals with comparative egg morphology of common pests of stored grain and flour from the genus *Oryzaephilus (O. surinamensis, O. mercator), Ahasverus* (*A. advena*) (*Silvanidae)* and *Cryptolestes* (*C. ferrugineus, C. turcicus, C. capensis, C. pusillus, C. pusilloides) (Cucujidae).* The morphological studies included following approaches: measurements (length, width, L/W ratio, area) and description (shape, colour) of eggs with the help of microscope, stereomicroscope and computer programmes (image analysis Video Capture and Jandel Scientific), photographic documentation of eggs on the commodities (digital Nikon Coolpix 950), and study of the ultrastructure of egg surface by scanning electron microscope (JSM 6400). Breading conditions were 27 ◦*C, 75% r.h. The eggs 1-3 days old* were used for examinations. Eggs of the studied genera significantly differ in shape, size and surface structure. (1) *Ahasverus sp.* eggs are oblong, with one end rounded and the other pointed (L/W ratio is 2.9 and area 0.088 mm^2). The chorion is sculptured. The whole surface is covered with distinct rounded tubercles (about 15-20 µm in diameter), which make these eggs easily distinguishable from eggs of other species. (2) Eggs of *Oryzaephilus* sp. are symmetrically oblong with anterior and posterior ends of almost identical shape, regularly rounded (L/W ratio is 3.0 and area 0.14-0.16 mm^2). The chorion looks smooth, but the magnification 550-2000x reveals imprints of the oblong polygonal follicular cells in the middle part of the egg and there are various numbers of irregular slightly concave circles (15-45 µm in diameter) on both poles. (3) Eggs of *Cryptolestes* sp. are oblong, with one end rounded, the other pointed and sometimes with a nipple-like projection (L/W ratio is 3.2-3.5 and area about 0.07-0.09 mm^2). The whole surface of the chorion is marked by imprints of the polygonal follicular cells, which are shorter and more rounded than those in *Oryzaephilus* species. This research was supported by a Grant No 522/99/1255, GACR and EP9138 NAZV.
Index terms: *Oryzaephilus, Ahasverus, Cryptolestes,* chorion structure.

[2730] CALYPSO – OPTIONS FOR A NEW CHLORONICOTINYL

J. Kuehnhold, Bayer AG, PF- E BE, Landwirtschaftszentrum Monheim, 40789 Monheim, Germany

Calypso, common name Thiacloprid, is a new chloronicotinyl insecticide. It shows a spectrum of activity against sucking insects, coleoptera and leaf mining lepidoptera like other compounds of this group. Additionally it offers a better ovicidal action against lepidopterous pests, particularly the codling moth. As a big advantage we consider its safety for bees and other pollinators which offers the possibility of its use in flowering cultures. Some relevant indications are aphids and white flies in vegetables where the product can be applied via foliar application or in the irrigation water in cultures on artificial substrate. In pome fruit orchards applications during flowering improve the control of plant bugs. Coleopterous pests in canola occurring in the flowering period can be controlled as well as aphids in sunflower and cereals.

Index terms: Thiacloprid, Calypso, Chloronicotinyl, Pollinators, Flowering Crops

[2731] *STEPHANITIS TAKEYAI* DRAKE & MAA AND OTHER LACE BUGS (TINGIDAE) AS PESTS OF ORNAMENTAL PLANTS FROM *ERICACEAE* FAMILY IN POLAND

Labanowski G.S. & G.M. Soika, Research Institute of Pomology and Floriculture, 96-100 Skierniewice, POLAND; E-mail: glabanow @ insad.isk.skierniewice.pl

Observations on occurrence of insects and mites were carried out in 1995-1999. Among insects recorded on ornamental trees and shrubs three species from *Stephanitis* genera were found. Two species: *Stephanitis oberti* Kolenati and *S. rhododendri* Horváth were observed on *Rhododendron* spp. and *Stephanitis takeyai* Drake & Maa on *Pieris japonica* D. Don. In Poland the most common is *S. oberti*, which was known previously only on *Vaccinium* spp., *Ledum palustre* L. and *Calluna vulgaris* Hull., but in 1995 it was found for first time on *Rh. campanulatum* D. Don and *Rh. catawbiense* Michx. In further years it was noted mainly on shrubs imported by growers from Holland and Germany. *S. rhododendri* was noted in Poland only once, in 1934 on *Rhododendron* sp. in west-south part of Poland. Next time it was observed in 1998 also in the same part of the country in association with *Rh. oberti* on *Rh smirnovii* Trauv. *S. takeyai* was discovered in 1998 in commercial nursery on *Pieris japonica* imported from Germany. It is new species for European fauna. *S. takeyai* is a dangerous pest for *Pieris japonica*, particularly sever damages were observed on cultivars: 'Select', 'Debutante', 'Cupido' and in a lesser degree on 'Flaming Silver', Variegata' and 'Redmill'.
Index terms: *Stephanitis oberti*, *Stephanitis rhododendri*, *Rhododendron*, *Pieris japonica*

[2732] LOCUST MANAGEMENT IN RUSSIA, UZBEKISTAN, KAZAKHSTAN AND OTHER CIS COUNTRIES: LESSONS OF DECENTRALIZATION

A. V. Latchininsky[1] & F. A. Gapparov[2], [1]Univ. of Wyoming and Association for Applied Acridology International, Laramie, WY 82071-3354, USA, E-mail: latchini@uwyo.edu; [2]Uzbek Inst. for Plant Protection, Tashkent 700004, Uzbekistan

Before the collapse of the Soviet Union in 1991, the Federal Plant Protection Service (FPPS) executed regular survey, monitoring and control of pest acridids on the entire territory of the ex-USSR. Among >500 species of acridids, >100 were reported as pests of rangeland and crops. However, only about half a dozen of them were of economic importance, inflicting damage on a regular basis. Three locust species – *Locusta migratoria migratoria*, *Calliptamus italicus* and *Dociostaurus maroccanus* were the objects of permanent attention due to their high damaging potential and migratory capacity. FPPS monitored and controlled locust outbreak areas along the borders with adjacent countries, e.g. Iran and Afghanistan. After 1991, the FPPS has been divided into National PPSs, and the system of locust control has lost its coordination. Difficult transition from public to private sector in agriculture contributed to the decrease of attention to the problems of pest management. Significant areas of abandoned, formerly cultivated, lands became the most favorable breeding areas for pest acridids, particularly *C. italicus*. In Kazakhstan alone, more than 11 million ha of former cereal cropland (half of the total grain production area in the late 1980s) were turned into weedy fallows between 1990 and 1999. As a result, Kazakhstan, Russia, Uzbekistan and other CIS countries suffered unprecedented locust and grasshopper outbreaks. In Russia, about 1 million ha were treated with insecticides in 1999 while between 1920 and 1990, the average annual area of anti-locust control rarely exceeded 300,000 ha. In Kazakhstan, the fall survey of 1999 revealed 8 to 10 million ha infested by egg-pods requiring control on >5 million ha in 2000. Locusts do not observe political borders, and swarm flights of *C. italicus* between Russia and Kazakhstan became frequent. In 1999 in Uzbekistan, hopper bands of *D. maroccanus* have penetrated from the north (Kazakhstan) and from the south (Afghanistan), causing locally severe damage to cotton and wheat crops. The catastrophic situation with locusts in the CIS countries demands new, modern and unified approaches to the organization of pest management. They include: survey and monitoring using remote sensing and GIS; creation of the early warning network, preventative insecticide treatments of locust "hot-spots" – permanent breeding areas; barrier treatments of hopper bands with persistent insecticides (e.g., IGRs, fipronil...) using ULV formulations; introduction of alternative control agents (e. g., microbiocontrol). The central unit for data collecting and processing is essential for effective multi-national campaign coordination and continuity of pest population monitoring across the borders.
Index terms: locusts, CIS countries, acridid pest management.

[2733] BIOLOGY OF SWEET POTATO WHITEFLY, (HOMOPTERA: ALEYRODIDAE) ON TRANSGENIC TOBACCO AND INTERACTIONS WITH A PARASITE

T. Y. Li[1], M. Harris[1], C. Nessler[2], J. Gould[3], W. Smith[4] & W. Jones[5], [1]Department of Entomology, Texas A&M Univ., 2475 TAMU, College Station, TX 77843-2475, USA, e-mail: e079tl@tamvm1.tamu.edu, [2]Department of Biology, Texas A&M Univ., 3258 TAMU, College Station, TX 77843-3258, USA, [3]Department of Forest Science, Texas A&M Univ., 2135 TAMU, College Station, TX 77843-2135, USA, [4]Department of Soil & Crop Science, Texas A&M Univ., 2474 TAMU, College Station, TX 77843-2474, USA, [5]USDA-ARS-Subtrop. Agric. Res. Lab, 2301 S. Int. Blvd., Weslaco, TX 78596, USA

A model system for investigating effects of alkaloids on insects in transgenic plants has been developed at Texas A&M University. Genes currently being studied are tryptophan decarboxylase (TDC) and tyrosine decarboxylase (TyDC) in tobaccos containing the β – glucuronidase marker driven by the cauliflower mosaic virus 35S promotor that accumulate tryptamine and tyramine, respectively. Work is underway to construct TDC and TyDC transgenic cottons. Egg cohorts of B. tabaci on TDC, TyDC and control tobaccos had similar developmental times to the adult stage in both generations, but significantly greater mortality on the transgenics than on the control. This mortality primarily occurred when adults failed to emerge from pupae, or emerged but couldn't survive, and to a lesser extent when 3rd instar nymphs didn't moult to the pupal stage. There were about 50% fewer adults produced in the two generations reared on the transgenics (TDC and TyDC) compared to the control. Mortalities observed from generation one to generation two in the same plant treatment were not significantly different. The total average oviposition per female was highest on TyDC (67.8) followed by the control (57.1) and TDC (46.9), but not statistically significantly different among treatments (0.05 level). The average eggs per day were highest for TyDC (9.7) followed by the control (6.7) and TDC (4.9); and female longevity was shortest for TyDC (6.7) followed by the control (8.5) and TDC (9.5). The transgenics do not appear to adversely affect oviposition or longevity but do significantly reduce survival compared to the control in this study. An experiment of comparison between the sweet potato whitefly parasitized by *Eretmocerus californicus* on transgenic tobacco and the control is currently being studied and will be briefly reported.
Index terms: *Bemesia tabaci*, *Eretmocerus californicus*, biocontrol

[2734] FRUIT BAGGING FOR PROTECTION OF CUCUMBER AGAINST THE MELONWORM, *DIAPHANIA HYALINATA*, AND THE PICLEWORM, *DIAPHANIA NITIDALIS*.

J. O. G. de Lima[1] & E. A. da Silva[1], [1]Laboratório de Proteção de Plantas, Univ. Estadual do Norte Fluminense, Av. Alberto Lamego 2000, 28.015-620 - Campos dos Goytacazes, RJ, Brazil. E-mail joscar@uenf.br.

In all regions of Brazil, the melonworm, *Diaphania hyalinata*, and the picleworm, *D. nitidalis*, destroy several cucurbit fruits, especially cucumber, which if unprotected is seriously damaged. Besides the frequent use of insecticides, no other single method is effective for protecting cucurbit vegetables. In order to find an alternative to insecticides, an experiment was carried out in the field to test the efficacy of paper bags for protecting the cucumber fruits against the pickleworm penetration. Bagging was accomplished no more than 24 h after the flower pollination (begining of the flower wilting process). In the four treatments used, the percentages of bored cucumber fruits at the first harvest (04.20.98) were: 1. Conventional application of insecticides (weekly application of deltamethrin at 5 g a. i./ha): 40.0 %; 2. Bagging the fruit and no insecticide application: 27.1 %; 3. Weekly application of deltamethrin (5 g a. i./ha) before and after bagging of the fruits: 30.0 %; and 4. Control (No insecticide application and exposed fruits): 52.4 %. Because of the poor quality of the paper bags, some of the bags split open at the first harvest and this number increasead at the second harvest (04.28.98). Due to these problems, the experiment was discontinued. However, the preliminary results were promising in that bagging reduced the need for application of insecticides. In addition, the color and size of the fruit were not altered by bagging. There is great potential for bagging of cucumber, especially using a new type of microperforated plastic bag, which is currently being tested.

[2735] TONIC EFFECT OF SOIL INSECTICIDE ON THE COFFEE (*COFFEA ARABICA*) PLANT AND ITS COST-BENEFICE

M.F.D. de Lima, J.L. Florcovski, F. Catissi, M.H. Calafiori & P.C. Carnevalli, Agronomic Engineering Course. CREUPI. Postal Box 05. 13990-000 - Espírito Santo do Pinhal – SP – Brazil. E-mail: cpagrpin@rantac.com.br

The soil insecticides are being applied in coffee culture to improve the plant growth. This experiment was carried out, during 2 years, in order to analyse this effect, with coffee, variety Mundo Novo, at experimental campus "Dr. Alcides Carvalho", in November, 1997. The experimental design was complete randomized block with 4 replications. The treatments were: A- control; B- triadimenol + disulfoton (Baysiston – 28 g/pit); C- ciproconazole + disulfoton (Altomix 103,2 – 25 g/pit); D- aldicarb + epoxiconazole by spraying (Temik 150 – 10 g/pit + Opus – 0,6 ℓ/ha); E- aldicarb (Temik 150 – 10 g/pit); F- triadimenol + disulfoton + aldicarb; G- carbofuran (Furadan 100 – 15 g/pit); H- triadimenol + disulfoton + NPK + micronutrients + manure; I- ciproconazole + disulfoton + fertilizers; J- aldicarb + epoxiconazole + fertilizers; K- aldicarb + fertilizers; L- triadimenol + disulfoton + aldicarb + fertilizers; M- carbofuran + fertilizers; N- NPK + macronutrients + manure. The fertilization was based on soil analysis. The evaluations were made to foliar retention, yield and cost. The results allowed to conclude that: a) foliar retention didn't occur because of insecticide application in the second year of the test; b) the yield was greater in the treatment with aldicarb + epoxiconazole with and without fertilizers. The treatment with aldicarb + fertilizers presented also greater yield in the first year and that with triadimenol + disulfoton + aldicarb + fertilizers, in the second year; c) the profit was greater in aldicarb + epoxiconazole without fertilizer during two years and it was followed by the treatment with aldicarb + epoxiconazole with fertilizer.
Index terms – coffee, insecticides, profit, foliar retention.

[2736] ESSENTIAL ELEMENTS OF A VECTOR MANAGEMENT PROGRAM

Manuel F. Lluberas[1], [1]Vector Control Systems Manager, H.D. Hudson Manufacturing Company, 500 North Michigan Ave., Chicago IL 60611.

Vector-borne diseases have staged a slow, yet steady re-emergence around the world. Countries where vector-borne diseases had been eradicated or brought under control have witnessed a resurgence of vector activity and concomitant increase in disease transmission. Moreover, an alarming number of the countries now waging battle against these diseases have no prior history of vector transmission within their borders. Consequently, many countries have been forced to allocate substantial portions of their limited national resources to the treatment and prevention of vector-borne diseases and the establishment of vector management operations. In light of this, the World Health Organization declared the mosquito as "public enemy number one." The resurgence of vector activity can be attributed to one or more of a long list of factors. These include rapid urbanization, habitat destruction, human encroachment on vector habitats, better transoceanic transportation, vector management program failure due to budgetary shortfalls, insecticide resistance, introduction of exotic vector species, and several other factors. Regardless of the reasons for the increase in vector activity and the resulting rise in vector-borne disease incidence, it is evident that the situation will continue to deteriorate. Accordingly, vector management and control programs must now be established in areas where none operate or evaluated in countries where one exists. Criteria for the development, implementation, and evaluate of vector management programs based on locally available technology and procedures that can be applied to local environmental and developmental conditions are presented.
Key words: vector management program; criteria; evaluation; program development

[2737] REDEFINING "INTEGRATED VECTOR MANAGEMENT"

M. F. Lluberas[1], [1]Vector Control Systems Manager, HD Hudson Manufacturing Company, 500 North Michigan Ave., Chicago IL 60611

Vector-borne diseases have staged a slow, yet steady re-emergence around the world. Countries where vector-borne diseases had been eradicated or brought under control have witnessed a resurgence of vector activity and concomitant increase in disease transmission. Moreover, an alarming number of the countries now waging battle against these diseases have no prior history of vector transmission within their borders. Consequently, many countries have been forced to allocate substantial portions of their limited national resources to the treatment and prevention of vector-borne diseases and the establishment of vector management programs. In light of this, the World Health Organization declared the mosquito as "Public Enemy Number One." The resurgence of vector activity can be attributed to one or more of a long list of factors. These include rapid urbanization, habitat destruction, human encroachment on vector habitats, better transoceanic transportation, vector management program failure due to budgetary shortfalls, insecticide resistance, introduction of exotic vector species, and several other factors. Regardless of the reasons for the increase in vector activity and the resulting rise in vector-borne disease incidence, it is evident that the situation will continue to deteriorate. Accordingly, vector management and control programs must now be established in areas where none operate and evaluated in countries where one exists. Criteria for the development, implementation, and evaluate of vector management programs based on locally available technology and procedures that can be applied to local environmental and developmental conditions are presented.
KEY- WORDS: vector management program; evaluation criteria; program development.

[2738] IDENTIFICATION WITHIN A BLEND OF THE ACTIVITY OF APPLE TREE ORGAN SURFACES METABOLITES ON *CYDIA POMONELLA*.(*LEPIDOPTERA, TORTRICIDAE*) OVIPOSITION

N. Lombarkia, S. Derridj, INRA, Unité de phytopharmacie et des médiateurs chimiques, route de Saint Cyr. 78026 Versailles Cedex. France.

The codling moth *Cydia pomonella* (*Lepidoptera, Tortricidae*) is the major pest of apple. Intensive treatments with insecticides induced insect resistance, biological control tactics are effective only on low populations. Thus it becomes neccessary to find other alternative protection of apple trees. Among new possible strategies, those which act on insect behaviour could be examined. In that field it has been observed that primary and secondary metabolites are present on the apple tree organ surface. Their amounts and proportions discriminate the studied organs. They can be correlated to the observed codling moth behaviour in the orchards. Here we precise the activity of the analysed metabolites on the insect oviposition. So, biological tests were carried out on Codling moth oviposition at two times (after 3 and 25 min of dark). The effect of metabolite blend and of substances within the blend was observed and compared to natural *Granny Smith* leaf leachate. The blend of six water soluble metabolites (three sugar – alcohols : Sorbitol, Quebrachitol, Myo-inositol and three soluble carbohydrates : Glucose, Fructose, Sucrose) found on the apple leaf and fruit surfaces influence *Cydia pomonella* oviposition. Fructose, sorbitol and myo-inositol are specially stimulant within the blend. Behavioural responses at the two times may be different according to the type of stimuli. The highest activity of the natural leaf water leachate on the *Cydia pomonella* oviposition against the corresponding artificial blend of the six metabolites draws to the hypothesis that more than the six metabolites studied could explain oviposition in the natural conditions.
Index terms : Soluble carbohydrates, Sugar – alcohols, behaviour, Codling moth

[2739] ENVIRONMENT PROTECTION THROUGH RESISTANT POTATO: RESEARCH, EDUCATION AND DELIVERING INFORMATION IN BRAZIL

M.T.R.Lopes[1], E.A.Silva[2], C.P.Stein[3], H.L.B.Sargo[2], J.D.Vendramim[1], F.M.Lara[2], R. S. Furiatti[4], J.A.Buso[5] & F. H. França[5], [1]Department of Entomology, ESALQ/USP, P.O. Box 9, CEP 13.918-900, Piracicaba, SP, BRAZIL, [2]Department of Entomology, UNESP – Campus, CEP 14.870-000, Jaboticabal, SP, BRAZIL, [3]Laboratory of Entomology, IAC, P.O. Box 28, CEP 13.001-970, Campinas, SP, BRAZIL, [4]Department of Plant Protection, UEPG, 84.100-330, Ponta Grossa, PR, BRAZIL, [5]Embrapa Hortaliças, Brasília, P.O. Box 218, 70.359-970, Brasília, DF, BRAZIL, E-mail franca@cnph.embrapa.br.

The first phase of the project supported by the McKnight Foundation "Obtaining Potatoes Less Dependent on Insecticides Through a Type of Broad Spectrum Resistance Mediated by Glandular Trichomes and Leptines" lasted from 1995-98 and aimed the following objectives: (1) To incorporate pest resistance into potato adapted to the range of ecologies represented by the participant countries; (2) To define the nature of resistance to each insect pest; (3) To evaluate and demonstrate at the farm level the value of potato pest resistance in the control of pests represented in these ecologies, and (4) To gain an increased understanding of the inheritance of pest resistance by continued utilization of RFLP and related molecular mapping techniques and to utilize this information in selections for adaptation and resistance. In order to reach these goals Embrapa Hortaliças, the Departments of Entomology of ESALQ/USP, UNESP-Jaboticabal, UEPG and IAC joined their efforts with colleagues from INIA Chile, Cornell University and North Dakota State University. The support from the McKnight Foundation provided equipment and supplies that enabled research and extension activities to all institutions. Potato germplasm exchange among countries and among institutions within the country was enhanced. As tangible products the collaboration among Brazilian partners with all McKnight Foundation support generated: two Ph.D. dissertations and two M.Sc. thesis; two papers published in refereed journals so far; over 25 posters and presentations in national and international scientific meetings; four exchange visits of Brazilian 21 faculty and students of six institutions to Chile and USA; publication of a two-volume book related to plant propagation that is adopted as textbook in undergraduate and graduate courses of four major universities in Brazil and printing and distribution of over 7,000 copies of four types of technical bulletins. Above 70 presentations, lectures, field-days, demonstration plots and short-courses were delivered during the period; and over 2,500 farmers, students, salesperson, extensionists and scientists were attended by the project.
Index terms: host plant resistance; potato; international partnership

[2740] RESISTANCE OF STRAWBERRIES TO *TETRANYCHUS URTICAE* (ACARI: TETRANYCHIDAE)

A. L. Lourenção[1], G. J. Moraes[2], F. A. Passos[1], G. M. B. Ambrosano[3] & L. V. F. Silva[2], [1]Instituto Agronômico de Campinas (IAC), Caixa postal 28, 13001-970 Campinas, SP, Brasil, E-mail: andre@cec.iac.br; [2]Escola Superior de Agricultura Luiz de Queiroz (ESALQ), USP, Caixa postal 9, 13418-900 Piracicaba, SP, Brasil; [3]Universidade Estadual de Campinas (UNICAMP), Caixa postal 52, 13414-018 Piracicaba, SP, Brasil.

The performance of eighteen strawberry clones (seventeen cultivars and one line) was evaluated for resistance to the two-spotted spider mite *T. urticae*. An experiment was carried out in greenhouse, using a complete randomized block design. Treatments consisted of clones artificially infested with *T. urticae*. Plants of line T-0104 and cultivars Blakemore, Raritan and IAC Princesa Isabel had significantly less severe damage symptoms than cultivars 'Cruz' and 'Oso Grande'; under the same conditions, the number of mites per unit area was significantly lower in 'IAC Princesa Isabel' than in 'Cruz', 'Dover' and 'Fern'. In a no-choice experiment conducted in laboratory using detached leaves of these clones, no significant difference was observed between treatments in relation to average daily oviposition, although a trend for lower oviposition was observed in 'IAC Campinas' than in 'Floridabelle', 'Oso Grande' and 'Toyonoka'. A preference of *T. urticae* for "IAC Guarani' in relation to "Floridabelle', 'IAC Campinas' and 'New Jersey 7335-5' was observed in a laboratory multiple-choice experiment involving clones with the highest and lowest oviposition rates in the previous test. Among the Brazilian cultivars, only 'IAC Guarani' was susceptible to *T. urticae*, whereas 'IAC Campinas' and 'IAC Princesa Isabel' showed levels of resistance similar to those of the best cultivars developed for this purpose.
Index terms: *Fragaria* X *ananassa*, two-spotted spider mite, host plant resistance.

[2741] THE BLACK COTTON BEETLE, *SYAGRUS RUGIFRONS* BALY (CHRYSOMELIDAE: COLEOPTERA): ITS IMPACT ON COTTON PRODUCTION IN SOUTH AFRICA AND PROBLEMS PERTAINING TO INTEGRATED PEST MANAGEMENT

C. E. Louw[1], A. Bennett[2], I. Matthysen[3] & L. C. Minnaar[4], [4] Agricultural Research Council, Tobacco & Cotton Research Inst., P/Bag X 82075, Rustenburg, 0300, North West Province, South Africa. E-mail: estelle@nitk1.agric.za

Syagrus rugifrons Baly, formerly known in South Africa as a sporadic pest, is receiving increasing attention because of its economic impact on cotton production in the Northern Province. In this region ratoon cotton is a common practice, producing two generations instead of the usual single generation when no winter-feeding is available. Larvae feed extensively on the root system of cotton plants while adults feed on leaves. Heavy infestations can lead to wilting due to a lack of photosynthesis (damage caused by adults) and a lack of nutrient absorption by the roots (ringbarking caused by larvae). Adult beetles hide under foliage or in cracks in the soil during the day but appear at night to feed on leaves, causing characteristic circular holes. When foliage gets tougher and drier later in the season, feeding take place on flowers, squares and the outer wall of the bolls, without causing damage to the inner, unripe fiber. Carbaryl®, a registered contact insecticide, is very effective but necessitate frequent spraying. It is also ineffective against the larvae feeding underground. Commercial farmers require quick results through chemical control. Although commercial farmers contribute a large percentage of the total annual yield, consideration must also be given to the needs of the small-scale farmer and the impact of these chemicals on the environment. The ARC-TCRI is now implementing trials that is more IPM-orientated. When following an IPM approach (by determining insecticide applications on the amount of plant damage present and by considering its effect on beneficial insects) constant spraying with carbaryl can be avoided. A possible solution is to plant with a seed dressing, followed by spraying only when population densities reach damaging levels. The effect of insecticides must be monitored on beneficial organisms such as spiders, and also on secondary insect pests such as spider mites, leafhoppers and whiteflies. The ARC-TCRI is in progress of constituting a threshold for spraying and compiling a chemical control programme that would be efficient, cost-effective and suitable in an integrated pest management system.
Index terms: Economic impact, chemical control, IPM

[2742] ECOLOGICAL AND BIOLOGICAL STUDIES ON THE POLYMORPHIC SPECIES *CHELYMORPHA CRIBRARIA* (COL.: CHRYSOMELIDAE) IN RIO DE JANEIRO, BRAZIL

M. V. Macedo[1], R. O. Gonçalves[1] & J. Vasconcellos-Neto[2], [1] Lab. Ecologia de Insetos, Depto Ecologia – IB - UFRJ - CP68020 - CEP21941-590 Rio de Janeiro, Brasil / E-mail: mvmacedo@biologia.ufrj.br; [2] Lab. Interações Insetos-Plantas, Depto Zoologia – IB – UNICAMP – CP 6109 – CEP 13083-970, Campinas, SP, Brasil / E-mail: jvascont@unicamp.br

Chelymorpha cribraria F. 1775 (Chrysomelidae: Cassidinae) is a polymorphic species which occurs in coastal sand dunes ("restinga") in Rio de Janeiro State, Brazil. The different forms of *C. cribraria* are given by the combination of pronotum and elytra colorations. It is found feeding on *Ipomoea pes-caprae* and *I. imperati* (Convolvulaceae) leaves. In this study we describe the population fluctuation of the species at National Park of Jurubatiba, in Carapebus County, Rio de Janeiro State, Brazil, over a period of 14 months. The biology of the different forms of *C. cribraria* under controlled conditions of temperature and photoperiod was also studied. In the field, the most common form all year long was the recessive homozigote, the metallic form. Population was higher during the spring and summer and almost disappeared during autumn and winter. However, leaves of the host plant species were available all the time. It is possible that temperature is one of the factors responsible for this pattern. In the laboratory the best temperature for development was 30°C, less individuals developed at 25°C and none succeeded in reaching maturity at 20 and 35°C. There were no differences in development time among the forms but males tended to emerge in a shorter time, probably because of their smaller size.
Index terms: *Chelymorpha*, polymorphism, population ecology, biology

[2743] EVALUATION OF INDOXACARB FOR LEPIDOPTEROUS PESTS CONTROL ON VEGETABLES

S. Martinelli[1], M. A. Montagna[1], N. C. Picinato[2], F. M. A. Silva[2] & O. A. Fernandes[1], [1]Dept. Fitossanidade, FCAV/UNESP, Rod. Prof. Paulo D. Castellane km 5, Jaboticabal, São Paulo, 14870-000, Brazil, E-mail: oafernan@fcav.unesp.br; [2]Du Pont do Brasil S. A., P. O. Box 09, Paulínia, São Paulo, 13140-000, Brazil.

The evaluation of efficacious insecticides for controlling pests is necessary to the improvement of the chemical control tactics. This project was elaborated with the purpose of evaluating the effectiveness of several insecticides usually sprayed for controlling *Plutella xylostella*, *Trichoplusia ni*, *Neoleucinodes elegantalis*, and *Helicoverpa zea*. The experiments were carried out at three different sites on tomato and cabbage crops in 1997. The insecticides utilized were: Indoxacarb (dosage range for tomato varied from 2.4 g a.i./100 l to 6.0 g a.i./100 l and for cabbage varied from 18 g a.i./ha to 42 g a.i./ha), Esfenvalerate (used only on tomato at 1.75 g a.i./100 l), Methomyl (used for tomato at 21.5 g a.i./100 l and for cabbage at 172 g a.i./ha), Deltamethrin (used only on cabbage at 6 g a.i./ha) and Triflumuron (used only on tomato at 15 g a.i./100 l). The experiments were statistically designed as randomized blocks. ANOVA was used and means were compared using Tuckey's test. The results showed that all products tested reached effectiveness levels higher than 80% for controlling *Helicoverpa zea* on the tomato crop. The product Indoxacarb was as efficient as Triflumuron which was the standard product. Also, *Neoleucinodes elegantalis* was efficiently controlled by insecticides tested after nine applications and the product Indoxacarb could be recommended at the lowest dosage (2.4 g a.i./100 l). All dosages of Indoxacarb presented excellent performance controlling *Plutella xylostella* and *Trichoplusia ni* on cabbage. Therefore, the lowest dosage should be used (i.e. 18 g a.i./100 l).
Index terms: *Plutella xylostella*, *Trichoplusia ni*, *Neoleucinodes elegantalis*, *Helicoverpa zea*, tomato, cabbage

[2744] FOLIAR SPRAY STRATEGY FOR RATIONAL CHEMICAL CONTROL OF *ORYZOPHAGUS ORYZAE* ON FLOODED RICE

J. F. da S. Martins[1], A. D. Grützmacher[2], U. S. da Cunha[2], F. P. Giolo[2], E. A. Pan[1] & J. J. Carbonari[3], [1]Embrapa Clima Temperado, P.O. Box 403, 96.001-970, Pelotas, RS, Brazil, E-mail: martins@cpact.embrapa.br; [2]Dept. de Fitossanidade, FAEM/UFPel, P.O. Box 354, 96.010-900, Pelotas, RS, Brazil; [3]Dept. de Entomologia, ESALQ/USP, P.O. Box 9, 13.418-900, Piracicaba, SP, Brazil.

Oryzophagus oryzae (Coleoptera: Curculionidae) is one of the most harmful insect species on flooded rice in Brazil. Commonly the insect is known by rice water weevil. The adults attack the leaves, but are the larvae that cause the main damages to the culture. To avoid yield losses, the granulated insecticide carbofuran has been applied around 20 days after flood (DAF) irrigation for larvae control. In spite of product efficiency, there are restrictions to its use due to high cost and fear of negative environmental impact. Foliar spraying (FS) with insecticide up to 5 DAF, aiming to kill adults at egg deposition period, results in drastic reduction of larval population. Moreover, FS is less costly than the application of granulated carbofuran and insecticides of different physiologic action, with selectiveness to several organisms that live on irrigated rice ecosystem, can be used. A randomized block experiment, with four replications was done in the 2000 season, at Embrapa Clima Temperado, to evaluate the efficiency of insecticide FS on the control of *O. oryzae*. The ten treatments were: FS 3 DAF with thiamethoxam (Actara 250 WG) at 25, 37.5 and 50 g a.i./ha; FS 3 DAF with diflubenzuron (Micromite 240 SC) at 144, 180, 216 and 240 g a.i./ha; FS 3 DAF with betacyflutrin (Bulldock 125 SC) at 6.25 g a.i./ha; FS 6 DAF with diflubenzuron (Micromite 240 SC) at 180 g a.i./ha; and check without treatment. Plots consisted of 10 rows of plants of cultivar BRS Chuí with 4.0 m long, 0.20 cm between rows, enclosed in earth walls to avoid contamination among treatments. Two larvae counting were accomplished, at 24 and 38 DAF. Sampling consisted of four cilindric volumes (8.5 cm high and 10 cm diameter) of soil and roots, collected from each plot. At 38 DAF Micromite 144 g a.i./ha was the only treatment that did not differ from check on the larval population level. The other treatments with Actara and Micromite did not differ from the Bulldock standard treatment. Actara, 50 g a.i./ha, FS at 3 DAF and Micromite 180 g a.i./ha, FS at 6 DAF, stood out. It is concluded that Actara and Micromite are effective on the control of *O. oryzae* through the FS. However, Micromite, with physiologic action, would be less aggressive to environment.
Index terms: *Oryza sativa*, rice water weevil, curative chemical control method

[2745] REDUCTION OF CARBOFURAN INSECTICIDE DOSAGE FOR *ORYZOPHAGUS ORYZAE* LARVAL CONTROLING AND ENVIRONMENTAL IMPACT EVALUATION IN THE FLOODED RICE ECOSYSTEM

J.F. da S. Martins[1], M.L.T. Mattos[1] & U. S. da Cunha[2], [1]Embrapa Clima Temperado, Caixa Postal 403, 96.001-970, Pelotas, RS, Brasil, E-mail martins@cpact.embrapa.br; [2]UFPel-FAEM, Departamento de Fitossanidade, Caixa Postal 354, 96.001-900, Pelotas, RS, Brazil.

The rice water weevil *Oryzophagus oryzae* is the major insect pest of the flooded rice culture in southern Brazil, with annual economic loss potential higher than US$ 40 million. Cultural practices of the flooded rice reduce the insect population, but, chemical control is usually necessary. Aerial applications of granulated carbofuran in the irrigation water for larval controling should be pointed out. Despite the high efficiency level of the insecticide, there are problems regarding to the high relative price and doubts about its affects in the environment. The registered dosage, for flooded rice, varies from 750 to 1000 g/ha. However, there is empirical information that the dosage of 400 g/ha controls efficiently the larval population in rice fields. In order, to reduce production costs and to evaluate environmental damages, the effect of different carbofuran (Furadan 50 G®) dosage in the control of *O. oryzae* larvae and the impact level in the flooded rice ecosystem are being studied. Dosage reductions, in 1997 and 2000, with applications via Ipanema EMB 201-A aircraft, in 4.5 to 20 hectares rice areas, indicated that 250, 500 and 750 g/ha of granulated carbofuran controlled 100% of the larvae population. It was concluded that there is a potential to reduce up to 67% the registered minimum dosage (750 g/ha) and, consequently, the production costs and risks to negative impact environment impact. In 2000 year, to evaluate the environmental impact of the carbofuran application, some aspects are being studied, such as: (1) the affects of the insecticide dosages in the rice field fauna, quantifying the population of arachnids, amphibians, crustaceans, insects, mollusks and fishes; (2) carbofuran and 3-hydroxi-carbofuran dissipation, measuring their concentration by chromatographic residue analysis, in soil and water, collected in treated areas and in the irrigation and drainage net of the rice field; (3) biodegradation of the insecticide by microorganisms isolated from rice field soils where it was applied; and (4) insecticide drift, installing equidistant rows of plastic trays (10 x 30 x 40 cm) containing 2 liters of water. The plastic tray rows were placed perpendicularly to the first strip of carbofuran aerial application, in the rice field border, according to the wind direction. Each row consisted of 10 trays aligned in 180 meters, over pasture area adjacent to the rice field. Carbofuran granules visualization and its residues detection in the tray water indicate the drift extension. Granules were visualized up to 37.5 meters far from the insecticide application strip, with 15-km/h wind, temperature of 27 °C and air relative humidity of 58%. The results on residue analysis in the water are not available yet.
Index terms: rice water weevil, chemical residues, soil, water, biodegradation

[2746] MORTALITY OF THE *ANTICARSIA GEMMATALIS* IN ARTIFICIAL DIET TREATED WITH AQUEOUS EXTRATS OF THE *MELIA AZEDARACH*

L. H. Martins & D. M. N. Gallego, Depto. Agronomia, Universidade Estadual de Londrina, C.P. 6001, Londrina-PR, CEP 86051-970, Brasil. E-mail : henriquemartins@usa.net.

This research shows the development of *Anticarsia gemmatalis* in artificial diet treated with aqueous plant extracts of *Melia azedarach*. Assays have been performed in laboratory, using 1° and 2° instar caterpillar. Different aqueous extracts were prepared at a 5% concentration - based on preliminary tests - from flowers, leaves and stems, dried in a stove at 40°C. Later, the extracts were incorporated in Greene's artificial diet, substituting partially the water used in the diet. The diets were then put in paper vessel containing one caterpillar per vessel for daily evaluation. The three treatments led to a 100% mortality. The treatment with flowers extracts showed a significative decrease in the mortality time for 1° as well as 2° instars caterpillar in comparison to the other treatments based on the Tukey test. Index terms: biological control; aqueous extrats; soybean caterpillar

[2747] INTEGRATED CONTROL MANAGEMENT AGAINST THE PEST COMPLEX OF LUCERNE CROPS

M.C. Mateias [1] & C. Popov[2], [1,2] Research Inst. for Cereals and Industrial Crops, 8264 Fundulea, N. Titulescu Str., 1, Calarasi District, Romania, E-mail: fundulea@cons.incerc.ro

Due to their perennial character, alfalfa crops shelter a high and diversified range of phytophagous insects. Possibly, a lucerne crop in the 3rd or 4rd year of production contains some 40 insect species belonging to various orders. Besides arthropods, lucerne crop may also harbour other pest groups. Our studies performed in the plain area in south and east Romania revealed the fact besides the pest factor mentioned, nutritive basis has an equally important role in the subject economy. Results. In the area 54 species of parasitic hymenoptera have been identified, of which 23 Braconids, 10 Chalcidoids and 14 Ichneumonids, while from Diptera 7 Larvaevoridae.. Great variety of hosts raised the problem of specificity and parasitary efficiency of some entomophages. Thus, the parasitoid *Bathyplectes curculionis* destroyed larvae of the weevil *Hypera variabilis* at a rate of 20-30%. Populations of gall midge *Contarinia medicaginis* -have been reduced up to 52% by parasitisation with *Systasis encyrtoides*. The Braconid *Apatheles praepotens* had parasitary shares of 74 and 58% against the Geometrids *Semiothisa clathrata* and *Tephrina arenacearia* respectively. For lucerne cutworm, *Heliothis maritima*, the main larval parasite was the Diptera *Exorista xanthapis*, whose parasitic activity ranged up to 19%. Among the factors of soil and plant management having a role in reduction of pest reproduction in lucerne crops and attack prevention, we recall: ground choice and preparation, seeding way, weed control, hay mowing and seed harvest. From previously prevented rations, it is not possible to consider control of a singular pest species as being ineffective and not economic, and pollution risk would be too much. By chemical preventive treatmens (seed dresing) a new step appeared (a modern, selective method) in preventing attack by some pests whean seeding alfalfa crops in spring (*Sitona* spp. adults associated with wireworms *Agriotes* spp. and adults of *Phytodecta fornicata*) Curative treatments (in season) are considered a necessary evil, mainly for seed crops. Control strategy of pests (attacking flowers, seeds et al.) with synthetic pyrethtoid compounds or growth inhibitors, pursuit treatment applications at the phenological phases: button, flowering start, flowering end. Conclusions. Protection of lucerne seed crops against the pests represents a significant chain-loop in cropping technology. In this sense entomofauna monitoring has priority, both for pests and useful specimens, in view of suitable management application.

Key words. Lucerne pest complex, parasites, predatores, chemical control.

[2748] MANAGEMENT OF A SOIL INSECT PEST WITH FUMIGANT – A UNIQUE CHALLENGE TO ADOPTION OF IPM

J. N. Matthiessen[1] & S. E. Learmonth[2], [1]CSIRO Entomology, Private Bag PO, Wembley, WA 6014, Australia, E-mail: johnm@ccmar.csiro.au; Agriculture Western Australia, Manjimup, WA 6258, Australia, E-mail: slearmonth@agric.wa.gov.au.

In SW Australia the South American insect whitefringed weevil (WFW), *Naupactus leucoloma*, is a severe pest of potatoes. Larvae damage at extremely low populations because individuals damage several tubers. Now-banned residual insecticides once provided control, but replacements proved less reliable. In the last decade almost all producers threatened by WFW have adopted the broad-spectrum soil fumigant metham sodium, despite a cost of c. $A800 (c. $US500) ha^{-1} compared with c. $A100 ha^{-1} for conventional insecticide such as chlorpyrifos. WFW is clearly the most feared pest in the mix of soil-borne pests and diseases that can reduce yields or, importantly in an era of extreme quality demand, reduce production of premium unblemished tubers. Most of the other soil-borne pest organisms are fungal and bacterial pathogens and nematodes that also affect the production of quality potatoes. With the advent of metham sodium as product-of-choice to control WFW, producers have noticed marked improvement in tuber quality through concomitant suppression of the other deleterious soil organisms. Higher returns for the larger proportion of improved quality tubers are now highly valued as an additional benefit to the effective control of WFW with metham sodium. This bonus alone provides justification for use of a high-cost pesticide and is a key driver of the prophylactic use of metham sodium as a 'cure-all' for the full suite of soil-borne pests and diseases. The use of the high-cost metham sodium primarily to control a soil insect, which is viewed as the 'key pest' amongst a diverse array of noxious soil organisms, and valuing associated benefits against pathogens, is unique in the literature. The reverse is the norm. Of considerable interest are indications that the interplay outlined may act quite strongly to thwart the acceptance of alternative management strategies for the soil pest insect that may be solely entomologically-focussed (eg. some form of IPM) or introduction of new insecticides. Indications are strong that whitefringed weevil management options that are considered 'softer' will need to be developed alongside considerations for alternative management of soil-borne diseases and nematodes. Entomologists have a strong case for the establishment of a team approach to assisting potato farmers produce quality product.

Index terms: Whitefringed weevil, *Naupactus leucoloma*, metham sodium, potatoes

[2749] RESISTANCE OF BEAN GENOTYPES TO *ZABROTES SUBFASCIATUS* (COLEOPTERA: BRUCHIDAE)

F. Mazzonetto[1] and J.D. Vendramim[1], [1] Department of Entomology, Plant Pathology and Agricultural Zoology, ESALQ, University of São Paulo, 13418-900, Piracicaba, São Paulo, Brazil.

Bean genotypes containing arcelin (ARC 1, ARC 2, ARC3 and ARC4) and bean genotypes without this protein (IAC Carioca Aruã, IAC Carioca Pyatã, IAC Carioca Akytã, IAC Maravilha, IAC Una, IAC Bico de Ouro, Porrillo 70 and Goiano Precoce) were evaluated concerning the resistance to the Mexican bean weevil *Zabrotes subfasciatus* (Boh.). The experiments were conducted under laboratory conditions in order to evaluate the non-preference for oviposition (with free choice and without free choice) and the development, longevity and fecundity of the insect in different genotypes. In the free choice test all genotypes presented fewer eggs than the cv. Goiano Precoce. In the no-choice test, the genotype containing arcelin 3 presented fewer eggs than the genotypes IAC Carioca Pyatã and IAC Carioca Bico de Ouro. The materials containing arcelin (ARC 1,2,3 and 4) showed antibiotic effects on the insect, prolonging the development period (egg to adult), reducing the males and females weight and longevity, and decreasing the fecundity. The cv. Goiano Precoce was the most suitable genotype for the development and reproduction of this insect.

[2750] ARTHROPODS ASSOCIATED WITH DOUBLECROPPED SOYBEAN

G. S. McCutcheon[1] & J. R. Frederick[2], [1]Dept. of Entomology, Clemson Univ. Coastal Research and Education Center, 2865 Savannah Hwy, Charleston, SC 29414-5332, USA. E-mail gmccthn@clemson.edu; [2]Dept. of Crop & Soil Environ. Sci., Clemson Univ. Pee Dee Research and Education Center, 2200 Pocket Rd., Florence, SC 29506-9706, USA.

The population dynamics of arthropods in soybean (cv. Northrup King S75-55) planted after a winter wheat crop using conventional and conservation tillage practices was determined in 1996, 1997, and 1998. The soybean treatments included surface residue management (no-till and double disking), deep tillage (deep tillage and none), and rotation (monoculture and rotated with corn) for soybean grown using 19-cm row widths. A disked, deep tilled, 76-cm row width check treatment was also planted. Lepidopterous pests included green cloverworm, *Plathypena scabra*; soybean looper, *Pseudoplusia includens*; corn earworm, *Helicoverpa zea*; velvetbean caterpillar, *Anticarsia* gemmatalis; and fall armyworm, *Spodoptera frugiperda*. Populations of *P. scabra* peaked during late August (beginning of pod fill) and remained high through the middle of September in disked, no-deep tillage treatment. Populations of *P. includens, H. zea,* and *S. frugiperda* occurred from late August through mid-September and were relatively low throughout the study. Populations of *A. gemmatalis* began to increase during mid September and peaked in population during the first week of October in the disked, deep tilled treatment. The southern green stinkbug, *Nezara viridula* was prevalent during late September and early October. Population density of this insect was greatest in the 76-cm row-width, disked, deep-tilled treatment. The threecornered alfalfa hopper, *Spissistilus festinus*, was detected in highest numbers from mid September through early October in the no till, deep tilled treatment. The most abundant predaceous arthropods were bigeyed bugs, *Geocoris punctipes* and several species of spiders. Other predaceous arthropods included damsel bugs, hooded beetles, and lady beetles. Parasitoids of the lepidopterans included the braconids *Cotesia marginiventris* and *Meteorus autographae*. A tachinid was reared from adult stink bugs. Compared to the check treatment, seed yields were an average of 28% higher with the narrow row/conservtion tillage system over all 3 years. Our data indicate that grower adoption of these new systems should result in higher profits with little change in arthropod insect populations.

Index terms: *Plathypena scabra, Anticarsia gemmatalis, Spissistilus festinus*, conservation tillage, *Glycine max*

[2751] DIAMONDBACK MOTH POPULATION DYNAMICS AND PARASITOID SURVEY IN THE FEDERAL DISTRICT, BRAZIL

M. A. Medeiros, L.O. Nascimento, Embrapa Hortaliças, Caixa Postal 218, 70.359-970. Brasília, D.F. Brazil, E-mail: malice@cnph.embrapa.br.

Population dynamics of Diamondback Moth (DBM) and their parasitoids on cole crops cultivated without insecticide spray was studied at the Embrapa Hortaliças Experiment Station located in Brasília, Brazil in 1999/2000. Twenty plants were harvested every week and larvae and pupae were collected. Pupae were separated, kept in gelatin capsules and stored in BOD chambers at a 25 ± 2° C, 70% RH, 14 hours photophase until the emergence of either DBM adults or parasitoids. Larvae were reared on cabbage leaves until pupation and then kept in gelatin capsules. DBM parasitoids emerged from about 18% of the field collected larvae and pupae. Nine parasitoid species were found: *Oomyzus sokolowskii, Diadegma* sp, *Actia* sp and possibly two species of *Apanteles* sp. and two species of *Conura* sp.; two other species are yet to be identified. *O. sokolowskii, Diadegma* sp and *Apanteles* sp. parasitized about 50%, 29% and 9% of DBM larvae and pupae, respectively. Hyperparasitism by *Conura* spp was observed in *Diadegma* sp. and *Apanteles* spp.
Index terms: *Plutella xylostella*, biological control.

[2752] PROCEDURES FOR ADULTICIDE EFFICACY TRIALS

M. V. Meisch

Techniques for collecting mosquitoes with advantages and disadvantages of each are discussed along with collecting equipment. Resting stations are best for *Anopheles* and certain *Culex*, while biting collections favor floodwater mosquitoes. Various traps can be used as well as rearing field-collected larvae or using those from a laboratory colony. Wild mosquitoes often offer a more natural and hardy test animal than laboratory reared specimens. Handling procedures including carbon dioxide, chill table, and mouth aspirator are evaluated. Cages may be either washable or disposable. Plot arrangement varies considerably according to height and distance. Various methods for assessing droplets are discussed along with weather records. Post treatment procedures include transfer versus non-transfer and statistical analysis.

[2753] A DOSE RECOMENDATION AND AN EVALUATION OF THE EFFICIENCY OF THE FARM CHEMICAL FASTANE 1P (ALPHACIPERMETHRIN) TO CONTROL *ATTA LAEVIGATA ATTA SEXDENS RUBROPILOSA*8 AND *ATTA BISPHAERICA*, (HYMENOPTERA: FORMICIDAE)

N. T. de Mendonca[1], D. H. Fileni[2], R. S. de Mendonça[2]& J.L.Beasini[3, 1] Conecta Santos Ltda., Santos, SP, Brazil, Zip Code 11075-690 E-mail: conectas.rogeriom@bsnet.com.br, [2] Inst. de Ciências Agrárias, Univ. de Alfenas/UNIFENAS, P.O. Box 23, Alfenas, MG, Brazil, Zip Code 37.130-000, E-mail: fileni@artefinal.com .br, [3] Trainee of the Univ. de Alfenas/UNIFENAS.

The leaf cut ants from *Atta* sp. are responsible for a great damage in the Brazilian agricultural, being one of the most important pest for a large group of plantations, specially for the permanent cultures. The control of *Atta* constitutes a subject to many researches once it is important to provide different and efficient methods to be applied for the farmers, according to their economic and technological capacity. The focus of this study was to evaluate the agronomic efficiency and recommended doses of the farm chemical Fastane 1P (alphacipermethrin) to control *Atta* sp. The test was set up at the areas of Alfenas and Machado, Minas Gerais State, Brazil, during the July up to October, 1999. Sixty ant nests from the following species were evaluated: *Atta laevigata, Atta sexdens rubropilosa* and *Atta bisphaerica*. The areas under test were planted with citrus and pasture and the ant infestation was considered severe since both areas didn't receive any ant control at least for 5 years . The mean area of the nests was around 40 m^2. Five treatments were done, being three treatments with the Fastane 1P in the following doses 7.5; 10 and 15 grams/m^2 of nest, one treatment with K-Othrine 2P (deltamethrin) at 10 grams/m^2 of nest and one treatment for control, with no pesticide. The chemical powder was applied in the activate canals of the nest using an insulation bomb - Guarany trade mark. The evaluation of treatments was done 30, 45, 90 and 105 day after the application. Due to the severe infestation conditions it was adopt a repass procedure after 45 days of the initial application, this procedure consisted in a reapplication of the dose considering a standard area of 10 m^2, independent of the visual area of the nest. The efficiency of the treatments were quantified during the last evaluation using dummy variables, zero for the activity nest and one for the inactivity, being considered inactivity when a total absence of ants was verified after digging two or three representative canals. A measure of effectiveness was obtained comparing the chemical treatment against the control treatment by regression model. The treatment with Fastane 1P, at the dose of 15 grams/m^2 of nest showed the best performance among the treatments with 83,33% of efficiency, this result was highly significative (standard erro=17,11%; t value=4,87) being the dose recommended to control the species of *Atta* under evaluation.
Index terms: *Atta.*, alphacypermethin, chemical control, ants.

[2754] EVALUATION OF THE EFFICIENCY OF THE FARM CHEMICAL FASTANE 1 P (ALPHACYPERMETHRIN) TO CONTROL THE ANTS FROM THE GENUS *ACROMYRMEX* (HYMENOPTERA: FORMICIDAE)

N. T. de Mendonca[1], D. H. Fileni[2], R. S. de Mendonça[2] & M.S.Faro[3], [1] Conecta Santos Ltda., Santos, SP, Brazil, Zip Code 11075-690, E-mail: conectas.rogeriom@bsnet.com.br, [2] Inst. de Ciências Agrárias, Univ. de Alfenas/UNIFENAS, P.O. Box 23, Alfenas, MG, Brazil, Zip Code 37.130-000, E-mail: fileni@artefinal.com .br, [3] Trainee of the Univ. de Alfenas/UNIFENAS.

The leaf cut ants from genus *Acromyrmex.* are responsible for a great damage in the Brazilian agricultural, specially in the pasture and reforestation areas, once they can overcame the genus *Atta* in quantity. The control of *Acromyrmex* may assume considerable importance according to the quantity of ant nests and their capacity of leaf cutting. The focus of this study was to evaluate the agronomic efficiency of the farm chemical Fastane 1P (alphacypermetrina) to control of *Acromyrmex* sp. The test was installed at the area of Miracatu, São Paulo State, Brazil, during the May up to July, 1999. Ten ant nests from the following species were evaluated: *Acromyrmex crassispinus, Acromyrmex striatus, Acromyrmex heyeri, Acromyrmex laticeps nigrosetosus, Acromyrmex disciger* and *Acromyrmex coronatus*. The local under test were planted with pine tree, banana and natural forest. The Fastane 1P was applied directly inside the nest or in the canals when they were present using a insufflation bomb - Guarany trade mark. A unique dose of 15 grams per nest was used. The behavior of the nests was observed during 4 hours after the treatment and the evaluation of the effectiveness was done 30, 60 and 90 days after. According to the local observations, after the chemical treatment the ants weren't able to move the colony to other place and lethal doses occurred after 3 hours. The evaluation of effectiveness during subsequent days showed that the farm chemical Fastane 1P, in a dose of 15 grams per nest provided 100% of efficiency to control the species of *Acromyrmex* under evaluation.
Index terms: *Acromyrmex* ., fastame, alphacypermetrina, ants

[2755] HABITAT DIVERSITY: EFFECT ON POPULATION DENSITIES OF PREDATORY INSECTS OF *HELICOVERPA* SPP. IN COTTON IN AUSTRALIA

R.K Mensah & A. Singleton, NSW Agriculture, Australian Cotton Research Institute, Locked Bag 1000, Narrabri, NSW, 2390, Australia, E-mail: Robert.Mensah@agric.nsw.gov.au.

Many predatory insects such as predatory beetles, bugs, lacewings and spiders have been recorded in Australian cotton, their potential value have not been widely exploited in cotton pest management due to lack of techniques to conserve and maximise both their abundance and effectiveness. Adoption of within field monocultures in the cotton production system in Australia is known to discriminate against and reduce the activity of predatory insects because they lack ecological diversity. The utility of crops such as sunflower (*Helianthus annuus*), safflower (*Carthamus tinctorius*), sorghum (*Sorghum bicolor*), lucerne (*Medicago sativa*) and tomato (*Lycopersicon esculentum*) as refugia for predatory insects of *Helicoverpa* spp. when they were planted as strips in commercial cotton fields was evaluated between 1993 and 1995. Densities of predatory beetles, bugs and lacewings were higher in lucerne crops than any other crops tested. In an experiment where lucerne was planted in strips within commercial cotton, the number of predators was highest in the lucerne strip and declined with increasing distance from the lucerne strip to the cotton crop. At the end of the study, 7.1, 6.1, 5.8 and 1.5 times more predatory beetles, bugs, lacewings and spiders per metre row respectively were recorded on the lucerne strips than on cotton. When lucerne was interplanted with commercial cotton to compare densities of predators on cotton with and without lucerne strips, 2.1, 2.5 and 1.2 times more predators were recorded on cotton with lucerne strips than cotton without lucerne strips. This indicated that the lucerne strips can serve as a refugium for predators which can then be moved into cotton to manage cotton pests. The relevence of these findings and the role of habitat diversity in integrated pest management programs in cotton and other crops will be discussed.

Index terms: Habitat diversity, *Helicoverpa* spp., refugia, ecological diversity.

[2756] IPM STRATEGIES ON GREENHOUSE VEGETABLES: CONSTRAINTS TO A GENERAL ADOPTION

A. Mexia[1] & Isabel Rodrigo[2], [1]Instituto Nacional de Investigação Agrária, Estação Agronómica Nacional, Quinta do Marquês, 2780 Oeiras ean@mail.telepac.pt ; [2]Instituto Superior de Agronomia, Departamento de Economia Agrária e Sociologia Rural, Tapada da Ajuda, 1349-017 Lisboa, isarodrigo@isa.utl.pt .

A general survey questionnaire was done to sixty growers in the Oeste region to understand eventual technical and sociological constraints faced by the growers for IPM adoption. The results provided data to clarify their technical profiles, goals and perspectives either for the faced pest problems or available control options, and their assessments for the achieved control results. The growers involved in the study were selected according to their pest control strategies: traditional chemical control, conditioning chemical control (restricted sprays caused by bumblebees releases), IPM strategies and from organic agricultural practices. The questionnaires followed crop profiles, which listed, in sequence, the cultural and phytossanitary techniques and some aspects related with greenhouse structural characteristics and commercial aspects for three crops: tomato, lettuce and greenbeans. For each task the information compiled was selected with equipment, working times and who performs the work. The studied cropping sequence was previously defined through other questionnaire involving a higher number of surveyed growers (almost 200). The results allowed us to identify restrictions for adoption of new technologies on sustainable agriculture. Therefore, is possible to assess growers' attitude to innovation either to new techniques of risk assessment and control measures (ex: biological control). The present study also provided insights to the tasks, cultural or/and phytossanitary, where growers spend more time and are faced with higher working costs and, consequently, to understand their possibilities to change traditional practices. Differences revealed by the results between their common practices and the proposed technical solutions, organised in a IPM program, are addressed, to understand and try to overcome the actual constraints faced by the growers to widely adopt IPM practices, regarded at the technical and socio-political grounds as advantageous.

Index terms: protected crops, IPM, sociological survey

[2757] IPM PROGRAMMES FOR PROTECTED VEGETABLE CROPS (IN OESTE REGION OF PORTUGAL)

A. Mexia[1], C. Marques[2], E. Figueiredo[2], F. Amaro[1], M.C. Godinho[3], Almeida, M.L.[4] & Nunes, A.P.[4], [1]INIA/EAN, Quinta do Marquês, 2784-505 Oeiras, Portugal; [2]DPPF/SAPI, Inst. Sup. Agronomia, Tapada da Ajuda, 1349-017 Lisboa, Portugal; [3]Esc. Sup. Agrária Viseu, Campus Politécnico, Repeses, 3500 Viseu; [4]DRARO, Zona Agrária Caldas da Rainha, 2500 Caldas da Rainha, Portugal; E-mail elisalacerda@isa.utl.pt

During the last 10 years IPM faced a tremendous development in Portugal, especially in grapevine, stone fruit and citrus crops. In 1995, for protected crops as for other crops there was no IPM programme to guide the growers /field technicians. Some field studies concerning risk assessment, natural control evaluation and alternative control methods had been carried out since 1990 in the Oeste region (at the Northwest of Lisbon). With this background this team defined an initial IPM programme for each crop, including the three IPM components: risk assessment, decision rules and selection of control methods for the pests and diseases considered by the technicians from regional services as key-pests. During three years these programmes were tested in two greenhouses located at a demonstrative field. Simultaneously, studies concerning risk assessment procedures, evaluation of the incidence of each pest in each crop and season, identification of parasitoids and predators, quantification of natural control activity and efficacy of alternative control continued to be carried out in eight greenhouses with different protection strategies (organic farming, IPM, traditional chemical control). With this knowledge, the IPM programmes were submitted to adaptations periodically. In the final phase of this three years project IPM programmes for tomato, lettuce, green beans, cucumber/melon and aubergine/sweet pepper were proposed and are now widely spread for field use as a first approach by field technicians. These programmes allowed to decrease the number of treatments (chemicals + *B. thuringiensis*), from 15% to 41% with the exception of the situations where it was often necessary to treat against caterpillars (+3 treatments in two crops in 1998) and in those cases Bt was selected. Production obtained in IPM greenhouses was always higher compared to the obtained in chemical control ones (from 10% to 115% more) with only one exception of equal production. Phytossanitary costs (in proportion of total production costs) were lower in IPM production with only one exception.

Index terms: tomato, lettuce, sweet pepper, green beans, cucumber

[2758] THE ROLE OF NATURAL ENEMIES AND HABITAT MODIFICATION IN CODLING MOTH MANAGEMENT PROGRAMS

N. J. Mills[1], T. Unruh[2] & U. Kuhlmann[3], [1]Insect Biology, Univ. of California, Berkeley, CA 94720-3112, USA, E-mail nmills@nature.berekeley.edu; [2]USDA-ARS Yakima Agric. Res. Lab., Wapato, WA 98951, USA; [3]CABI Bioscience Centre, CH-2800 Delémont, Switzerland.

Traditionally, codling moth management programs have relied almost exclusively on organophosphate insecticides. However, resistance development and regulatory restrictions have led to the replacement of traditional sprays with mating disruption and more selective products, allowing the integration of natural enemies and habitat modification as additional tactics for codling moth management. Recently two parasitoids have been imported from Central Asia, the purported native range of codling moth, and have become established in the western USA; *Liotryphon caudatus* (Hym.: Ichneumonidae) – a solitary ectoparasitoid that attacks codling moth cocoons under bark and is most active mid summer, and *Mastrus ridibundus* (Hym.: Ichneumonidae) – a gregarious ectoparasitoid that attacks codling moth cocoons on the ground as well as under bark and is most active toward the end of the season. A third species, *Bassus rufipes* (Hym.: Braconidae) a larval endoparasitoid, has yet to become established in the USA. Augmentative releases of indigenous natural enemies have also been considered as potential tactics for codling moth management. Although entomopathogenic nematodes are typically soil inhabitants, *Steinernema* species have been isolated from codling moth, and recent studies in Europe and the USA indicate that high levels of parasitism of overwintering codling moth can be achieved in tree bands and fruit bins following nematode application. Similarly, inundative releases of the indigenous egg parasitoid *Trichogramma platneri* (Hym.: Trichogrammatidae) in California indicate that substantial reductions in damage can be achieved for low pressure populations of codling moth in walnuts and pears. Habitat modification can also be an important tactic in the management of codling moth populations. The smooth bark of high-density plantings may limit the availability of cocooning sites in apple orchards and pruning wounds may frequently be used for cocooning in such orchards. Fruit stripping after harvest in pears and removal of untended nearby wild trees have also proved successful in reducing codling moth populations and fruit damage. Similarly, the use of overhead irrigation and ground cover management by altering the orchard microclimate can reduce codling moth damage, but may have undesired effects on the incidence of disease.

Index terms: *Bassus rufipes*, *Liotryphon caudatus*, *Mastrus ridibundus*, *Steinernema* spp., *Trichogramma platneri*

[2759] CONTROL OF CITRUS LEAF MINER BY IPM TECNIQUES AT YOUNG LEMON PLANTING IN SICILY

G. Mineo, Inst. of Agricultural Entomology, Univ. of Palermo Viale delle Scienze – 90128 Palermo ITALY, E-mail mineog@unipa.it.

Field trials looking at the efficacy of cultural - like timing of pruning, of breaking of water stress period, of post-stress irrigations, etc. - selective chemicals and biological procedures in order to control the Citrus Leaf Miner (CLM) in a new plantation of citrus lemon, 14 Ha in extent and about 3 years old, were carried out in Sicily during 1998 and 1999. In 1998 the citrus grove was divided into 4 blocks, one of which was treated with Lannate® (*a. i.* Methomyl 19%); one with Biolid E® (*a. i.* Paraffin-oil); one with Confidor® (*a. i.* Imidachloprid 20%); another one with inoculative releases of *Cirrospilus diallus* and *C. pictus*, obtained from parasitized larvae of CLM collected in the field. In 1999 the same citrus grove was instead divided into 3 blocks one of which was treated with Lannate®; one with Biolid E® and another one with inoculative releases of *Citrostichus phyllocnistoides*, *Semielacher petiolatus*, *Asecodes delucchii* and *A. erxias*. Adults of eulophid wasps were obtained from infested CLM leaves collected from tender shoots of plants of *Citrus aurantium* put in rearing cabinets of a green house under seminatural climatic conditions. In the laboratory, parasitized individuals were selected and bred until the emergence of the wasp. The final efficiency of the different techniques used was measured by the percentage (in cm^2) of necrotized leaf surface due to the CLM larval trophic activity observed both on the sprayed and on the unsprayed plants. Results concerning various pest management procedures are discussed.
Index terms: *Phyllocnistis citrella*, cultural procedures, selective chemicals, indigenous and exotics parasitoids, biological control.

[2760] INTEGRATION OF PLANT RESISTANCE WITH INSECTICIDES FOR THE MANAGEMENT OF COTTON LEAFHOPPER, *AMRASCA DEVASTANS* [DISTANT]

S.Mohankumar[1,2] & M.S.Venugopal [2], [1] CSES Dept., Virginia Tech, Blacksburg, VA24061, USA, [2]TamilNadu Agricultural University, Coimbatore-641003, INDIA. smk65@hotmail.com

Field experiments on the integration of plant resistance witch insecticides to manage *A. devastans* were carried out at rainfed, irrigated summer, irrigated winter and rice follow cotton environments. Four cotton varieties namely KC1 (resistant), MCU5 (moderately resistant), LRA5166 (susceptible) and DCH32 (highly susceptible) were tested for integration with methyl-o-demeton (500ml/ha), monocrotophos (1000ml/ha), endosulfan (2000ml/ha), quinalphos (2000ml/ha), fenvalerate (225ml/ha), neem oil (2%), neem seed kernel extract (5%) for the management of cotton leafhopper. Combinations of single, two and three sprayings were given on 30,45,60 days after sowing (DAS) were tested along with need based application based on action threshold. The leaf hopper population was recorded on 30, 37, 45, 52, 60, 67 and 75 DAS. The population of other sucking pests namely whitefly, aphid and mealybug population were also recorded on 45, 60 and 75DAS.The natural enemies (cocconellids, spider and green lacewing) were counted on 45, 60, 75 DAS. The yield was recorded and cost-benefit ratio was worked out. Among the insecticides, methyl-o-demeton and monocrotophos recorded lower population and were on par in all the environments and varieties. In all the environments except rainfed environment, three sprays of monocrotophos or methyl-o-demeton recorded lower population, higher yield and better cost – benefit ratio. On resistant variety, single spray of monocrotophos or methyl-o-demeton or botanicals recorded lower population. On moderately resistant variety, two sprays of monocrotophos or methyl-o-demeton were superior to three sprays of botanical insecticides. On susceptible and highly susceptible varieties, three sprays of monocrotophos or methyl-o-demeton recorded lower population, higher yield and more cost – benefit ratio. The increase in number of sprays towards the susceptibility reaction was evident. In rainfed environment, the need based application of chemicals proved better than scheduled sprays in all the varieties.
Index terms: *Amrasca devastans* management, plant resistance, insecticides, natural enemies

[2761] SPATIAL DISTRIBUTION OF SILVERLEAF WHITEFLY IN MELON

M. A. Montagna & O. A. Fernandes, Dept. Fitossanidade, FCAV/UNESP, Rod. Prof. Paulo D. Castellane km 5, Jaboticabal, São Paulo, 14870-000, Brazil, E-mail: oafernan@fcav.unesp.br.

Silverleaf whitefly (*Bemisia tabaci* strain B or *Bemisia argentifolii*) has been introduced into northeast of Brazil and become a major pest of melon crops. The development of sampling and controlling tactics should be developed after obtaining good knowledge of ecological aspects of such a pest. As the melon crops are cultivated in typical arid native vegetation ("caatinga"), the proposal of this project was to evaluate the spatial distribution of silverleaf whitefly in that agroecosystem. All leaves of two plants (cv. Gold Mine) were scouted on a weekly basis. Both nymph and adults were counted. Also, tree 4-ha melon crop (cv. Gold Mine) areas were divided in 100 sampling sites. Each site had all nymphs and adults counted from one plant on a weekly basis. The results demonstrated that leaves 9 through 14, considering leaf 1 as the terminal leaf at the growing tip of the plant, were the best for sampling both nymphs and adults. Silverleaf whitefly population did not clumped in the field despite proximity of infested areas. The population was randomly distributed in the areas and therefore fewer samples should be taken for accessing the population.
Index terms: *Bemisia tabaci* strain B, *Bemisia argentifolii*, sampling, infestation

[2762] FIRST RECORD OF *NEOHYDATOTHRIPS SAMAYUNKUR* (THYSANOPTERA:THRIPIDAE) IN BRAZIL

R.C. Monteiro[1], M. A . C. Zawadneak[2] & L.Mound[3], [1]Departamento de Entomologia, ESALQ/USP, Caixa postal 9, 13418-900, Piracicaba, SP, Brasil; [2]Departamento de Patologia Básica, Universidade Federal do Paraná, Curitiba, PR, Caixa postal. 19031, E-mail: macassil@bio.ufpr.br [3] C.S.I.R.O. Entomology, G.P.O . Box 1700, Canberra ACT 2601, Australia.

Neohydatothrips samayunkur is recorded for the first time in Brazil, on marigold (*Tagetes patula*, Compositae) at Curitiba, Paraná State. Thrips occurs during all the plant's life cycle, including reproductive stage, from August to May. Damage was visible when the third definitive leaf opens, and the thrips was mostly found on young leaves and on the leaf axils. Attacked plants showed leaves with scarring, silvering and distortion, with leaves becoming dry in field conditions. Flowers showed no symptoms. Thrips limit the growth of marigold seedlings and also adult plant development. Chemical treatment with acephate (100 g product/100 l H_2O) is used, giving efficiente control. *N. samayunkur* is associated with Compositae plants only of the genus *Tagetes*. The marigold thrips is record so far in Mexico; EUA; Australia; Japan; Sri Lanka; Costa Rica and El Salvador. *N. samayunkur* is bicolored yellow and brown, with the following characters: banded wings (dark base and pale apex, with two dark and two pale transverse bands betwen them); abdominal tergites with several rows of minute microtrichia laterally; transverse dark line on tergites; 5-7 pairs of dark spots along the dark line on tergites 3-7; pronotum with a brown blotch in the 2/3 posterior area; very weak reticulation within the ocellar triangle rather than transverse striation.
Index terms: *Neohydatothrips samayunkur*, Insecta, *Tagetes patula*

[2763] DETERMINATION OF THE OPTIMAL AND UPPER THRESHOLD OF TEMPERATURE FOR THE DEVELOPMENT OF *SELENASPIDUS ARTICULATUS* IN CITRUS

R.C. B. Moraes[1], M.L. Haddad[1], R.M. Loayza[2] & J.R.P.Parra[1], [1]Dep. Entomologia, Fitopatologia e Zoologia Agrícola, ESALQ/USP, Av. Pádua Dias, 11 13418-900, Piracicaba - São Paulo, Brasil, E-mail rcbotequ@carpa.ciagri. usp.br; [2]Univ.Nac.Agraria la Molina, Lima, Peru.

Upper threshold of temperature for the development of *Selenaspidus articulatus* was estimated in this research in order to develop simulation models to predict the occurrence of this pest. Initially, the biology of *S. articulatus* was studied under laboratory conditions at temperatures of 18, 20, 22, 25, 28, 30 and 32 °C to determine the upper threshold of temperature for the development of males and females of this important citrus pest in the State of São Paulo, Brazil. Based on Sharpe & Demichele model, the upper threshold temperatures were 30.3 and 30.2 °C for males and females, respectively. The optimal temperature for the development of males and females of this species was 28 °C based on estimation of the parameters of the model. Sharpe & Demichele model was suitable for determining the thermal requirements. The coefficient of determination was above 0.93. No significant differences were found in the upper and lower threshold (previously determined) temperatures for development of males and females of *S. articulatus*, based on overlap of confidence intervals. The information obtained herein can be incorporated in simulation models to predict the occurrence of *S. articulatus* and improve the control of this pest.
Index terms: *Selenaspidus articulatus*, Sharp & Demichele model, citrus scale.

[2764] OCCURRENCE OF GRASSHOPPER *SCHISTOCERCA PALLENS*, (ORTHOPTERA:ACRIDIDAE) IN RORAIMA, BRAZIL

M. A. B. Moreira[1] & F. J. F. Luz[1]. [1]Embrapa Roraima, Br 174, km 08, Distrito Industrial, Boa Vista -RR. Caixa Postal, 133. CEP 69.301.970. E-mail marcos@cpafrr.embrapa.br.

An outbreak of the population of *S. pallens* occurred in the state of Roraima, between setember and october of 1998, in the indigenous area of Surumu and Baixo-Cotingo, municipality of Pacaraima. The increase of the population of this grasshopper may have occurred due to the unusual high amount of rain that fell during these months, following the great drought during the normal dry season (october/97 to march/98), due also to the concomitant fires that occurred, beside the decrease in the natural grasshopper enemy level. This pest attacked many crops like cashew tree, citrus, banana, native grass, cassava, native plants and other weed plants. The outbreak happened during the highly rainy days of the the begining of the dry season attacking mainly the grass and native pastures, and later attacking the sunrrouding crops. Dispersal flights of this species seem to happen due to decrease in supply and the search for new alimentary areas. Nowadays, the population is at common density and restricted to some areas in the state of Roraima.

[2765] COTTON HOST PLANT RESISTANCE TO THE SILVERLEAF WHITEFLY TRANSMITTED COTTON LEAF CRUMPLE DISEASE

E. T. Natwick[1], C. Cook[2], R. Gilbertson[3], Young-Su Seo[3] & T. Turini[1], [1]University of California Coop. Ext., 1050 E Holton Rd, Holtville, CA 92250, USA, E_mail etnatwick@ucdvis.edu; [2]United Agri Products, Santa Rosa, TX; [3]University of California, Davis, CA 95616.

Eight cotton, *Gossypium hirsutum*, cultivars or breeding-lines were evaluated in Imperial Valley, CA for resistance to the silverleaf whitefly, *Bemisia argentifolii*, transmitted cotton leaf crumple (CLCr) disease caused by cotton leaf crumple geminivirus (CLCrV). The cultivars were Texas 121, AP 4103, AP 6101 and Stoneville 474 and the breeding-lines were DG 2383 and DG 2387, which have Cedix parentage, and DG 2108 and DG 2165, which do not have Cedix parentage. Cotton entries were rated visually for severity of CLCr disease symptoms using the following rating scale: 1 = leaf smooth, few if any bumps or blisters; 2 = some obvious blisters and crumpling, but less than 50% leaf with symptoms; 3 = Obvious crumpling, blisters, vein clearing from more than 50% to close to 100%, leaf not rolled; 4 = severe crumpling, blisters, leaves noticeably rolled and distorted. Leaf and petioles from each plot were used to confirm the presence of whitefly transmitted geminiviruses by squash blot hybridization with a general DNA probe. DNA sequencing of a polymerase chain reaction (PCR) amplified fragment from an infected plant was used to confirm that the geminivirus was CLCrV. DNA extracts were prepared from leaf tissue and PCR analysis was conducted using degenerate geminivirus primers. To evaluate resistance to CLCrV, ten representative leaves from each variety were given a visual CLCr disease rating and then squashed onto nylon membranes and DNA extracts prepared using the Dellaporta extraction method for PCR analysis. The membranes with the squash blots were probed a CLCrV-specific probe. The following rating scale was used to assess the results with the CLCrV-specific probe: 0 = signal (no infection); 1 = faint and uneven signal (questionable infection); 2 = obvious and generally uniform signal (infected plant; low to moderate levels of virus); 3 = dark uniform signal (infected plant; moderate to low levels of virus) 4 = dark black uniform signal (infected plant; very high level of virus). Results showed differences in whitefly infestation levels and virus disease symptoms among cotton entries. The variety Stoneville 474, with hirsute leaves, had more silverleaf whitefly adults and nymphs than any of the other entries. The breeding-lines DG 2383 and DG 2387, with Cedix parentage, and DG 2165 had a lower CLCr disease rating than other entries. The breeding-lines DG 2165, DG 2383 and DG 2387 have heritable traits for CLCr disease resistance that are being investigated for development and release of CLCrV-resistant cotton varieties.
Index terms: *Bemisia argentifolii*, CLCrV, vector, *Gossypium hirsutum*

[2766] POSTHARVEST CONTROL OF CODLING MOTH: CHALLENGES AND RECENT ADVANCES

L. G. Neven[1], M. A. Williams[2], J. Hansen[1] & P. Dentener[1], [1]USDA-ARS, Yakima Agricultural Research Laboratory, 5230 Konnowac Pass Road, Wapato, WA 98951, USA, E-mail neven@yarl.ars.usda.gov; [2]Margaret Williams, Department of Primary Industries, Water and Environment, 13 St Johns Ave New Town 7008, Tas, Australia, E-mail Margaret.Williams@dpiwe.tas.gov.au.

Codling moth is a pest of quarantine concern to many Asian Pacific countries. To prevent the introduction of this pest, many procedures have been tested or developed. Traditionally, fumigation with methyl bromide had provided the most direct postharvest control of codling moth larvae in fresh fruit. Other treatments, such as cold storage with controlled atmospheres, have been proposed, but not widely accepted. New innovations in non-chemical control of codling moth include heat treatments, heat plus controlled atmospheres, microwaves, radio frequencies, electroshock, and irradiation hae been tested. Also, new fumigants and GRAS (generally recognized as safe) chemicals have been tried. Procedures for mitigating the occurrence of this pest are the systems approach and the establishment of pest-free zones using sterile insect technique. We will discuss each of these procedures, the state of development, and the likelihood of application.
Index terms: *Cydia pomonella*, non chemical, fumigants, systems approach

[2767] EVALUATION OF THE EFFICIENCY OF THE INSECTICIDE ACTARA 10 GR®, THIAMETHOXAN IN DIFFERENT DOSES FOR THE CONTROL OF OYSTERSHELL SCALE, *LEPIDOSAPHES ULMI*, (HOMOPTERA, DIASPIDIDAE), UNDER SEMI-CONTROLLED CONDITIONS, IN APPLE FUJI, IN SC, BRAZIL

I. Nora, EPAGRI (Empresa de Pesquisa Agropecuária e Difusão de Tecnologia de Santa Catarina). Caixa Postal, 591 – 89500-000 –Caçador, SC, Brazil. E-mail: nora@unc-cdr.rct-sc.br.

Oystershell Scale, *Lepidosaphes ulmi*, Was first described By Linnaeus in 1875. This pest has various hosts and in our conditions the most important are: apple, pear, plum and grape. This pest is commonly found in apple orchard of southern Brazil. The scale weakens the plant by its feeding and it is occasionally found on the fruit so that the fruit is not salable. Various factors affect the proliferation of this pest. The population of oystershell scale increases most when the grower frequently sprays the trees with organic phosphorus insecticides. Now we are testing a new insecticide - Actara 10 Gr® (Thiamethoxan), a neonicotinóide of systemic action, at the concentration of 10 gr. of Thiamethoxan/Kg. It controls suckers, scrapers and biters. The recommended doses are 10 times smaller than those of conventional insecticides. The experiment was carried out on one year old apple trees of Fuji. The trees were contaminated using apple tree branches with Oystershell scale. The contaminated shoots were attached to the plants being tested. After 40 days the oystershell scale migrated and fixed themselves on the Fuji trees. The experiment was designed in randomized blocks, 6 treatments, and 4 replications, and received only one application of insecticides. The treatments used were Actara 10 Gr® on the following doses: 1 = 0,5 g/plant; 2 = 0,75 g/plant; 3 = 1,0 g/plant; 4 = 1,5 g/plant); and 5 = Supracid® Methidathion (MTP 40%) 100 mL/100 L of water and 6 – control (without treatment). In a preliminary evaluation of the plants it was shown that in a 10 cm of shoot length (1.9 cm in diameter) it was found an average of 177.3 Oystershell scale by replication. The application of Thiamethoxan was around the plant in the form of a ring and incorporated into the soil. It was observed that at the first evaluation carried out 15 days after the beginning of the experiment, Supracid® had eliminated Oystershell scale. Actara 10 Gr® in all the replication ceased the oystershells development and reduced the size of it. The development of the Oystershell scale was normal in the control. The evaluation 30 days after treatment Actara 10 Gr® caused 100% mortality of the Oystershell scale. This preliminary study showed that Actara 10 Gr®, even at low concentration, is effective for controlling the oystershell scale in apple trees.

Index terms: Actara 10 Gr®, thiamethoxan, oystershell scale (*Lepidosaphes ulmi*), apple Fuji

[2768] INTRODUCTION AND REARING OF *PHYTOMYZA OROBANCHIA* AS PART OF AN INTEGRATED PEST MANAGEMENT PROGRAM ON BROOMRAPE

H. L. Norambuena, J. E. Díaz S. & S. G. Escobar[1], [1]Centro Regional de Investigación Carillanca, Inst. de Investigaciones Agropecuarias, P. O. Box 58-D, Temuco, Chile, E-mail hnorambu@carillanca.inia.cl.

Orobanche ramosa is regarded as the most economically important parasitic weed species in Chile. Currently, the government has implemented a project to reduce the pest spread and ecomic impact of the parasitic plant. On the one hand, preventive control of the weed is practiced primarily through laws and their enforcement. On the other hand, research work focussed on development of integrated control, including biological methods, started recently in the country. The monophagous fly *Phytomyza orobanchia* was introduced from Morocco in 1998 and 1999 with the aim to investigate the constraints and possibilities of its use in natural vegetation (classical approach) and cropping systems (inundative approach). This poster summarises recent work on conservation and augmentation of the bioagent as a first step toward integrated pest management of *O. ramosa* in Chile.

Index terms: *Orobanche ramosa*, parasitic weed, biological control, bioagent rearing, Agromyzidae

[2769] DEVELOPMENT AND DAMAGE OF THE RICE WEEVIL ON TRITICALE AND WHEAT CULTIVARS

J. P. S. Novo[1], G. E. Valle[1], A. A. Lago[1], J. G. Freitas[1] & A. C. Durigan[1], [1]Instituto Agronômico, Caixa Postal 28, 13001-970, Campinas, SP, Brazil, E-mail: jpsnovo@cec.iac.br.

The development and damages of the rice weevil (*Sitophilus oryzae)* on triticale (*X Triticosecale)*, bread wheat (*Triticum aestivum*) and durum wheat (*Triticum durum*) were evaluated. The experiment was carried out at the Laboratory of Entomology of the Instituto Agronômico, at Campinas, State of São Paulo, Brazil, under controlled conditions of 25 ± 2 °C, 70 ± 5 %RH and 12 h photophase, in a completely randomized design with four replications, using the following cultivars: IAC-1 of triticale, IAC-24, IAC-120, IAC-287, IAC-289, IAC-350 and IAC-355 of *T. aestivum*, and IAC-1001, IAC-1002, IAC-1003 of *T. durum*. Each treatment consisted of 150 g of grains, infested with 100 adult weevils for 7 days, when they were sifted. The grains were kept in glass vials with screen caps for 60 days, and evaluated for the number and the medium weight of insects, percentage of damaged grains and loss of weight. Results showed that the cultivars of durum wheat IAC-1003 and IAC-1002 and the bread wheat IAC-120 showed the largest percentages of damaged grains, i. e., 38.0, 37.0 and 36.9%, respectively, differing from those of the triticale genotype IAC-1 (24.2%) and of the bread wheat IAC-289 (26.6%). The genotype IAC-120 showed the largest percentage of weight loss (24.7%), differing from all the others. The weight losses of IAC-1001 (18.4%) and IAC-1003 (18.0%) differed from those of IAC-287 , IAC-24 and IAC-1, with 12.9, 12.3 and 7.7% respectively. The IAC-1, which showed the smallest weight loss, also had the smallest number of emerged insects (499.2) and the smallest medium weight of insects (1.25 mg), differing from all the other cultivars. The largest medium weight of insects was presented by IAC-1003 (1.82 mg), differing from the other cultivars. The largest numbers of emerged insects presented by the cultivars IAC-120 (1131.0) and IAC-1003 (1022.7) differed from those of IAC-289 , IAC-287, IAC-355 and IAC-1, with, respectively, 785.7, 775.7, 758.2 and 499.2. It can be concluded that the cultivar of triticale IAC-1 was the most resistant while the cultivars of *T. aestivum* IAC-120 and of *T. durum* IAC-1001, IAC-1003 and IAC-1002 were the least resistant to the rice weevil.

Index terms: *Sitophilus oryzae*, *Triticum aestivum*, *Triticum durum*, *X Triticosecale*, stored grain insect

[2770] EFFECT OF POTASSIUM FOR THE CONTROL OF WHITEFLY, *BEMISIA TABACI* B GENOTYPE IN COTTON (*GOSSYPIUM HIRSUTUM*) PLANT

D. M. de Oliveira & M. H. Calafiori, Agronomic Engineering Course. CREUPI. Postal Box 05. 13990-000 - Espírito Santo do Pinhal – SP – Brazil. E-mail: cpagrpin@rantac.com.br

Potassium has showed effect on the insect in some cultures probably because it acts on cellular wall. This test was carried out to observe the nutrient influence on the whitefly in cotton, variety IAC-22, in greenhouse of Agronomy Engineering Course – CREUPI, in June, 1999. Treatments were arranged in a completely randomized design with 8 replications. The treatments were: A- control; B- NPK (ammonium sulphate, simple superphosphate, potassium chloride); C- NPK + K; D- NPK + 2K; E- NP; F- cow manure. The fertilization was realized based on soil analysis. There were two plants per plot. Four evaluations were made counting adult and nymph of whitefly after 57 days of planting in one leaf/plant and two leaves/plot. The results allowed to conclude that: a) the smallest population of adults and nymphs was found in the treatment without fertilizers and with cow manure; b) the greatest number of the whitefly occurred firstly in the treatment without potassium and it was followed by that with excess of nutrient.

Index terms – potassium, cotton, *Bemisia tabaci*.

[2771] AGRONOMICAL EFFICACY OF DIFFERENT FORMULATIONS AND MIXTURES OF THE INSECTICIDE LAMBDACYHALOTHRIN FOR THE CONTROL OF *PERILEUCOPTERA COFFEELLA*, ON COFFEE CROP THROUGH FOLIAR SPRAY

M.A.C. Oliveira [1] & S. Igarashi [2], [1] DECISÃO - Tecnologia Agropecuária S/C Ltda., Av. dos Expedicionários, 84, Cep. 86.047-610, decisão@sercomtel.com.br Londrina, PR. [2] Universidade Estadual de Londrina - UEL, Caixa Postal 6001, Londrina, PR, Brasil.

Historically, Brazil has been in the highest position as a coffee producer and exporter in the international market. However, a decrease in the exportation level has been occurring. One of the determining factors of this decrease in Brazilian exports, in the international market, is the lack of quality standards of the national product. Leaf miner (*Perileucoptera coffeella*) is a serious problem on coffee crop in the country. The control of this pest is the main objective of this research, which was conducted in Arapongas city, Paraná state, Brazil, using the variety Catuaí Vermelho, 12 years old, planted at the spacing of 4 x 2 m, using parcels with six (6) holes, using four (4) replicates and statistical outlining of blocks at random. The treatments with the insecticides Lambdacyhalothrin 50 CS, 250 CS and 50 CE were applied when the infestation level of the leaves reached 5% and the mixtures of the insecticides Lambdacyhalothrin plus Chlorpirifos at the dose of 5.0 g a.i./ha were applied when the infestation level of the leaves reached 20%; the treatments were repeated whenever these levels were reached. The results showed that the insecticide Lambdacyhalothrin is efficient for the contrl of leaf miner (*Perileucoptera coffeella*) at the doses tested, observing the adequate timing for reapplication, obtaining an efficacy of control higher than 90% with monthly applications. The mixture of the insecticides Lambdacyhalothrin and Chlorpirifos increased the period of control of the pest, reducing the number of applications. No symptom of phytotoxicity occurred on coffee crop.

[2772] AGRONOMICAL EFFICACY OF THE PRODUCTS CYPROCONAZOLE AND THIAMETHOXAM IN THE CONTROL OF *HEMILEIA VASTATRIX, PERILEUCOPTERA COFFEELLA* AND *QUESADA GIGAS*, THROUGH APPLICATION IN THE SOIL

M.A.C. Oliveira [1] & S. Igarashi [2], [1] DECISÃO - Tecnologia Agropecuária S/C Ltda., Av. dos Expedicionários, 84, Cep. 86.047-610, decisão@sercomtel.com.br Londrina, PR. [2] Universidade Estadual de Londrina - UEL, Caixa Postal 6001, Londrina, PR, Brasil.

During the evolution of the coffee culture in Brazil modified the tied up economy concept considerably to the coffee. When the soils lost its natural fertility, the agronomic knowledge became the most important factor in the formation of productive coffee plantations. The coffee is attacked by a lot of plagues and diseases that, when not combatted properly, they cause great damages, reducing the production drastically. The degree of importance of the plagues and diseases vary in the different areas. That rehearsal was installed in Guarací city - Paraná State in Coffee of the variety Mundo Novo, in the year of 1998, tends as objective to evaluate the efficiency of the products Cyproconazole and Thiamethoxam, in the control of *Hemileia vastatrix, Perileucoptera coffeella* and *Quesada gigas*, through application by soil, being maybe adopted statistical outlining of blocks at random with 12 treatments, four repetitions and parcels of 10 m2, constituted by 10 plants. The application was accomplished through soil, being distributed the products in the projection of the cup of the plant coffee, incorporating them slightly. The severity of the rust was evaluated in 100 leaves of the medium third of the plant, the number of grubs of leaf mine in 100 leaves of the superior third and the number of cicadas being dug trench of 40 x 40 x 100 cm. Analyzing the results can be concluded that insecticide Thiamethoxam is efficient in the control of *Quesada gigas* in doses the starting from 200 g i.a. /ha, in the control of *Perileucoptera coffeella* in doses the starting from 250 g i.a. /ha and fungicide Cyproconazole is efficient in the control of *Hemileia vastatrix* in doses the starting from 200 g i.a. /ha until 190 days after the application. No phytotoxicity symptom occurred with the application of the tested products.

[2773] SAFETY OF PROTECTIVE CLOTHING AND SEMI-CABIN FOR TRACTOR DRIVER APPLYING INSECTICIDES AND ACARICIDES BY TRACTOR-TRAILED AIR-CARRIED SPRAYER IN CITRUS (*CITRUS SINENSIS*)

M. L. Oliveira[1] & J. G. Machado Neto[1], [1]Dept. de Fitossanidade, FCAV/UNESP – Câmpus de Jaboticabal, 14.870-000, Jaboticabal, SP, Brazil. E-mail oliveiraml@hotmail.com; joaquim@fcav.unesp.br.

Safety of the tractor driver applying pesticides to citrus by tractor-trailed air-carried sprayer was evaluated calculating the margin of safety (MOS) from data of NOEL of pesticides and the occupational exposure in a 6 hours workday. Working condition of tractor driver was classified as safe (if MOS ≥ 1), or unsafe (if MOS <1). Dermal exposure of tractor driver (DE) was evaluated using or not protective clothing and semi-cabin. Protective clothing was composed by AZR clothing (hood, long sleeved jacket, pants and acetate face visor) completed by nitrila gloves, rubber boots and charcoal treated disposable respirator. Evaluations on tractor driver were carried out in applications using Arbus 2000 Valência tractor-trailed air-carried sprayer in citrus orchard of the Cambuhy Agrícola Farm, Matão-SP, Brazil during february/99. Cu^{+2} of a cupric fungicide was used as tracer of spray. DE of tractor driver was quantified directly on white overall with long sleeve and hood and on cotton gloves. Exposure of face was evaluated on female sanitary pads attached on disposable face masks and exposure of feet was on same type of pads attached on upper part of rubber boots. DE of tractor driver in three working conditions were evaluated in ten replications for each activity during 30 to 40 minutes. After the exposure overalls were divided into parts and were immersed in solution of HCl (0.1 N) for extraction of the tracer. Same procedure was carried out on pads. Quantification of Cu^{+2} was by atomic absorption spectrophotometer. The values of Cu^{+2} recovered in spray collectors and concentration of the tracer in the spray solution were used to estimate the DE. Dermal exposure to 135 recommended pesticides were estimated using DE to spray and the dose of pesticides. These data were used to calculate MOS with the following equation: MOS = [NOEL x 70] / [1.1 DE]. The DE to spray driving the tractor without semi-cabin and clothing was of 217.3 mL/day. Wearing protective clothing it was 7.2 mL/day and with semi-cabin, 145.1 mL/day with 96.7% and 33.2% efficiencies respectively. Among 135 insecticides and acaricides recommended for citrus 56.4% were classified as safe (MOS ≥ 1) for the tractor driver working without protective clothing and semi-cabin, 91.1% when the tractor driver used the protective clothing and 57.4% when the semi-cabin was used.

Index terms: citrus, pesticides, protective clothing, semi-cabin

[2774] INTEGRATED METHODS TO CONTROL *BEMISIA TABACI* BIOTYPE B, IN MELONS

M. R. V. Oliveira[1], E. R. Fernandes[2] & H. G. C. Rocha[2], [1]Embrapa Recursos Genéticos e Biotecnologia. P.O Box 02372, CEP 70.849-970, Brasilia, DF, Brazil. E-mail: vilarin@cenargen.embrapa.br; [2]Bolsistas PADFIN/CNPq.

Over the last decade, irrigated fruitculture in northeastern Brazil, has become intensive, with production system occupying approximately 2,5 millions hectares and yield of ca. 30 millions tons. Melons are among the major crops, grown throughout the year. This is a high value export-driver industry, and so far has been under political pressure to decrease insecticide use. The impact of *B. tabaci* biotype B in melons, over the last three years, has made farmers to rely exclusively on insecticides. Studies were conducted in conjunction with PROFRUTAS/MAISA S/A, located at Mossoró, RN. *Cucumis sativus* cv Agroflora 646 (AF646) was used as a host plant. A comprehensive study assessing a good quality of the plants with the introduction of agriculture aminoacids in the irrigation system, responses of whitefies to Confidor®, Applaud® and Sanmite® were measured. Seven treatments and an untreated control were replicated four times in an randomised complete design experiment. Foliar sprays of agriculture aminoacids were also applied during the experiment. Treatment # 2 was used as standard for comparision with other treatments. Nymphs and adults of silverleaf whitefly were sampled by counting adults via leaf turn in an area of 4 cm^2, on five plants at random, 20, 35 and 61 days, of beginning the experiment. Results indicated that treatment # 6 had higher yield (22,1% = 4.385kg/ha) when compared to treatment # 2, and treatment # 8 showed a higher sugar content in the fruits (18,2%). The plants treated with less application of insecticides associated with agriculture aminoacids supported much better the attack of the B-biotype of *B. tabaci* showing higher yield and sugar contents in the fruits.

Index terms: aminoacids, *Bemisia tabaci*, melons, insecticides.

[2775] INTRODUCTION-PART 2: CHALLENGES AND OPPORTUNITIES FOR PEST MANAGEMENT OF *BEMISIA* IN THE NEW CENTURY

M.R.V. Oliveira[1] S. E. Naranjo[2], P. C. Ellsworth[3] & O. A. Fernandes[4], [1]Embrapa/Cenargen, Cx Postal 02372, CEP 70-849-970, Brasilia-DF, Brazil, Email: vilarin@cenargen.embrapa.br; [2]USDA-ARS, 4135 E. Broadway Rd, Phoenix, AZ 85040, USA, Email snaranjo@ix.netcom.com; [3]Dept. Entomology, University of Arizona, Maricopa Agricultural Center, Maricopa, AZ 85239, USA, Email: peterell@ag.arizona.edu; Dept. Fitossanitade, FCAV/UNESP, Rod. Carlos Tonanni km 5, 14870-000 Jaboticabal, SP, Brazil, Email: oafernan@fcav.unesp.br

The *Bemisia* complex (*B. tabaci and B. argentifolii*) are important pests of many field and vegetable crops throughout the subtropics and tropics of the world. In the past decade there has been a rapid expansion of these pests and associated crop damage throughout many regions of the world. This symposium will highlight the myriad of pest management research and implementation efforts targeting *Bemisia* worldwide. The speakers represent a broad cross-section of the affected countries covering a broad array of research areas. The full-day symposium is split over two sessions of the congress (Session 14: Integrated Pest Management and Session 2: Agricultural Entomology). Part 2 of this symposium will focus on 1) host plant resistance to *Bemisia* and its associated viruses, 2) ecological factors that need to be considered in the management of multiple-crop pests like *Bemisia*, 3) conservation, evaluation and integration of biological control in IPM systems, 4) international and national research programs for addressing the *Bemisia* problem and 5) implementation and adoption of IPM systems in various parts of the world.
Index terms: *Bemisia tabaci*, *Bemisia argentifolii*, host plant resistance, multiple-crop pest, biological control, IPM systems

[2776] SPECIES INTERACTIONS IN MULTI-SPECIES BIOLOGICAL PEST MANAGEMENT SYSTEMS: DO THEY ENHANCE OR DETER BIOLOGICAL CONTROL?

M. P. Parrella, Department of Entomology; University of California, Davis, California 95616, USA. E-mail: mpparrella@ucdavis.edu

Biological control developed in glasshouses around the world with repetitive releases of a single species of natural enemy. While this methodology has been a model for success, particularly with *Encarsia formosa* whitefly control and *Phytoseiulus persimilis* for control of two-spotted spider mites, it is being replaced by an approach which utilizes multiple natural enemies for the same target pest. This evolution has occurrred because of the advent of new polyphagous pests in the glasshouse (eg., *Frankliniella occidentalis* and *Bemisia argentifolii*) and because of the very low aesthetic thresholds inherent in many crops (particularly floriculture). Multiple tactics must be used in the floriculture greenhouse if IPM and biological control are to become an integral part of grower practices. Toward that end, my laboratory has been examining the use of two or more natural enemies together for control of key pests and this has cut across different guilds of natural enemies. For example studies have been completed or are ongoing in the following areas; the use of a fungus (*Beauveria bassiana*) and an aphid parasitoid (*Lysiphlebus*) for control of melon aphids on Asiatic lilies; the utility of a predatory coccinelid (*Delphastus*) in conjunction with a whitefly parasitoid (*Eretmocerus*) for control of whiteflies in poinsettia; and a nematode (*Neoaplectana)* in conjunction with a leafminer paraitoid (*Diglyphus*) for control of leafminers on chrysanthemums and gerbera. These studies involve detailed laboratory investigations to examine potential compatibility which focuses on ecological interactions and intraguild predation. If promising, the next step involves small greenhouse trials on campus, and then larger trials with commercial growers.
Key Words: Biological Control, Intraquild Predation, predators, parasitoids, pathogens

[2777] AN CONTRIBUTION TO IMPROVE THE IPM IN STONE FRUIT ORCHARDS IN PORTUGAL

M. I. Patanita[1] & S. Brotas[1], [1]Escola Superior Agrária de Beja, Apartado 158, 7801-902 Beja. Portugal. E-mail: ipatanita@esab.ipbeja.pt

The development of integrated pest management in stone fruit orchard in some european countries and the recent approval by the OILB/SROP of the guidelines for integrated production in stone fruit orchard have had a deep impact on the evolution of these new technologies in Portugal. In order to improve the IPM in stone fruit orchards, this paper presents the results of weekly sampling in two plots, having different strategies for crop protection (IPM and traditional chemical control). The relative importance of the pests organisms is discussed per pest control strategy.
Index terms: Integrated pest management, peach-tree, med fly, aphids.

[2778] EFFECTS OF AGE AND SEX ON MORTALITY OF *TRIBOLIUM CASTANEUM* EXPOSED TO WHEAT TREATED WITH DIATOMACEOUS EARTH

M. C. Z. de Paula[1], P. W. Flinn[2], Bh. Subramanyam[3] & Sonia M. N. Lazzari[1], [1]Univ. Federal do Paraná, P.O. Box 19020, 81.531-990 - Curitiba, Paraná, Brazil, E-mail mcris31@hotmail.com; [2]Grain Marketing & Production Research Center, 1515 College Ave., Manhattan, KS 66502, USA, E-mail flinn@usgmrl.ksu.edu; [3]Kansas State University, Dept. of Grain Science and Industry, 201 Shellenberger Hall, Manhattan, KS 66506, USA, E-mail bhs@wheat.ksu.edu.

Mortality of the red flour beetle, *Tribolium castaneum*, exposed to wheat treated with diatomaceous earth were evaluated in the laboratory. Male and female adult *Tribolium castaneum* were collected at different ages: 0, 2, 4, 8, and 64 days post-eclosion. In the laboratory, 2 quarts of wheat (12.2% moisture) were treated with the diatomaceous earth product Insecto® at a rate of 0.25 g/kg of grain. Untreated grain served as a control. 650 g of untreated and Insecto® treated grain was placed into quart glass jars. Either 20 female or 20 male adults were placed into each jar. The adults were all of the same age-class, either 0, 2, 4, 8, 16, 32, or 64 days post-elcosion. Each treatment was replicated 5 times. The jars were kept in a chamber maintained at 30.5 ± 0.4°C and 65 ±10% rh. After 7 days the wheat was sieved and mortality of insects in each jar was recorded. Survivorship ranged from 67 to 95%. Survivorship was significantly lower at 2 days post eclosion then at any of the other adult age classes. Adult male mortality was not significantly different from adult female *T. castaneum* mortality.
Index terms: Red flour beetle, Insecticidal dusts, Stored-products.

[2779] THE EFFECT OF A PLANT GROWTH REGULATOR (APOGEE) ON INSECT PESTS OF PEAR AND APPLE

G. S. Paulson & L. A. Hull[1], Department of Biology, Shippensburg Univer., Shippensburg, PA, 17257, USA; Penn State Univer. [1], Fruit Res. and Ext. Center; Biglerville, PA, 17307-0309, USA.

Orchard managers maximize production by accurately controlling the balance between reproductive (fruitfulness) and vegetative growth. This is an extremely complicated task because there are so many factors that must be considered when making management decisions. Excessive vegetative growth produces a tree canopy that is too dense for effective penetration of sprays resulting in increased fruit loss due to damage caused by insects and diseases. In addition it is difficult to maintain a pesticide residue on vigorously growing shoots. A dense canopy also results in less desirable fruit color and may contribute to the spread of diseases such as powdery mildew. A new plant growth regulator produced by BASF called Apogee (BAS 125 W) will provide orchard managers with a new tool to help them effectively manage vegetative growth. Before Apogee is put into general use it is important to understand the effect of its use on populations of insects, both pestiferous and beneficial. The research reported here focused on the effect of Apogee on populations of the obliquebanded leafroller (*Choristoneura rosaceana*) and the spirea aphid (*Aphis spireacola*) in apples, and pear psylla (*Cacopsylla pyricola*) in pears. These pests have life histories that are strongly linked with the production of lush succulent leaves associated with new growth. Since applications of Apogee will reduce availability of new growth, our research evaluated the impact this would have on the behavior, growth and development of these pests. In addition, we evaluated the effect of Apogee on the efficacy of currently used pesticide programs. Apogee significantly reduced vegetative growth in both pears and apples. Pear psylla and spirea aphid populations were significantly reduced in Apogee treated pear and apple, respectively. In apples treated with Apogee shelter building behavior of the obliquebanded leafroller was modified resulting in a significant reduction in the number of shelters/tree and the percentage of fruit damaged.
Index terms: *Choristoneura rosaceana*, spirea aphid, *Aphis spireacola*, pear psylla, *Cacopsylla pyricola*

[2780] NEW PERSPECTIVES FOR MANAGING GRASSLAND SPITTLEBUGS

D. C. Peck[1], [1]Tropical Grasses and Legumes Project, CIAT, A.A. 6713, Cali, Colombia, E-mail: d.peck@cgiar.org

Spittlebugs (Cercopidae) are the most widespread and damaging pest of the most extensive agricultural activity in the Neotropics, pastures for milk and beef production. Despite a long history and increasing pest status in forage grasses and sugar cane an effective and coordinated IPM program does not exist. One limitation is a rudimentary understanding of the variation in spittlebug-forage-habitat interactions, crucial to tailoring management to the diverse geographic and production systems where grassland spittlebugs occur. Comparative population studies were performed over two years in four contrasting sites in Colombia. The methodology was designed to describe on-farm, regional and seasonal variation in certain components of population ecology including species composition, abundance, synchrony, phenology and natural enemies. At representative farms plots were established in separate paddocks under the normal grazing regime. Spittle mass and sweep net surveys were performed twice weekly. Nymphs were determined to instar, adults to sex and species, and natural enemies were censused. Six classes of enmies and six spittlebug species were identified from these sites. In the two sites highly seasonal for rainfall, one species occurred, and population fluctuation and synchrony were the greatest. Strong evidence was gathered for rapid colonization of previously uninfested areas of a farm through adult movement, suggesting that suppression of initial population foci is important for management. At the site of intermediate seasonality, one species dominated while two others were present, and population fluctuations and synchrony were reduced. In the site that never experienced a dry season, three species were sympatric, population fluctuations were further reduced and species-specific, and there was a continuous presence of nymphs and adults, or no population synchrony. Local phenology was most precisely determined through analysis of nymphal life stages permitting a detailed evaluation of population development and number of generations. For instance, six generations of *Aeneolamia reducta* were completed despite 2-3 months of drought. There was excellent correspondence in generation time as estimated from population fluctuations (43.1d) and biology studies (45.2d). In sites seasonal for rainfall, spatial and temporal determination of early season outbreaks is vital for directing control tactics to suppress local populations before they spread to other areas and contribute to future generations. Less seasonal sites with continual pest presence and little population synchrony are more appropriate for application of cultural control and deployment of natural enemies such as fungal entomopathogens.
Index terms: Cercopidae, forage pests, population dynamics, *Aeneolamia*

[2781] NATURAL CONTROL OF GUAVA WEEVIL *CONOTRACHELLUS* SP. (COLEOPTERA: CURCULIONIDAE) IN AGUASCALIENTES, MEXICO

C. Perales-Segovia, CIGA-ITA No. 20, Apdo. postal 1439, Central Camionera, CP 20170, Aguascalientes, Aguascalientes, México, E-mail: cperales@prodigy.net.mx.

The research was consisted in proving in the orchard and in lab, comercial and non comercial plant extracts with insecticide properties against the weevil *Conotrachellus* sp. (Coleoptera: Curculionidae) of the guava *Psidium guajava* L. (Myrtaceae). The evaluated treatments were: seeds of lila *Melia azedarach* L. (Meliaceae) and dried full plant of cempasuchil *Tagetes* sp. (Compositae), prepared as an infusion at 5% (50 g/L^{-1}); Biocrack, comercial extract made of garlic *Allium sativum* L. (Liliaceae) at 4 ml/L^{-1} dosis; Vioarm, comercial extract made of higuerilla *Ricinus communis* L. (Euphorbiaceae) at 4 ml/L^{-1} dosis and a control without application. In the field the treatments were applied to trees and guava leaves randomly selected. The parameters evaluated were: damaged leaves and infestation in accordance with weevil number. Were applied at the lab the same treatments to guava leaves put onto petri dish where five alive guava weevils. In this case the leaves damage and the weevil mortality were evaluated. According to results, in trees, only the control without application statistically outstood from the rest of the treatments presenting the largest number of damaged leaves. The damage leaves level was reduced in a 45% in the cempasuchil. In pest infestation significant differences weren't statiscally detected, but with the use of Biocrack a smallest number of weevil were detected. In the randomly selected leaves, damage to the control was only detected, it didn't present any infestation in any of the treatments. In the lab the strongest damage was present in the control without application. Of the plant extracts, the best was the Vioarm which reduced the pest insect damage in 46%. To reference to insect mortality, after having applied the insecticide with 100% of mortality, the Biocrack was the best treatment having applied as it caused 50% of weevil mortality.

[2782] *MACROSIPHUM EUPHORBIAE* (HEMIPTERA: APHIDIDAE) CONTROL AND *FRANKLINIELLA SCHULZEI* (THYSANOPTERA: THRIPIDAE) WITH DIFFERENT INSECTICIDES ON TOMATO CROP (*LYCOPERSICUM ESCULENTUM*)

M. F. A. Pereira[1,a], A. L. Boiça Júnior[1] & J. H. FIORELLI[2], [1]Depto. Fitossanidade, Univ. Est. Paulista. Via de Acesso Prof. Paulo Donato Castellane, s/n. Jaboticabal – SP, Brazil. 14870-000. mpereira@fcav.unesp.br; aboicajr@fcav.unesp.br. [a] Schorlarship and Financial Support from CNPq. [2]Bayer S.A., São Paulo, SP.

The *Macrosiphum euphorbiae* and *Frankliniella schulzei*, species cause serious damages to tomato crop, mainly by virosis transmission as tomato botton leaf yellow, tomato yellow top and potato virus Y (*M. euphorbiae*) and the tomato spotted wilt (*F. schulzei*). Aiming to evaluate the control of these pests by spraying with different insecticides, it was installed a experiment in tomato Rio Grande variety. It was adopted the experimental casual block design with four repetitions. The treatments as well as the utilized products and their respective doses in litre/ha were: 1 – witness (without control); 2 – Provado 200 SC 0.35; 3 – Provado 200 SC 0.5; 4 – Calypso 0.15; 5 – Calypso 0.20; 6 – Tamaron BR 0.8; 7 – Tokuthion 500 CE 0.5 and 8 - Turbo 0.1. The spraying with the insecticides was made according to the pest attack, 36 days after sowing, spending 520 l/ha of solution. The evaluations occured 2, 4, 7 and 11 days after spraying, tnisting softly a tomato leaflet per plant and counting the number of adults and nymphs thrips in ten plants per parcel. Later, it was collected one leaflet per plant, in five plants per parcel and were put in paper bags, which were taken to the laboratoty and being used a stereoscopic microscope, it was counted the number of nymphs and adults aphids present in leaflets. For statistics analysis, the datas were submitted to a test of variance F, being the averages compared by the Tukey test on 5% probability. All products on tested doses, differentiated statistically from the witness but were similar among themselves, showing over 92% efficiency. The insecticides Provado and Calypso (on two tested doses) and Turbo, were efficient until 11 days after spraying for *M. euphorbiae* control. However, even showing a low population during evaluations, the thrips population was pretty larger on witness, which differentiated from inseticide treatments statistically after 11 days of products appliance, not being observed any significant differences between the products and the tested dosages, which showed efficiency over 80% controlling *F. schulzei* until 7 days after spraying.
Index terms: chemical control, thrips, aphid

[2783] PROTECTION PERIODS OF *BEMISIA TABACI* BIOTYPE B (HEMIPTERA: ALEYRODIDAE) ATTACK, ON BEAN CROP (*PHASEOLUS VULGARIS*), IN THREE SOWING DATE

M. F. A. Pereira[1,a] & A. L. Boiça Júnior[1], Depto. Fitossanidade, Univ. Est. Paulista. Via de Acesso Prof. Paulo Donato Castellane, s/n. Jaboticabal – SP, Brazil. 14870-000. mpereira@fcav.unesp.br; aboicajr@fcav.unesp.br. [a] Schorlarship and Financial Support from CNPq.

The whitefly *Bemisia tabaci* (Genn., 1889) Biotype B (Hemiptera: Aleyrodidae), is considered a key pest to bean crop (*Phaseolus vulgaris* L), mainly because of the damages caused due to virus transmission of golden mosaic. Aiming to obtain data with potential of usage in integrated pest management, a study has been carried out to verify the periods in which the bean crop must receive chemical protection against this pest attack. The experiments were conducted on field conditions, with the IAC-CARIOCA variety, in three sowing date. It was adopted the experimental casual block design with eighteen treatments and four repetitions. The spraying with the insecticides was made of first until eighth weeks after the plants emergence, according to the treatments. The evaluations occured 2-3 days after spraying, collected one leaflet per plant, in ten plants per parcel and were counted the number of nymphs-whiteflies present in leaflets. The 50 days after plants emergence, was to evaluted the plants percentage with golden mosaic symptoms. During the harvest, was to evaluted the bean production. For statistics analysis, the datas were submitted to a test of variance F, being the averages compared by the Tukey test on 5% probability. The results allowed to conclude that: During the "drought", the bean crop must be protected from the first to the eighth week after the plants emergence and until the sixth week during the "wet" and "winter" date. The nymph-whitefly population was higher during "drought", "wet" and "winter" date, respectivey, which correlated positively with the plants percentage with golden mosaic symptoms. According to the occuring of whitefly, it is important to protect the bean crop, mainly on early phases of culture development, regarless of sowing date. The highest decreasing percentages of bean production due to *B. tabaci* Biotype B attack, were during "drought", "wet" and "winter" date, respectively.
Index terms: whitefly, chemical control, integrated pest management, golden mosaic

[2784] FIELD STUDY TO COMPARE AN INTEGRATED FLEA CONTROL TREATMENT OF CAPSTAR AND PROGRAM TO ADVANTAGE USED ALONE AGAINST THE CAT FLEA (SIPHONAPTERA: PULICIDAE)

B.A. Peters[1], P.F. Miller[1] & C.A. Hort[2], [1]Dept. of Health Sciences, Univ. of Technology, Sydney, P.O. Box 123 Broadway, NSW 2007, Australia, E-Mail b.peters@uts.edu.au; [2]Novartis Animal Health Australasia, Sydney, Australia.

Forty-five private households in Cairns, Australia were selected for this study. The households had between 1-4 non fractious dogs or cats. On-animal flea infestations were assessed by one minute area counts to each of the right and left lateral, tailhead, dorsal midline and inguinal regions. The integrated flea control products consisted of nitenpyram - Capstar® and lufenuron - Program® (Novartis Animal Health). The topical insecticide was imidacloprid - Advantage® (Bayer Animal Health). Three treatment groups with 15 homes in each group were used. Group 1 was treated with Capstar once weekly for 6 weeks and with Program every 4 weeks for the duration of the study. Group 2 was treated with Capstar twice a week for 6 weeks and with Program every 4 weeks. Group 3 was treated once every 4 weeks with Advantage. In Group 1 at any assessment after the first 6 weeks, if the total on-animal flea numbers using area counts were ≥5 then Capstar was administered once weekly until flea numbers were below 5 (assessed weekly). Group 2 was as above only Capstar was administered twice weekly. Adult flea numbers were monitored in the environment for groups 1 and 3 only using 2 Whitmire Pulsating Light Flea Traps left out overnight. There was no minimum requirement for environmental fleas in this study. On-animal flea assessment and environmental monitoring were conducted at 2, 4, 6 and 8 weeks after the first treatment date and then once every 4 weeks until week 48. At every assessment except one, groups 1 and 2 achieved a higher on-animal percentage reduction of fleas than group 3. At the final 48 week assessment, on-animal flea reductions were 99.3% for Group 1, 99.7% for Group 2 & 70.5% for Group 3. For the majority of the study, no fleas were trapped in the environment in homes in Group 1. In Group 3 fleas were trapped in the environment in a high percentage of homes at most assessments. The results demonstrate that an integrated flea control treatment of Capstar and Program is superior to Advantage used alone in reducing both on-animal and environmental flea infestations.
Index terms: *Ctenocephalides felis,* nitenpyram, lufenuron, imidacloprid

[2785] NEW AND IMPROVED COTTON BOLL WEEVIL TRAP FOR USE IN IPM, PREVENTION, SUPRESSION AND ERADICATION PROGRAMS

S. E. Plato, J. C. Plato, J. S. Plato & T. A. Plato, Plato Industries, Inc., 2020 Holmes Road, Houston, TX 77045, USA, E-mail: plato@nol.net

The boll weevil trap and Grandlure pheromone are key components in IPM, prevention, suppression and eradication programs (BWEPs) for boll weevils (*Anthonomus grandis Boh.*). The isolation, identification and synthesis of the boll weevil pheromone, grandlure, led to the design, development and commercial production of traps. The first commercially produced trap was named the Hardee trap, after its inventor, Dr. Dick Hardee; subsequently to this model came a model designed by Dr. Bill Dickerson that was patented by the USDA and commercialized by the Southeast Boll Weevil Eradication Foundation (SEBWEF) in the 1980's and 1990's. The SEBWEF trap became the most widely used trap in the Americas and has become a mainstay for detection and spray decisions in IPM and US BWEPs. Without these two traps and the Grandlure pheromone, the US BWEPs probably would not be possible with the technology being employed by most states and the early season "pinhead" spray program would not be as accurate in IPM programs. The SEBWEF trap as currently manufactured has several deficiencies and the new trap as designed, patented and developed by S&S Trap Company eliminates most of the deficiencies. Consequently, the new S&S trap provides financial savings in labor and replacements. It was designed to be as effective as the old traps, but more "user friendly" and with more functionality during installation and servicing/monitoring/inspections. The S&S trap has 26 improvements when compared to the SEBWEF trap; it is discussed in detail in this poster.
Index terms: *Anthonomus grandis*, eradication programs, Grandlure

[2786] USE AND IMPACT OF MATING DISRUPTION IN COMMERCIAL PEACH INTEGRATED CROP MANAGEMENT PROGRAMS IN NEW JERSEY, USA

D. F. Polk[1], P. Winkler[1], D. Schmitt[1], M. Peters[1] & E. Rizio[1], [1]Rutgers Cooperative Extension, Rutgers Fruit Research and Extension Center, 283, Rt 539, Cream Ridge, NJ 08514, USA, E-mail polk@aesop.rutgers.edu.

New Jersey peach growers spend an average of $494/ha for pesticides, of which $173/ha or 7.7 kg/ha per season is for insecticides. Pests include oriental fruit moth (OFM) (*Grapholita molesta*) and tarnished plant bug and stink bugs (*Lygus lineolaris, Acrosternum hilare, Euschistus servus, E. tristigmus*). Other targets often include Japanese beetle (*Popilla japonica*), tufted apple budmoth (*Platynota idaeusalis*), green peach aphid (*Myzus persicae*), and flower thrips (*Frankliniella tritici*). Objectives include investigating the efficacy of pheromone dispensers and fitting mating disruption with existing integrated pest and crop management (IPM, ICM) practices. An area-wide program was started in 1998 and continued in 1999 and 2000. The project focuses on seasonal management of OFM and other orchard pests. By 1999 mating disruption practices were used at 13 farms on 544 acres (220 ha), including 91 blocks of fruit planted with 37 cultivars that ripened from early July through mid-September. OFM dispensers were Shin Etsu (Biocontrol) Isomate-M and Isomate-M100 during 1998 and Isomate-M100 in 1999, along with Hercon Disrupt. Dispensers were placed just after the first peak flight. Both mating disruption and standard insecticide treated blocks were regularly monitored for arthropods and diseases, and compared on the same farms. Post harvest injury data was collected from over 50,000 fruit. Insecticide treatments for first generation OFM were timed with a degree day model, and also used to control plum curculio and early season plant bugs. Insecticides were omitted until the end of July. Treatments for green peach aphids, plant bugs, and flower thrips were made on an as needed basis. All insecticide treatments were resumed on late varieties from early August through early September. Trap shut-down was achieved on all farms. No differences were seen in OFM flagging throughout the season. The single greatest factor that affected the use of insecticides was tarnished plant bug and stink bug populations. Insecticide use was reduced by up to 60%. Insecticide cost savings reached $99 per ha on late season varieties. There were no significant differences in OFM injury. Plant bug and Japanese beetle injury were slightly higher in some varieties under mating disruption.
Index Terms: *Grapholita molesta,* pheromones, IPM, stone fruit

[2787] STUDY OF FACTORS INVOLVED IN REDUCING POPULATION LEVEL OF *HAPLODIPLOSIS MARGINATA*

C. Popov[1] & A. Bărbulescu[2, 1,2] Research Inst. for Cereals and Industrial Crops, 8264 Fundulea, N. Titulescu Str., 1, Calarasi District, Romania, E-mail: fundulea@cons.incerc.ro

The Saddle gall midge (*Haplodiplosis marginata*) is a major pest of wheat in Romania, causing damages on some 250.000 ha in the Plain of Low Danube. Methodology. Investigations have been pursued on the distribution, evolution of life-cycle and factors favourizing it, attack intensity, soil biological supply and diapause role in populations dynamics, as well as control opportunities. Results. Attack intensity with 20-25 larvae/plant reduced plant height by 34%, the number of grains in a spike by 63% and grains weight by 64%. Heavily infested plots, with attack frequencies exceeding 40-45% attacked plants, can be considered compromised. Its preferred host is wheat; no resistant cultivars have been identified. At heavy outbreaks, attack frequencies of 100 % have been recorded, with intensities of more than 35 larvae/plant. At the same environment conditions barley, rye and triticale exhibited much lower attack levels, compared to wheat. Abundant rainfall (exceeding 200 l/sq.m.) during April 15-June 15 favourized numerical explosions, recording massive transformation of overwintering larvae to pupae, and then to adults, as well as high survival of first larvae, before to penetrate between husk and straw. The years with reduced rainfall in the same period, sometimes below 15-20 l/sq.m., induced extension of larval stage in soil by 1-2 years, while excessive drought induced high mortality of eggs and first instar larvae. In unfavourable years, 60-90% of larvae do not reach the adult stage. Biological supply of overwintering larvae in soil can reach up to 5-6.000 individuals/sq.m. Among the control measures, crop rotation is particularly important, because sowing winter spike grains in plots with high overwintering larval supply is avoided. It is not recommended that plots with more than 30 larvae/sq.m. to be cropped with wheat. Wheat sowing should be also avoided up to a distance of 2-3 km from plots with high biological supply, due to opportunities to infest crops by flying insects. In the particular case of this pest, chemical soil treatment failed to give satisfactory results, irrespective of pesticides used. Conclusions. Good results have been obtained with treatments (1-3), applied in season, to control adults and partially new larvae. Under the conditions prevailing in Romania, the first treatment is applied in the first decade of May, and the next ones, when necessary, at 8-12 days intervals. The best results have been obtained with synthetic pyrethroids.

Key words. *Haplodiplosis marginata*, life-cycle, chemical control.

[2788] SUNN PEST (*EURYGASTER INTEGRICEPS*) MANAGEMENT IN ROMANIA

C. Popov [1] & A. Bărbulescu [2, 1,2] Research Inst. for Cereals and Industrial Crops, 8264 Fundulea, N. Titulescu Str., 1, Călarasi District, Romania, E-mail: fundulea@cons.incerc.ro

Eurygaster integriceps is one of the most important pests of wheat in Romania. In damaging area, security of wheat harvest quality is inconceivable without some energetic protection measures. Its chemical control is achieved according to the integrated control principles, while forecast and warning of treatment are performed by monitoring pest populations in the whole distribution area. Methodology. Investigations covering a great number of years tried to underline the contribution of some elements in outlining the integrated control concept for sunn pest. These elements are: ratio between species and their distribution areas in Romania, size and space distribution of sunn pest populations, study of annual peculiarities of their life cycle, relationships between pest and oophagous parasites, establishing the Economical Damage Thresholds and the means for their control. Results. In the damaging area (22 districts) of sunn pest, 230,200 ha of oak forests are included, and wheat is annually cropped on 737,000-1,184,000 ha. In October, all 575 forests are inspected, and density of diapausing insects is established. In field, repeated inspections are performed in April-July, and density of overwintering adults, dynamics of oviposition and its level, parasitization level, density and evolution of the new generation being established. In years with particularly favorable climate conditions (e.g. in 1996), in forests densities can reach up to 150 exp./sq.m., with a total of some 25,000 mil. insects, while in field densities reach up to 25 overwintering adults/sq.m., and up to 135 nymphs/sq.m. Chemical control is differently applied only in areas and plots where the EDT was overpassed. Surfaces where the chemical control is applied vary from a year to another, while harvest quality analysis, as established by the percentage of damaged grains, practically performed to all production in the damaging area, reveals the excellent results of a complex activity for protection of wheat crops in Romania from the particularly harmful outbreak by sunn pest. Conclusions. Management of sunn pest is a permanent concern in the whole country, and it is based on a methodology developed by Research Inst. for Cereals and Industrial Crops-Fundulea, and applied across the country by the District Inspectorates for Plant Protection. Chemical control of sunn pest in Romania is supported by Government.

Key words.*Eurygaster integriceps*, monitoring, forecast, warning.

[2789] INTEGRATED MANAGEMENT OF KEY INDIAN RICE INSECT PESTS

Anand Prakash and Jagadiswari Rao, Division of Entomology, Central Rice Research Institute, Cuttack-753006, Orissa, India, E-mail prakas52@yahoo.com

In India, rice is grown in 42.3 million ha under varying moisture regimes and diverse ecological situations like rain-fed upland (7.1 m ha), irrigated medium land (17.7 m ha), favorable low land (10.0 m ha), unfavorable low land (6.0 m ha) and deep water (1.5 m ha), having an annual grain production of 82.1 m tons (1997-98), contributing to 45% of cereal production of the nation. Rice being a crop of warm and humid environment is very conducive to pests, diseases and weeds and subjected to 20-30% yield losses every year. Insect pests alone are reported to cause about 10-20% of yield losses to rice crop in India. Yellow stem borer, *Scirpophaga incertulus* Walk; rice gall midge, *Orseolia oryzae* Wood-Mason; brown plant hopper, *Nilaparvata lugens* Stal.; white-backed plant hopper, *Sogatella furcifera* Horvath; rice leaf-folder, *Cnaphlocrosis medinalis* Guen. and rice earhead bug, *Leptocorisa acuta* Thunb. are the major/key insect pests causing direct damage to rice plant/grain, whereas rice green leaf hoppers, *Nephotettix* spp. especially *N. virescens* Dist. is a principal vector of tungro associated viruses causing indirect considerable losses to rice production. The integrated management of key Indian rice insect pests discussed in this paper includes four major components as follows: 1. Needs strong support from the government particularly with regards of availability inputs like seed of the selected varieties, irrigation water for synchronized planting (a supplemental irrigation)/life saving irrigation especially for rain-fed rice, pest surveillance, forecasting and the over all monitoring of the crop and the pest in the IPM area. 2. IPM being a dynamic and constantly evolving approach, its components as well as tactics should be changed as the situation warrants. 3. Training of the farmers in IPM specially identifying pests and their natural enemies, damage concepts of economic levels being the most important to enable them in making their own decisions & 4. The concept of safe and least application of pesticide only during the specific situations like large populations of migratory insects and virus vectors, where immediate reductions in their populations are required. Safe pesticides are those, which cause minimum damage to non-target organisms including bio-agents and environment.

Index terms: Rice, gall midge, earhead bug, yellow stem borer, green leafhopper, brown plant hopper

[2790] *TETRANYCHUS URTICAE* RESISTANCE TO ABAMECTIN IN FLORIDA STRAWBERRY AND THE IMPACT ON ADOPTION OF BIOLOGICAL CONTROL BY *PHYTOSEIULUS PERSIMILIS*

J. F. Price, C. K. Chandler & D. E. Legard, Univ. of Florida, Gulf Coast Research and Education Center, 5007 60th St. E., Bradenton, FL, USA 34203. E-mail:jprice@gnv.ifas.ufl.edu.

Florida produces about 2500 hectares of fresh-market strawberry, *Fragaria x ananassa*, annually valued at about $150 million wholesale. The key arthropod pest of strawberry in Florida is the twospotted spider mite, *Tetranychus urticae*, which affects almost the entire production area. The miticide, abamectin, has been effectively used to control spider mites. Other chemical control agents available include fenbutatin-oxide (organotin) and fenpropathrin and bifenthrin (pyrethroids). Resistance to fenbutatin-oxide in twospotted spider mites developed in the late 1980s and early 1990s and to the two pyrethroids during the mid-1990s. Abamectin has failed to provide satisfactory twospotted spider mite control on some farms since the 1998/1999 season. Greenhouse and laboratory experiments were performed to determine the resistance status of twospotted spider mites to abamectin on Florida strawberry. Data from these experiments indicate that an approximate 10 fold resistance to abamectin exists in spider mites from affected farms when compared to a colony of spider mites collected 2 years earlier from strawberry. When abamectin at one quarter of the label concentration was evaluated, about 20% less mortality occur

[2791] INTEGRATED PEST MANAGEMENT OF NECTARINES IN THE RIO NEGRO VALLEY OF ARGENTINA

M. D. Raffo[1], L.I. Cichón[1], [1]INTA, EEA Alto Valle, CC 782, CP 8332, General Roca, Provincia de Río Negro, Argentina. E-mail doloresraffo@inta.gov.ar.

The upper Rio Negro Valley of Argentina is one of the most important fruit districts in the Southern Hemisphere. In its 50,000 ha apples and pears total near 90% of the planted area. However in recent years stone fruits have been planted at an increasing rate to diversify the crops and because this late district has a window of opportunity for domestic and foreign markets. Oriental fruit moth (OFM), *Cydia molesta*, is the key pest for peaches and nectarines, causing damage to shoots and fruits. Western flower thrips, *Frankliniella occidentalis*, appeared suddenly in1994 spoiling fruit finish. Green peach aphid, *Myzus persicae*, is a minor pest. Traditionally all these pests are controlled with standard chemical applications with good success but we hypothesize that soft techniques may substantially decrease pesticide input in commercial orchards. To test that, four five-hectare plots of nectarines were use to compare two strategies of pest management. One block was treated with standar pesticides each time that the pressure of the pest required a spray. The applied insecticides were Clorpirifos and Metomil to control OFM and Thiametoxan, Imidacloprid, Formetanate and Kaolin for thrip and aphids. The remaining three plots were under the mating disruption technique (MD). We used dispensers for OFM of different brands: Check Mate (270/ha), Isomate 100 (400/ha) and Rak 20 (500/ha). Thrips and aphids control was performed with the same chemicals used in the standard treatment. Monitoring of OFM was done with Pherocom 1C® traps having 1 mg of pheromone and feeding traps of Terpinyl acetate. These traps were checked on a weekly basis. Thrips, mites (predatory and phytophagous) and aphids were monitored from shoot samples following the technique described by Boller. OFM damage in the MD plots was < 0,7 and 5,3 % for fruits and shoot tips, respectively whereas in the standard plot damage was 0,5 and 4,5 for fruits and shoot tips respectively. In the MD plots no OFM was detected in the traps but the feeding traps did detect OFM in both MD and standard plots. One drawback of the MD technique was the damage by cut worms (2-8%) during the second season. Thrips and aphids were kept below the economical threshold in both strategies of pest control. The soft approach for pest management tested in this trial proved to be effective and promising. Long term effects need to be evaluated.
Index terms: *Cydia molesta*, *Frankiniella occidentalis*, *Myzus persicae*, Terpinyl acetate,

[2792] COMPATIBILITY OF NEEM PESTICIDES WITH PARASITOIDS – A REALISTIC APPROACH IN IPM

S. Raguraman[1] & R. P. Singh[2], [1]Department of Entomology, Agricultural College and Research Institute, Tamil Nadu Agricultural University, Madurai-625104, e-mail: raguraman99@hotmail.com; [2]Division of Entomology, Indian Agricultural Research Institute, New Delhi 110012.

We screened aqueous suspension, ethanolic extract, hexane extract and ethanolic extract of hexane extract of neem seed kernel (NSK) for different biological effects *viz.*, oviposition deterrence, feeding deterrence, toxicity, sterility and insect growth regulatory (IGR) activity against two important polyphagous parasitoids-an egg parasitoid, *Trichogramma chilonis* Ishii and a larval parasitoid, *Bracon hebetor* Say. All the extracts were tested at 5.0, 2.5, 1.2, 0.6 and 0.3 % at 27±1°C and 65±5 % R.H. using rice moth, *Corcyra cephalonica* (Stainton) as the host for both the parasitoids. With regard to *T. chilonis*, all extracts deterred the oviposition (parasitization) but the degree of activity varied considerably both in choice and no-choice tests. Extracts also showed feeding deterrent effect at or above 1.2% both under choice and no-choice conditions. Feeding toxicity revealed that all the neem extracts even at 5% concentration caused a mortality ranged between 40 and 55%. But the mortality increased when the female *T. chilonis* contacted the neem treated eggs for oviposition. No adverse effects on sterility and development of *T. chilonis* were observed. These biological effects indicate that treatment of crop with neem extracts should be followed after inundative releases of the parasitoid, *T. chilonis* in IPM. With regard to *B. hebetor*, no effects on parasitization, feeding, mortality and fertility were recorded even at 5% concentration of all the neem extracts. But the larval and pre-pupal stages of *B. hebetor* are susceptible to IGR effects of the extracts tested. Thus, in this case, a minimum safety period is suggested to avoid contamination of host larvae and larvae of the parasitoid, *B. hebetor*. For both the parasitoids, a pre-sampling to know the stage of the parasitoid is necessary to avoid any ill effect. These suggestions are only for the above two parasitoids. However, data on behavioural and physiological effects of neem pesticides on other parasitoids are essential for compatible use in IPM.
Index terms: Neem extracts, biological effects, parasitoids, IPM.

[2793] MANAGEMENT OF SUCKING INSECT PESTS IN COTTON ECOSYSTEM WITH A NEW SYSTEMIC MOLECULE, ACETAMIPRID

S. Raguraman & S. Uthamasamy, Department of Agricultural Entomology, Agricultural college and Research Institute, Tamil Nadu Agricultural University, Madurai 625 104, India, Email: raguraman99@ hotmail.com

Acetamiprid is a new insecticidal compound with cyanoamidine structure developed by Nippon Soda Ltd., Japan. It affects acetyl choline receptor of insect central nervous system and has acute contact and stomach poisoning with highly systemic and translaminar activity. We tested the formulated product of acetamiprid 20 % SP at 5, 10, 15 and 20 g a.i./ha along with other insecticides *viz.*, acephate 75 SP, triazophos 40 EC, monocrotophos 36 SC and methyl-o-demeton 25 EC against sucking insect pests of cotton in three consecutive field trials. The studies included evaluation of bioefficacy, safety to non-target insects, phytotoxicity and harvest time residues. Experiments were conducted during 1998 and 1999 seasons with *Supriya* and MCU 10 cotton varieties. Need based application with a spray fluid of 500 l/ha was made whenever the target pest(s) exceeded the threshold level. The results revealed that acetamiprid 20 SP at 10, 15 and 20 g a.i./ha effectively checked the populations of whitefly, *Bemisia tabaci* Genn., leafhopper, *Amrasca devatans* (Dist.), thrips, *Thrips tabaci* Lind. and aphid, *Aphis gossypii* Glover. Higher population of predatory coccinellid, *Coccinella septumpunctata* L. was recorded in acetamiprid treatments than the check insecticides a week after spray. Acetamiprid did not exihibit any phytotoxic symptom on cotton leaves in all the three seasons. Foliar application of actamiprid recorded low levels of deposit in seed (0.6 to 5.5 ppm) and oil (0.2 to 2.5 ppm) compared to lint (2 to 17 ppm). However, the level of contamination in cotton lint, seed and oil after 7 days of second application was below detectable level. It appears that acetamiprid is a promising candidate insecticide for the management of sucking insect pests of cotton.
Index terms: Acetamiprid, bioefficacy, sucking pests, phytotoxicity, residues, cotton ecosystem.

[2794] FOLIAR AREA CONSUMPTION BY THE WORM, *ANTICARSIA GEMMATALIS* IN SOYBEAN CULTIVATION

Z. A. Ramiro[1], [1]Centro Exp. do Instituto Biológico, C. P. 70, 13001-970, Campinas, SP, BRAZIL. E-mail zamiro@uol.com.br;

The soy plague control recommendations are based upon the concepts from Pest Management (MIP), having to be executed for the action levels. To the soy worm, *Anticarsia gemmatalis*, two parameters: the number of worms/meter or the defoliation percentage. Various researches have proven that the defoliation percentage may vary due to the kind of cultivation used. At the current research work, it was possible to evaluate the defoliation percentage made by the *Anticarsia gemmatalis* worm in three soy cultivations: IAS-5, IAC-17 and IAC-100.Worms from the first instar were individualized in Petri dishes, having leaves from that cultivation as food substratum. In order to maintain the humidity, a small piece of wet sponge was set in each of dishes. The dishes that contained the worms were kept in BOD under controlled conditions. From the third instar on, the foliar area consumed by worms was daily measured with the aid of a foliar area measurement device, through the difference between the offered foliar area and the consumed one in that period. As for statistic analysis purposes, twenty-five dishes were considered somewhat a repetition, distributed in statistic outlines of blocks entirely displayed in no specific order, with four repetitions per cultivation. The averages from the foliar area consumed by twenty-five worms (repetitions) during the third, forth and fifth instars were analyzed, and the results of such research are represented in the graphic, in which the occurrence of significant differences among the three studied instars can be observed.
Indes terms: *Anticarsia gemmitalis*, soybean

[2795] USE OF THIAMETHOXAM IN THE *BEMISIA* SPP (HOMOPTERA: ALEYRODIDAE) CONTROL IN CULTIVATION OF VEGETABLES AND COTTON, IN MONITORED AREAS

Z. A. Ramiro[1], R. L R. Lara[2], N. W. Perioto[2] & J. C. C. Santos[2], [1]Centro Experimental do Instituto Biológico, C. P. 70, CEP 13001-970, Campinas, SP, BRAZIL. E-mail: zamiro@uol.com.br; [2]Laboratório de Sanidade Animal e Vegetal de Rib. Preto/IB, Rua Peru, 1472-A, CEP 14075-310, Ribeirão Preto, SP, BRAZIL. E-mail: lsav-rp@ceterp.com.br

In the last ten years, species belonging to the *Bemisia* genus, vulgarly known as white-fly, have become one of the main cotton, vegetables and ornamental plants plagues, having as main form of control the use of chemicals. The use of traditional insecticides has been proven to be ineffective, mainly due to the fact that young and adult forms are developed in the lower part of the leaves. In the beginning of the 90's, new products that came up with a new perspective to control nimphs and adult white-flies appeared in the market; among them, there was the thiamethoxam, which belongs to the neonicotinoid group, whose efficiency has already been proven by several researches on the control of various plagues, including species of *Bemisia*. However, in order to avoid the development of resistant populations, strategies of how to handle the utilization of this i.a. must be studied. In order to achieve so, several tests that aimed for the application of the thiamethoxam, at the formulation of 250 WG in cotton and vegetables areas were run. In two cotton cultivation fields (IAC-20 and DELTA OPAL), the efficiency of thiamethoxam was compared to the products used by the agriculturist - triazophos, carbosulfan and imidacloprid - in the white-fly and aphids control. Vegetables areas with *Bemisia argentifolii* in zucchinis, fruit of the eggplants and broccoli were monitored and had three applications of thiamethoxam, using 5 g i.a/100 ℓ of H_2O dosage, intermingled with two applications of the conventional product – imidacloprid. In one of the tests using the fruit of the eggplants, the thiamethoxam efficiency was compared to the i.a triazophos. The evaluations in the vegetable areas were made through a direct counting of the number of adults in 10 leaves/part, the number of adults collected in a "tábua-de-batidas" and the number of nimphs in 4 cm^2/ leaf in 10 leaves/part. In the monitored areas, aiming for the adults reduction, stick traps and CC-trap were set. In the cotton fields, surveys on nimphs, white-flies and aphids in 50 leaves/areas were done. By the results, it is noticeable that the i.a thiamethoxam was highly efficient in alternation with products currently used to control *Bemisia* species, in cotton plantations and in vegetables; due to such results, the thiamethoxam must be one of the chemical components to be used on MIP (Pest Management) programs.
Bemisia spp., cotton, vegetables, handling.

[2796] EFFICIENCY OF INSECTICIDES AND GYPSUM IN THE CONTROL OF BROWN STINK BUGS (*SCAPTOCORIS CASTANEA*) IN CORN, IN THE SOUTHEAST OF THE STATE OF GOIÁS

J.F. Rattes, C. dos R. Sousa and L.C. da Silva, Fesurv/Esucarv. Caixa Postal 104, Cep: 75901-970 Rio Verde - GO. E-mail: rattes@fesurv.br.

The efficiency of insecticides and gypsum was evaluated in controlling brown stink bugs (*Scaptocoris castanea*) (Coleoptra:Cycidae) in corn. It was confirmed that at 15 days after the treatment (DAT), the greatest efficiency on stink bug nymphs were obtained with Thiamethoxam 10 G (40.30%) and Fipronil 250 SC (39.04%). At 29 DAT with Thiamethoxam 700 WS (84.16%) and Fipronil 250 SC (69.52%) and at 45 DAT with gypsum (73.45%) and Thiamethoxam 700 WS (72.55%). In the adult stage at 15 DAT with Thiamethoxam 10 G (68.58%) and Endossulfan 350 CE (61.84%). At 28 DAT with Imidaclopride 600 PM (71.21%) and Gypsum (62.51%) and Thiamethoxam (62.08%) and at 45 DAT with Thiamethoxam 250 WG (85.60%). Imidaclopride 600 PM (84.35%) and Endossulfan 350 CE (83.25%). The treatments with Gypsum show an increasing efficiency in the nymph phase as well as in the adult phase.
key words: Insecta, Cynidae, chemical control, soil-infesting insects

[2797] INSECTICIDES AND PLASTER USED FOR CONTROLLING BROWNY STINKBUG (*SCAPTOCORIS CASTANEA*) POPULATIONS IN CORN CROPS IN THE SOUTHWEST REGION OF GOIÁS

J.F. Rattes, C. dos R. de Sousa[2] & L.C.B. da Silva, [123]Fesurv/Esucarv. Caixa Postal 104. Cep: 75901-970 Rio Verde-GO. E-mail: rattes@fesurv.br

An experiment was carried out in Goiatuba, GO, during the period of 01/12 to 02/26 in 1999, in order to evaluate the efficiency of different kinds of insecticides (applied during seed treatment, planting time and sprayed over the plants) and plaster (applied during planting time) in keeping *Scaptocoris castanea* population under control. The statistic design was randomized blocks with four replications. Twelve treatments were evaluated: Thiamethoxam 700 WS (210 g a.i./100 Kg of seeds); Thiamethoxam 250 WG (200 g a.i./ha); Thiamethoxam 10 G (100 g a.i./100 Kg of seeds); Fipronil 250 SC (125 g a.i./100 Kg of seeds); Fipronil 800 Grd (128 g a.i./ha); Furatiocarb 400 Snaqc (400 g a.i./100 Kg of seeds); Imidacloprid 600 PM (240 g a.i./100 Kg of seeds); Clorpirifós 450 CE (900 g a.i./ha); Plaster – $CaSO_4$ (2000 Kg/ha); Vamidathion 300 CE (450 g a.i./ha); and Endossulfan 350 CE (525 g a.i./ha). Vamidathion 300 CE was sprayed over the plants on the 10th, 20th and 35th days after seed germination. The evaluations were performed on the 15th, 28th and 45th days after treatment (DAT). The averages were calculated and tested by the Tukey test showing no significant differences at the probability level of 5%. The percentages of efficiency were calculated according to Henderson & Tilton. For *S. castanea* in its young stage the highest percentages of efficiency on the 21st DAT were achieved when applying Thiamethoxam 10 G (40.30%), followed by Fipronil 250 SC (39.04%); on the 28th DAT the best results were Thiamethoxam 700 WS (84.16%), followed by Fipronil 250 SC (69.52%); and on the 45th DAT the best results were Plaster – $CaSO_4$ (73.45%) followed by Thiamethoxam 700 WS (72.55%). For insects in their adult stage, the highest percentages of efficiency on the 21st DAT were achieved when applying Thiamethoxam 10 G (68.58%) and Endossulfam 350 CE (61.84%); on the 28th DAT the best results were achieved when applying Imidacloprid 600 PM (71.21%), Plaster – $CaSO_4$ and Thiamethoxam 700 WG (62.51 and 62.08, respectively). On the 45th DAT the best results were achieved when applying Thiamethoxam 250 WG (85.60%), Imidacloprid 600 PM (84.35%) and Endossulfan 350 CE (83.25%). The use of Plaster demonstrated an increasing efficiency in controlling young stage, which ranged from 5.30%, 33.16% up to 73.45% in the evaluation performed on the 21st, 28th and 45th, respectively. The same tendency was observed in controlling adult stage, which ranged from 28.94%, 62.51% up to 63.08% on the 21st, 28th and 45th, respectively.
Index terms: Insecta, Cydnidae, Chemical control

[2798] PERFORMANCE OF GROWTH REGULATOR INSECTICIDES ON THE CONTROL OF ARMYWORM (*PSEUDALETIA SEQUAX*) IN CORN

J.L. Reichert[1] & R.D.Tanabe[2], [1]Lab. Entomology, College of Agronomy & Veterinary Medicine , Univ. Passo Fundo, P.O Box. 611, ZIP 99001-970 Passo Fundo - Brasil. E-mail Reichert @ upf.tche.br; [2] Agronomy Graduate Student

The armyworm *Pseudaletia sequax* is a major insect pest of winter cereal crops. This insect also affects corn development when this crop is planted on residues of oat plants (no tillage). As an attempt to solve this problem, growers add insecticides to the herbicide used for oat dessication prior to corn planting. In this research, the insecticides Novaluron 10 g a.i./ha, Lufenuron 15 g, Teflubenzuron 15 g, Methoxyfenozide 28.8 g, Chlorfluazuron 20 g, Triflumuron 24 g, and Diflubenzuron 25 g were evaluated their performance for controlling *P. sequax*. The experiment was carried out in a growth chamber adjusted to 22±2 °C and 12-hour photophase. The insecticides were applied onto experimental plots (3 m wide × 15 m long) by means of a CO_2 backpack sprayer adjusted to deliver 200 L/ha at a 45-PSI pressure. At the application, plants were at the growth stage of four leaves. The larvae used in this test were from a stock population. The experimental units were arranged in a complete randomized design with eight treatments and five replications. Each replication consisted of 8-10 larvae (1-2 cm) kept in plastic containers (11 w × 11 l × 3 cm h). The larvae were fed with leaves from the insecticide sprayed area. Insecticide efficacy was calculated according to the Henderson & Tilton's formula at three, five, and seven days after insecticide application. For statistical analyses, data were transformed by $\sqrt{(x+0.5)}$. At the first assessment, Diflubenzuron and Chlorfluazuron controlled *P. sequax* 76.7 and 73.3%. At five days, the insect control provided by the insecticides was above 85% or equaled 100% (Triflumuron and Diflubenzuron). At seven days after application, the overall control was > 90%. In conclusion, all insecticides tested in this research performed efficiently against *P. sequax*, being recommended to control armyworm on no tillage corn plantings.
Index terms: *Rachiplusia nu*, growth regulator insecticides, no tillage

[2799] EFFECT OF DIFFERENT LEVELS OF NITROGENOUS AND POTASSIC FERTILIZATION ON THE POPULATION OF *COCCUS VIRIDIS* (HOMOPTERA; COCCIDAE) IN SWEET ORANGE (*CITRUS SINENSIS*), CULTIVAR "FOLHA MURCHA"

W.C. Rodrigues[1,2], P.C.R. Cassino[1,3], J. S. Costa-Junior[1], O.R.F. Azevedo[1], R. Silva-Filho[1] & S.S.P. Souza[1], [1]Dept. de Entomologia e Fitopatologia, IB, Centro de Manejo de Pragas "Cincinnato Rory Gonçalves" - UFRRJ, BR 465 Km 07, Seropédica, RJ, Brazil, CEP 23890-000, BR. E-mail: cimp@ufrrj.br. [2]E-mail: wcosta@ufrrj.br; E-mail: [3]pr.cassino@uol.com.br.

Several studies have showed the importance of a balanced mineral fertilization on control of the insects populations. The objective of this study was to evaluate the effects of two levels of nitrogen (N_0 = 0g N and N_1= 269g N) and potassium (K_0 = 0g K_2O and K_1 = 200g K_2O) on the population density of the green soft scale, *C. viridis*. The experimental area was in a sweet orange (*C. sinensis*) orchard planted with the cultivar "Folha Murcha", and .consisted of 74 18-year-old plants. Evaluation trials were run over the period January to June, 1999. The experimental desing used was a 4x5 randomized block design. Each plot was consisted of a plant. The treatments tested were: N_0K_0 (control), N_0K_1, N_1K_0 and N_1K_1. Data collection was made weekly, and based binomial sampling plan of presence-absence. Data were transformed (square root [x% + 0.5]), and subjected to analysis of variance. The treatment means were separated using Duncan's least significant difference test (P≤0.05). The infestation levels observed of the green soft scale were: N_0K_0 = 2.42%; N_0K_1 = 1.86%, N_1K_0 =2.59% and N_1K_1 =2.27%. The treatment means was statiscally significant. There was a tendency of the population density of *C. viridis* to be higher in plants treated with N_1K_0 and lower in plants treated with N_0K_1.
Index terms: *Coccus viridis*, Nitrogen, Potassium, Orange, Integrated Manegement.

[2800] EFFECT OF NITROGENOUS AND POTASSIC FERTILIZATION ON THE POPULATION OF *ALEUROTHRIXUS FLOCCOSUS* (HOMOPTERA; ALEYRODIDAE), IN SWEET ORANGE (*CITRUS SINENSIS*), CULTIVAR "FOLHA MURCHA"

W.C. Rodrigues[1,2], O.R.F. Azevedo[1], R. Silva-Filho[1], P.R.R. Silva[1,3], P.C.R. Cassino[1,4] & S.S.P. Souza[1], [1]Dept. de Entomologia e Fitopatologia, IB, Centro Integrado de Manejo de Pragas "Cincinnato Rory Gonçalves" - UFRRJ, BR 465 Km 07, Seropédica-RJ, Brazil, CEP 23890-000, [2]E-mail: wcosta@ufrrj.br; [3]E-mail: pramalho@fst.com.br; [4]E-mail: pr.cassino@uol.com.br.

Studies on mineral fertilization affecting population of insects have been realized a long time ago. They show that a balanced fertilization tend to control insect-pest populations. This study was designed to evaluate the effect of 2 different levels of nitrogen (N_0 = 0g N and N_1 = 269g N) and potassium (K_0 = 0g K_2O and K_1= 200g K_2 0) on the population of *A. floccosus*. The experiment was conducted from January to June, 1999. The experimental area consisted of 74 18-year-old plants of sweet orange (*C. sinensis*), cv. "Folha Murcha". A randomized block design was used whit 4 treatments (N_0K_0, N_0K_1, N_1K_0 and N_1K_1) replicated 5 times. Evaluations were done weekly using the binomial method logy ("presence-absence"). Data on percentage of insects present on the branches were transformed (square root [x% + 0.5]). The infestation levels observed were: 2.87% for N_0K_0, 2.71% for N_0K_1, 2.55% for N_1K_0 and 1.98% for N_1K_1. Significant treatment effects could be found by Duncan's separation of means test (P≤ 0.05). The number of white flies upon no fertilized plants was greater than upon plants that were treated with both fertilizers.
Index terms: *Aleurothrixus floccosus*; Nitrogen; Potassium; Orange; Integrated Management.

[2801] INTEGRATED BIOLOGICAL CONTROL OF WHITE FLIES (*BEMISIA TABACI*) IN OAXACA, MEXICO[1]

Ruiz V., J.[2], Aquino B., T.[2] y Medina Z., J.[3], Centro Interdisciplinario de Investigación para el Desarrollo Regional (CIIDIR), Unidad Oaxaca, Instituto Politécnico Nacional, Phone / Fax: (951) 7 04 00 y 7 06 10, email: jvega@redipn.ipn.mx. [1] DEPI-IPN Project No. 978003 and SIBEJ-CONACyT No. A-030, [2] CIIDIR OAXACA, Sta. Cruz Xoxocotlán, Oax. [3] ITA No. 23, Nazareno Xoxocotlán, Oax.

To evaluate the combined control capability of two entomopathogenic fungi, an entomophagous agent and alive barriers against white flies, two field experiments were established during 1997 and 1998 with irrigated tomato and hot peppers. Third degree interactions were significant for crop yields in both crops. In hot peppers, the largest crop yields were observed with the combination maize barriers + *Chrysopa* spp. + *Paecilomyces farinosus* and maize barriers + Confidor, but in tomatoes the largest crop yields were obtained with *Chrysopa* spp. + Confidor. The second largest yield, however, was observed with the treatment maize barriers + *Chrysopa* spp. + Confidor, which indicates a positive effect of alive barriers. A significant increment of 12 to 15 % relative humidity was observed in plots with maize barriers. Because of the planting dates, hot peppers grew under very low populations of white flies, while tomatoes experienced heavy infestation. The percent of heavily diseased plants correlated inversely with crop yields. It was concluded that using *Chrysopa* spp. + Confidor can be a good option for transplanting dates during the hot and dry part of the growing season (February-May), were high temperatures and white fly populations lower the effectivity of entomopathogenic fungi. However, farmers with low economic resources could use maize barriers + *Chrysopa* spp. + *Paecilomyces javanicus* or maize barriers + *Paecilomyces javanicus*, especially in planting dates with low white fly's populations, such as those carried out on late July or during October. During the first planting period, rain in excess of 30 mm per event exerts noticeable physical control of white flies, while lower temperatures during the Fall Season also decrease the insect's activity.
Index terms: entomopathogenic fungi, *Chrysopa* spp., maize barriers

[2802] THEORY OF MUTUALISTIC PLANT PROTECTION (MPP) AND ITS PRACTICE: MAINLY REGARDING COTTON APHID MANAGEMENT BY SURROUNDING MARGINAL ALFAFA ZONE

Z. Runzhi & Z. Guangxue, Institute of Zoology, the Chinese Academy of Sciences, Beijing 100080)

The pest management methods would be durable, ecologically stable, flexible and feasible for meeting the demands of the sustainable development of agriculture and forestry. Considering the points above, the authors suggested a new way of the pest management. That is a strategy of using mutual plants to regulate the interactions of biotic factors around the environment of the target plant. The concept of the Mutualistic Plant Protection (MPP) could be the developmental direction in the future plant protection. MPP means that a plant could produce the most output by the regulations of plants, animals, microorganisms, and other associated factors in the adjacent area to maintain pests in a long-term stable population. The principle of feasibility of these regulation methods is the law of the mutual ways of all organisms including plants and pests in the natural world. At beginning stage of cotton aphids, *Aphis gossypii* Glover, invading to cotton field, a large amount of insects accumulated in the marginal alfafa, *Medicago sativa* L., zone surrounding it. They were 6.94 times (excluded natural enemies) as many as in cotton field. These insects were mainly *Therioaphid maculata* (Buckton), and its occurrence in fields 10–15 days earlier than that of cotton aphid. Consequently, abundant natural enemies had bred in alfafa zone while the period of cotton aphid increasing rapidly in cotton filed in middle June in Xinhe County, Xinjiang Autonomous Region. The total number of major natural enemies including Coccinellids, Chrysopids and Syphid flies in alfafa zone were 13.65 times as that in cotton field within the same acreage of fields. At this period, it was very effective to force natural enemies from alfafa zone to the cotton field to control the rapid increase of cotton aphid population in cotton field nearby by cutting the alfafa stands.
Index Terms: Mutualistic Plant Protection (MPP), pest management, Cotton aphid (*Aphis gossypii* Glover), alfafa (*Medicago sativa* L

[2803] EVALUATION OF INSECTICIDES TO CONTROL *MIGDOLUS FRYANUS* IN SUGARCANE

M. M. M. Rupp[1] & C. C. M. Resta[2], [1]UEM, Dept of Agronomy, State Univ. of Maringá, Colombo Avenue, 5790, Maringá, PR, Brazil 87020-900, E-mail rupp@netpar.com.br; [2]UEL, Dept. of Agriculture, State Univ. of Londrina, P.O. Box 6001, Londrina, PR, Brazil 86051-990, E-mail cesarmarre@hotmail.com.

In sugarcane plantation, in areas of high infest Migdolus is common the need of replantation of these affected areas. In this culture is possible to reach 4 or more cuts in the same area, the pest attack may bring a large economic prejudice. In the present work, there was the objective in evaluate the efficiency of insecticides Dissulfan and Endozol in the control of Migdolus in cane. The experiment was conducted in conditions field, at Usina Juliana, in Tapejara/PR. The outline used was blocks at random, with 10 treatments and 4 time. Each part had 7 ruts of 15 meters, in the space of 1,10 meters, with tolets of the variety SP 70-1143. The treatments had from Endsulfan—Dissulfan 350 CE: dosage of 6,0; 8,0; 11,5 and 14,0 litters p.c./ha and Endozol 500 SC (4,2; 5,6; 8,0 and 9,8 litters p.c./ha),--Heptacloro (Biarbinex 400 CE: 9 litters of p.c./ha and witness (without insecticide). The products were applied in the ruts of the plantation on the tolets. The Migdolus larval were counted in samples and it was evaluated the damages. It was concluded the Dissulfan 350 CE (dosages of 6,0; 8,0; 11,5 and 14,0 litters p.c./ha) and Endozol 500 SC (4,2; 5,6; 8,0 and 9,8 litters p.c./ha) insecticides presented efficiency in the Migdolus control during the experiment. The treatments with Dissulfan and Endozol (all the dosages) presented minor Migdolus attack to the rizomas. It wasn't observed the phytotoxicity from the insecticides, in the proved dosages, to sugarcane crop.
Index terms: longhorn beetle, chemical control, endosulfan

[2804] HARMFUL AND BENEFICAL INSECT SPECIES IN TWO VARIETIES OF *LUPINUS* SPP. IN ARGENTINA

S. Russo[1], G.S. Mareggiani[1] , M.J. Cordara[1] & M. P. Vilariño[2], 1 Cátedra Zoología Agrícola, 2 Cátedra Cultivos Industriales. Facultad Agronomía. Av. San Martín 4453 (1417). Buenos Aires. Argentina. srusso@mail.agro.uba.ar

Lupinus spp. is a crop in development in Argentina, and knowledge of its pests in our climate, and of their deleterious effect on *Lupinus* adaptation, is not good at present. A survey was conducted to determine harmful and benefical species in two sweet varieties with similar levels of quinolizidine alkaloids, in the experimental campus of Buenos Aires University during two successive years. Varieties selected were *Lupinus albus* var Rumba and *L. angustifolius* var. Gungurrú. Once a week samples were taken, considering one whole plant as an experimental unit. Three different phenological stages were considered: I) emergence until full vegetative development, II) Full vegetative development until full flowering stage, III) Full flowering stage until full fructification. The results show no insect damage during the first stage. During the second stage, the maximum amount of phytophagous and benefical insect species was observed. Phytophagous species included seven Coleoptera, being particularly harmful to the foliage *Disonychodes exclamationis* and *Lema bilineata* (Chrysomelidae), and three Lepidoptera whose larvae caused defoliation (*Anticarsia gemmatalis* and *Spodoptera virginica*, Noctuidae) or damage to the shoots (*Epinotia aporema*, Tortricidae). Benefical species included two Coccinelidae (*Cycloneda sanguinea* and *Eriopis connexa*), and polenophagous Hymenoptera. The third stage included a great amount of Heteroptera: three belonging to the family Pentatomidae: *Nezara viridula*, *Edessa meditabunda* and *Arvelius albopunctatus*, and one Coreidae: *Athaumastus haematicus*, being this pest considered the most harmful in this phenological stage. Also, the Lepidoptera just mentioned above, have been observed causing damage in this stage. Monitory of both varieties showed no significative difference in quantity and quality of insect species, not affecting differentially *Lupinus* yield. These results indicate that in our climate conditions, *A. gemmatalis* and *A.haematicus* are the key pests for the *Lupinus* varieties here studied.
Index terms: *Anticarsia gemmatalis, Athaumasthus haematicus, Lupinus albus, L. angustifolius*, quinolizidine alkaloids.

[2805] AVENTIS CONTRIBUTION TO INTEGRATED CROP MANAGEMENT (ICM)

A. Sagenmüller, J. Fabretti & R. T. Hewson, Aventis CropScience, Lyon, France

Through the development of new crop protection products, seeds, biotechnology and agronomic services, such as diagnostic systems and resistance management strategies, Aventis is providing the farmer with valuable ICM tools for sustainable, safe and economic agricultural production. ICM is seen as the successful way forward for farming, and is an integral part of the Aventis policy of helping the farmer produce reliable supplies of affordable food with the least impact on man and the environment. To this end, a global network has been established with trained staff carrying out research work, training farmers and advisors and liaising with the key contacts in each country. Some of the success stories arising out of projects carried out are described in this poster. In India, trials in rice and cotton showed that higher yields and net profits could be achieved through the adoption of IPM. Similar results with cotton in Brazil has seen this concept extended to tomatoes and other crops. In Colombia, control of the coffee berry borer was achieved through a combination of chemical and microbial control. Communication of ICM to farmers is important, and success in Malaysia was achieved through an ICM magazine. ICM involves using the latest technology and examples are included from the Netherlands with a computerised warning system for potato blight control, and France with a computer model for predicting optimal dates for grain aphid treatment. Trials in peaches in Italy with the pyrethroid Decis showed the importance of positioning products in programmes to obtain optimum control of the pest with least harm to beneficials. A UK study on different farming systems has shown that good yields and quality produce can be obtained using modern, sustainable, farming methods, whilst at the same time encouraging native flora and fauna to flourish. Also in the UK, the adoption of conservation headlands in cereals showed that through selective use of herbicides, problem weeds can be controlled whereas others that are beneficial for birds and arthropods are not harmed. Finally, research in the USA has shown that biotechnology can be an important new tool of ICM. These and other case studies have shown that it is possible, by careful product choice and timing, based on pest, disease and weed monitoring and the development of economic thresholds, to achieve levels of control and crop yield from integrated programmes that are often better than conventional ones. The need for lower inputs has often resulted in these programmes being more cost-effective, and achieved with less environmental impact. Having well-trained staff working closely with farmers and growers in a practical field situation, often in conjunction with the public sector, were all important factors contributing to the success of these initiatives.
Index terms: Case studies/global network/economic/sustainable

[2806] CHEMICAL CONTROL OF "LEAF MINER", *LEUCOPTERA COFFEELLA* WITH BINFENTHRIN 100 CE LONELY AND ASSOCIATE WITH ANOTHERS INSECTICIDES, IN COFFEE CROP

L.O. Salgado[1]; A. C. Silva[1] ; A. J. Ferreira[2] & Correa, L. E. A [3], 1 – Agroteste - Pesquisa e Consultoria Praça Leonardo Venerando, 284 C.P 201 Lavras/MG 37.200-000 Brazil E-mail agrotest@ufla.br; 2 Universidade Federal de Lavras/UFLA C.P 37 Lavras/MG 37.200-000 Brazil 3 – FMC do Brasil Ind. e Com. Ltda - Campinas SP 13 010-910 Brazil

The "Leaf miner", *Leucoptera coffeella* is one of the major pests of coffee crop in Brazil. Pest management program involved studies on sampling, economic thresholds, biological and chemical control. The insecticide was tested in Perdões/Minas Gerais State – Brazil from October and November 1999. The trial was set up in adult c.v. "Catuaí", with 4,0 x 1,0 m spacing. The experimental design used was randomized blocks, with 10 treatments replicated 4 times, each plot with 28 m^2. The treatments were applied in spray method (PL-BV 9000), with volume of 300L/ha. All treatments were applied one time in 15/10/99. The treatments were (g.i.a/ha): 1. Check; 2. Fenpropathrin 300 CE + Cartap 500 – 75 + 500; 3. Bifenthrin 100 CE + Profenofos 500 – 40 + 500; 4. Bifenthrin 100 CE + Profenofos 500 – 30 + 500; 5. Bifethrin 100 CE + Profenofos 500 – 20 + 500; 6. Bifenthrin 100 CE + Profenofos 500 – 10 + 500; 7. Bifenthrin 100 CE + Carbosulfan 400 SC – 10 + 200; 8. Bifenthrin 100 CE – 10;9. Fenpropathrin 300 CE – 75 and 10. Cartap 500 – 500. Were realized 4 evaluations in 7 DAA (Days after application), 14 DAA, 28 DAA and 45 DAA, collecting 20 leaves/plot with feasible lesions. Were established the number of larvae lives. The means were separated with Tukey test ($p<0,05$) and the efficiency established with Abbott formula. The insecticide Bifenthrin 100 CE associate with Profenofos 500 showed efficiency between 70,00 and 100,00% of 7 until 45 days after application.
Index terms: *Leucoptera coffeella*, leaf miner, chemical control, coffee crop.

[2807] CHEMICAL CONTROL OF "LITTLE FRUIT BORER", *NEOLEUCINODES ELEGANTALLIS*; WITH LAMBDACYHALOTHRIN 50 CS AND 50 CE IN TOMATO CROP

L.O. Salgado[1], A. C. Silva[1] & A.J. Ferreira[2], [1] – Agroteste - Pesquisa e Consultoria Praça Leonardo Venerando, 284 C.P 201 Lavras/MG 37.200-000 Brazil E-mail agrotest@ufla.br; [2] Universidade Federal de Lavras/UFLA C.P 37 Lavras/MG 37.200-000 Brazil

The efficacy of Lambdacyhalothrin 50 CS against "Little fruit borer", was tested at São João farm, in Varjão de Minas/Minas Gerais State-Brazil, from may 1998. The trial was set up in c.v. U 570, planted in 1,0 x 0,5 m spacing. The experimental design used was randomized blocks, with 6 treatments replicated 4 times, each with 4 lines of 10 m. The treatments were applied 7 times starting in 31/03/98 (7/7 days). The treatments in g.i.a/100L were: 1. Lambdacyhalothrin 50 CS – 1,5; 2. Lambdacyhalothrin 50 CS - 2,5; 3. Lambdacyhalothrin 50 CE – 1,5; 4. Lambdacyhalothrin 50 CE – 2,5; 5. Betacyfluthrin 50 CE – 1,25 and 6. Check. The insecticides were applied in spray method with CO_2 (50 lb/pol^2) and volume of 600L/ha. Were realized 2 evaluations in 13/05/98 and 18/05/98. Were evaluated 25 fruits/plot, were established the number of "borers fruits". The means were separated with Tukey test ($p<0,05$) and the efficiency of insecticides calculated with Abbott formula. The insecticide Lambdacyhalothrin 50 CS (1,5 and 2,5 g.i.a/100L) showed an efficiency of control between 91,7 and 100,00%, Lambdacyhalothrin 50 CE (1,5 and 2,5 g.i.a/100L) showed an efficiency of control between 83,3 and 94,1%.
Index terms: *Neoleucinodes elegantalis*, chemical control, fruit borer, tomato crop.

[2808] EFFICACY OF THIAMETHOXAN (ACTARA 10GR) TO CONTROL THE WHITE PEACH SCALE, *PSEUDAULACASPIS PENTAGONA* (HOMOPTERA:DIASPIDIDAE) IN PEACH TREES

L.A.B. Salles, Embrapa Clima Temperado, P.O.Box 403, Pelotas, RS 96001-970, Brazil. E-mail salles@cpact.embrapa.br.

The white peach scale, *Pseudaulacaspis pentagona,* is an exotic pest in Brazil and colonizes a wide variety of crops, especially fruit crops, and peach is one of the crops most severely attacked. The crawlers of this species are particularly susceptible to insecticide control, whereas the second stage nymphs and later instars, which are protected by their scales, as well as the adult females are more difficult to kill. Intensive and extensive use of sprayed insecticide in peach trees for its control has resulted in outbreaks, especially due to the elimination of the widespread encyrtid parasitoid *Encarsia berlesei.* White peach scale is a multivoltine species having three generations per year in southern Brazil. Settled crawlers normally appear in October, February and April in peach orchards. The objective of this study was the use of a systemic soil insecticide at the beginning of vegetative plant stage to control the overwinter and spring generation of female scales. The study was conducted in a commercial peach orchard. The granular insecticides were applied in a shallow furrow made around the trunk of the plant and covered with soil just after its application. A single application was made when plants were at the beginning stage of leaf development. The following treatments were used: thiamethoxan (Actara 10GR) at dosage of 50, 75, 100 and 125 g of commercial product per plant and, as a standard, carbofuran (Furadan 50G) at dosage of 10 g per plant. The evaluation of scale mortality was done in branches removed from two different areas of the plant, 54 days after insecticide application. Weather conditions were normal for the region during the experiment development period. All five treatments did not differ statistically. The highest average mortality occurred with Actara 10GR at dosage of 75 g (95.8%), followed by Actara 10GR at dosage of 125 g (90.5%) and Actara 10GR at dosage of 50 g (89.8%) per plant. Furadan 50G at dosage of 10 g per plant and Actara 10GR at dosage of 100 g per plant had the lowest performance, respectively 88.8% and 79.0% of mortality. It is possible that consistency between mortality and dosages of Actara 10GR did not occur due to high parasitism rate (42,2% in the control). The possibility of using a granular insecticide in the soil, and in the infested plant only, offeres a new opportunity for much more rational control of this key pest. Supported by the natural occurring control by the mentioned parasitoid species, it could be considered as an ideal control strategy for peach orchards.
Index terms: *Pseudaulacaspis pentagona*, soil insecticide, management, control

[2809] ESTABLISHMENT OF A ROTATIONAL PROGRAM WITH TRACER (SPINOSAD) FOR *SPODOPTERA FRUGIPERDA* (FALL ARMYWORM) CONTROL IN CORN

A. C. Santos & L. A. Pavan, Dow AgroSciences. Depto Pesquisa. R. Alexandre Dumas, 1671- 4C, 04717-903, S. Paulo, SP, Brazil. E-mail: acsantos1@dow.com

Corn is a very important crop in Brazil being cultivated in about 13.000.000 ha. *Spodoptera frugiperda* is the key pest in corn and may cause up to 35% of yield losses. Several products have been used to control this pest, however, some of them are harmful to natural enemies. Resistance problems have also been detected mainly to those molecules extensively used through center pivot. Spinosad has shown excellent *S. frugiperda* control and also is highly selective to predators. The new mode of action will contribute to an Insecticide Resistance Management Program being an excellent tool to be used in a Rotational Program to control fall armyworm in Corn. Four field trials were conducted during 98/99 season, at Mogi Mirim (2) and Araras (2), SP, in order to select alternative compounds to be applied in a Rotational Program (IRM) to control *S. frugiperda* in Corn. Split plot design was used (3 x 3). At the first application Spinosad was sprayed at 24 gai / ha, Lufenuron (15 gai) and Tebufenozide (72 gai) or Thiodicarb (80 gai) as a main plot. By the 2nd application time (based on re-infestation of the main plots) the sub plots received the products alternated according to randomization. Evaluations consisted in visual observation of scratched plants (50 plants / plot) made before and after application within 3 days interval until 27 days after the first application (DAAA). Larvae counting in 15 plants /plot was also assessed at 3, 6 and 9DAAA. Factorial analysis was performed for all observations. Means comparison was also done by using Tukey's ($\alpha = 0.10$). Tebufenozide when used as a main plot or sub plot did not show acceptable performance on *S. frugiperda* in corn. Lufenuron reached good control in both applications timing being able to be recommended in an IRM Program. Spinosad reached also a good fall armyworm control in both applications timing and its residual activity was comparable to Lufenuron. Under the trial conditions, there was no difference in efficacy between Spinosad and Lufenuron when used as a first application. Thiodicarb used as a main plot or sub plot showed acceptable performance, however when used as a main plot (first application) presented residual activity shorter than Spinosad and Lufenuron. Thiodicarb could be considered as an alternative product to be recommended in the IRM. As a general conclusion Lufenuron (15 gai/ha) was the best alternative product and Spinosad (24 gai/ha) followed by Lufenuron was the best sequence. Other sequence such as Lufenuron / Spinosad also provide excellent control. Tebufenozide (72 gai/ha) was not a good partner for Spinosad and Thiodicarb can be eventually used as an alternative product. Future trials are planned using new compounds.
Index Terms: IPM, IRM, Spinosad, Lufenuron, Thiodicarb, Tebufenozide

[2810] RESISTANCE OF COTTON GENOTYPES (*GOSSYPIUM HIRSUTUM*) TO *ALABAMA ARGILLACEA* (LEPIDOPTERA: NOCTUIDAE)

T. M. dos Santos[1,*] & A. L. Boiça Júnior[1]. [1]Univ. Est. Paulista. Dep. de Fitossanidade. Via de Acesso Prof. Paulo Donato Castellane, s/n. Jaboticabal – SP. Brazil. 14870-000. E-mail: tmsantos@fcav.unesp.br; aboicajr@fcav.unesp.br *Scholarship and Financial Support from Fundação de Amparo à Pesquisa do Estado de São Paulo (FAPESP).

It was evaluated eleven cotton genotypes resistance to *A. argillacea*, considering biological aspects of this insect at young ad adult phases. The trials were conducted in climatic chambers at 25 ± 1°C under relative humidity of 70 ± 10% and photophase of 12 hours. It was used the completely randomized design, with 11 treatments constituted by cotton genotypes, each one with 30 replications. The first instar duration was significantly greater when *A. argillacea,* cotton leafworms fed with CNPA 94/139 and CNPA Precoce 1 genotypes, 3.64 and 3.60, respectively. During the second instar, the cotton leafworms fed with CNPA 94/139 genotype presented significantly shorter development period, 1.67 days. The variation interval for the third and fourth instars duration was, respectively, 1.80 to 2.08 and 1.87 to 2.19 days. The cotton leafworms fed with CNPA Precoce 2 presented fifth instar duration of 4.95 days. The average weight at 5 days of age was lower when fed with CNPA Precoce 1 genotype. The pre-pupal and pupal periods presented variation interval from 1.00 to 1.94 and 7.82 to 8.67 days, respectively. The interval variation for the larval phase was 13.08 to 14.68 days. CNPA Precoce 1, CNPA Precoce 2, CNPA 9211-18 and CNPA 9211-21 genotypes promoted significantly higher duration of larva-adult period, respectively 22.76; 22.90; 22.91 and 22.52 days. During the larval and larva-adult periods, the leafworms fed with CNPA 9211-41 and CNPA 9211-31 genotypes presented lower survival rates, 64.20 and 60.71; 62.07 and 58.62% respectively. *A. argillacea* females originated from leafworms fed with CNPA Precoce 1 genotype showed shorter oviposition period and lower number of eggs laid. It was concluded that CNPA 9211-31, CNPA Precoce 1, CNPA Precoce 2 and CNPA 9211-41 genotypes showed antibiose and/or feeding nonpreference resistance, while GL2 GL3 and CNPA 9211-29 were susceptible to cotton leafworm.
Index Terms: Insecta, host plant resistance, cotton leafworm, biology.

[2811] USE OF THE PHEROMONE TRAPS "GRANDLURE" FOR ATTRACTION AND CONTROL OF THE BOLL WEEVIL, *ANTHONOMUS GRANDIS* IN COTTON

W. J. dos Santos[1], [1]Área de Proteção de Plantas; Inst. Agronômico do Paraná; Caixa Postal 481. 86001-970, Londrina – PR – Brazil. E-mail: waljor@pr.gov.br

The boll weevil is considered the major cotton pest for its high reproduction capacity and damage, great dispersion power in the agroecosystem and multiple generations. Boll weevil control in Brazil increased the amount of insecticide used in approximately 35%. At the end of the crop season groups of boll weevil adults move to vegetated areas (e.g. woodlands, grasslands) existent in the proximity of the cultivated areas. The adults then reduce their metabolism feeding occasionally on various grains of pollen that allow them to survive until the next cotton season. Although insecticides are the main weapons to control the boll weevil, sexual pheromones has shown a great potential for both the monitoring and control of this insect. Various types of traps baited with pheromone have been developed and one that appears promising is the Boll Weevil Attract and Control Tube (BWACT). This device consists of a biodegradable carton tube (90 cm long) covered with a yellow-lemon paint mixed with malathion and an insect food attractant. A plate (7.5 x 7.5 cm) containing synthetic pheromone (grandlure) is placed inside of the upper portion of the tube. The BWACT, by acting as sexual and alimentary stimulants, attracts the adults which after making contact with the tube's surface containing the insecticide die. In order to evaluate the efficiency of the tube in attracting, arresting and killing adult boll weevil, as well as to measure adult dispersion, BWACTs were installed in traditionally infested area in Centenário do Sul, PR - Brazil. Four BWACTs, 70 m apart, were placed in three different strata on the border of a former cotton field after stalk destruction: elevation, woodland, and river. A different treatment was assigned to each tube in the respective stratum: transparent sticker, cotton oil, and control. To facilitate insect capture the base of the BWACT was fixed inside of a plastic container (50 cm of diam.). Evaluations were conducted monthly. The results showed an average daily capture of 968.76, 722.04, and 76.12 adults in the tubes treated with sticker, oil, and control, respectively. The data also showed a great dispersion of the boll weevil towards the woodland than to the stratum in the high elevation or close to the river. The substances associated wit the BWACT (sticker and cotton oil) increased weevil's retention in 11 times compared to the control. The BWACTs resulted efficient in controlling and killing the boll weevil. They also proved to be an important tool to estimate the weevil's abundance and dispersion.
Index terms: Insecta, *Gossipyum hirsutum, insect pest management.*

[2812] INSECTICIDE RESISTANCE IN CODLING MOTH WORLDWIDE: MONITORING, MECHANISMS AND CROSS-RESISTANCES

B. Sauphanor[1], W.G. Thwaite[2], L. Cichon[3] & J.C. Bouvier[1], [1]Unité de Zoologie-Apidologie, INRA, Agroparc, F 84914 Avignon Cedex, E-mail sauphano@avignon.inra.fr; [2]Orange Agricultural Institute, Forest Road, Orange NSW 2800, Australia; [3]EEA Alto Valle INTA, 8332 General Roca, Rio Negro, Argentina.

The codling moth, *Cydia pomonella*, exhibits a propensity for developing resistance to various insecticides. Resistances to arsenates and to DDT were documented in this species in 1928 and 1956, respectively, after many years of continual use. Resistance to organophosphate (OP) insecticides recently occurred in the U.S.A., Australia, South Africa and Latin America. At the same time, European populations of *C. pomonella* became resistant to different insecticide classes registered against this species, e.g. pyrethroids, OPs, and most insect growth regulators, including insecticides such as ecdysone agonists to which there had not been previous exposure. Enzymatic analysis coupled with insecticide bioassays of populations from southern Europe revealed multiple or cross-resistances to several insecticides, frequently involving enhanced oxidative metabolism. Additional mechanisms including insensitivity of the target site of pyrethroids or OPs also occur. These mechanisms can explain the variability of the spectrum or of the magnitude of insecticide resistance in different populations. The resistance conferred by a combination of these mechanisms does not completely suppress the efficacy of the most widely used organophosphates. However, the frequency and the rate of the treatments has to be increased, which also increases the environmental problems associated with higher insecticide use. Insecticide resistance management mostly involves insecticide alternations, considerations about fitness costs associated with resistance and use of insecticides with possible negative cross-resistance. Implementation of control alternatives such as mating disruption or granulosis virus together with limited insecticide use is expected to be the best long-term strategy.
Index terms: *Cydia pomonella*, resistance management, fitness cost.

[2813] CHEMICAL CONTROL OF BOWL WEEVIL *ANTHONOMUS GRANDIS* (COLEOPTERA: CURCULIONIDAE) AND *ALABAMA ARGILLACEA* (LEPIDOPTERA: NOCTUIDAE)

J. R. Scarpellini[1], [1]Laboratório de Sanidade Animal e Vegetal de Ribeirão Preto – Instituto Biológico – Rua Peru nº 1472-A, Zip code 14075-310 Ribeirão Preto, SP. E-mail jrscarpellini@netsite.com.br

The objective of this work was to verify the effect of fipronil; deltametrina, endosulfan and deltametrina + triazophos in the control of boll weevil and cotton leaf worm. The statistical design was random blocks, with seven treatments and four replicates, and the trial was conducted in field conditions, at Jaboticabal county, São Paulo State, Brazil. The treatments (g a.i./ha) were: endosulfan 350 CE (700); endosulfan 330 MC (660); deltamethrin + trizophos (10 + 350); deltamethrin 50 SC (10). Deltamethrin 200 SC (10); fipronil 300 CE (60) and untreated check. Five application were necessary to mantain low population of boll weevil, using a knapsak sprayer CO^2 working at 40 psi and delivering a water volume of 200 l/ha, at 23 and 30/12/1999 and 12; 19 and 28/01/2000. For evaluation of boll weevil control, 50 squares were observed per plot, has been register damaged squares. The number of larvae of cotton leaf worm was counted in five meters of culture per plot. The results showed that endosulfan 350 CE (700); endosulfan 330 MC (660); deltamethrin 50 SC (10). deltamethrin 200 SC (10); fipronil 300 CE (60) presented good control for boll weevil, with 7 days intervals, in normal infestation e good control in comercial area. For cotton leaf worm, the results showed that endosulfan 350 CE (700); deltamethrin + trizophos (10 + 350) and fipronil 300 CE (60) presented good performance in the control, with high mortality of larvae and more protection for leaves.
Index terms: endosulfan, deltamethrin, fipronil, chemical control

[2814] EFFECT OF EMAMECTIN BENZOATE ON SEVERAL LARVAL STAGES OF COTTON LEAF WORM *ALABAMA ARGILLACEA* (LEPIDOPTERA: NOCTUIDAE)

J. R. Scarpellini[1], [1]Laboratório de Sanidade Animal e Vegetal de Ribeirão Preto – Instituto Biológico – Rua Peru nº 1472-A, Zip code 14075-310 Ribeirão Preto, SP. E-mail jrscarpellini@netsite.com.br

The objective of this work was to determine the performance of emamectin benzoate on several larval stages of cotton leaf worm. The statistical design was full random distribution, with seven treatments and four replicates, and the trial was conducted in laboratory conditions. Two types of application were made: directly on the insect and on leaves that were later given to the insects to feed. The four larval stages used were determined as described: under 0.5 cm lenght, between 0.51 and 1.0 cm, between 1.01 cm and 2.0 cm and above 2.01 cm. The direct application was also made on pupae and pre-pupae stages. The treatments were: emamectin at 3.84, 5.76, 7.68 and 9.6 g a.i./ha; abamectin at 9.0 g a.i./ha; lufenuron at 150 g a.i./ha and one untreated check. Larvae mortality was assessed at 12, 24, 48 and 72 hours after the treatment for both direct application and leaf application. The conclusion about the application on leaves was that all larval stages died 12 h after starting eating the leaves treated with emamectin at 9.6 g a.i./ha and 24 h after starting eating the leaves treated with emamectin at 7.68 g a.i./ha. Emamectin at 3.84 and 5.76 g a.i./ha promoted high mortality on larvae under 1.0 cm, 48 hs after start feeding. High larvae mortality was observed on leaves treated with lufenuron 48 hs after feeding started although later stages were able to transform into pupal stage. All treatments applied directly on the insects provided high mortality on larvae smaller than 1.0 cm. The mortality was also high for all treatments on larvae bigger than 2.01 cm but less than the mortality on younger larvae.
Index terms: cotton leaf worm, larval stages, emamectin

[2815] EFFECT OF THIAMETHOXAM AND DIAFENTHIURON IN THE CONTROL OF APHIDS *MYZUS PERSICAE* (HOMOPTERA: APHYDIDAE) AND THRIPS *FRANLINIELLA SCHULTZEI* (THYSANOPTERA: THRIPIDAE) ON TOMATO

J. R. Scarpellini[1], [1]Laboratório de Sanidade Animal e Vegetal de Ribeirão Preto – Instituto Biológico – Rua Peru nº 1472-A, Zip code 14075-310 Riirão Preto, SP. E-mail jrscarpellini@netsite.com.br

The objective of this work was verify the effect of thiamethoxam and diafenthiuron on the control of aphids *Myzus persicae* and thrips *Franliniella schultzei* on tomato. The statistical design was random blocks, with seven treatments and four replicates, conducted in field conditions at Monte Alto, São Paulo State, Brazil. Four application were made at 6, 13, 20 and 27 days after transplantation using a knapsack CO^2 sprayer working at 40 psi and delivering a water volume of 200 l/ha. The treatments (g a.i./ha) were: thiamethoxam (25, 40 and 75); diafenthiuron (400); profenofos + cypermethrin (320+32); acephate (75) and an untreated check. It was counted the number of alive aphids 7 days after third application and 7, 14 and 18 days after fourth application in the whole area of 25 leaves per plot with the help of a 4 X magnifying lens. Thrips were evaluated by counting weekly the number of plants in the plot with typical virus infection symptons. The better results on aphid control were obtained by thiamethoxam (25 g a.i./ha) and diafenthiuron (400 g a.i./ha). The better results on thrips control were obtained by thiamethoxam (50 g a.i./ha); diafenthiuron (400 g a.i./ha) and profenofos + cypermethrin (320/32 g a.i./ha).
Index terms: thrips, aphids, thiamethoxam, diafenthiuron

[2816] EFFECT OF THIAMETHOXAM AND DIAFENTHIURON ON NINPHS OF WHITE FLY *BEMISIA ARGENTIFOLII* (HOMOPTERA: ALEYRODIDAE) ON BEANS

J. R. Scarpellini[1], [1]Laboratório de Sanidade Animal e Vegetal de Ribeirão Preto – Instituto Biológico – Rua Peru nº 1472-A, Zip code 14075-310 Ribeirão Preto, SP. E-mail jrscarpellini@netsite.com.br

The objective of this work was to verify the effect of thiamethoxam and diafenthiuron on nymphs of *Bemisia argentifolii* on bean. The statistical design was random blocks, with seven treatments and four replicates, conducted in field conditions at Miguelópolis, São Paulo State, Brazil. Five applications were necessary because of the high infestation in that region, in the period from March to April, 1998. The treatments (g a i./ha) were: thiamethoxam (25 and 50), thiamethoxam + diafenthiuron (25 + 300); diafenthiuron (300 and 400). Imidacloprid (175) and untreated check. It was counted the number of alive nymphs at 15, 21, 29 and 36 days after the first application in the whole area of 10 leaves per plot under stereoscopic microscope (10 X). The better results were obtained by thiamethoxam (50 g a.i./ha) and thiamethoxam + diafenthiuron (25 + 300 g a.i./ha).
Index terms: white fly, nymphs, thiamethoxam, diafenthiuron.

[2817] EFFECT OF THIAMETHOXAM ON NYMPHS OF WHITE FLY *BEMISIA ARGENTIFOLII* (HOMOPTERA: ALEYRODIDAE) IN SUMMER SQUASH

J. R. Scarpellini[1], [1]Laboratório de Sanidade Animal e Vegetal de Ribeirão Preto – Instituto Biológico – Rua Peru nº 1472-A, Zip code 14075-310 Ribeirão Preto, SP. E-mail jrscarpellini@netsite.com.br

The objective of this work was to determine the performance of thiamethoxam on nymphs of *Bemisia argentifolii* on summer squash. The statistical design was random blocks, with eight treatments and four replicates, conducted in field conditions at Ribeirão Preto, São Paulo State, Brazil. Two types of application were made, depending on the treatment: drench on soil fifteen days after transplantation and foliar application when the infestation was high. Four foliar applications were necessary. The treatments (g a i./ha) were: thiamethoxam (50, 100 and 150) and imidacloprid (140) single application in drench performed at december,1998; diafenthiuron (400) and pymetrozine (200 and 400) four foliar application performed during December-January 1999 and an untreated check. It was counted the number of alive nymphs at 12, 26 and 40 days after the drench application in the whole area of 10 leaves per plot under stereoscopic microscope (10 X). The better results were obtained by thiamethoxam (150 g a.i./ha) drench application, and diafenthiuron (400 g a.i./ha) and pymetrozine (400 g a. i./ha) applied on the foliage.
Index terms: white fly, nymphs, diafenthiuron, pymetrozine.

[2818] EFFECT OF THIAMETHOXAM ON NYMPHS OF WHITE FLY *BEMISIA ARGENTIFOLII* (HOMOPTERA: ALEYRODIDAE) ON TOMATO

J. R. Scarpellini[1], [1]Laboratório de Sanidade Animal e Vegetal de Ribeirão Preto – Instituto Biológico – Rua Peru nº 1472-A, Zip code 14075-310 Ribeirão Preto, SP. E-mail jrscarpellini@netsite.com.br.

The objective of this work was to determine the performance of thiamethoxam on nymphs of *Bemisia argentifolii* on tomato. The statistical design was random blocks, with eight treatments and four replicates, conducted in field conditions at Ribeirão Preto, São Paulo State, Brazil. Two types of application were made, depending on the treatment: drench on soil nine days after transplantation and foliar application when the infestation was high. Five foliar applications were necessary. The treatments (g a i./ha) were: thiamethoxam (50, 100 and 150) and imidacloprid (140) single application in drench performed on January, 1999; diafenthiuron (400) and pymetrozine (200 and 400) five foliar application performed during January-February, 1999 and an untreated check. It was counted the number of alive nymphs at 15, 28 and 40 days after the drench application in the whole area of 10 leaves per plot under stereoscopic microscope (10 X). It was concluded that the better results were obtained by thiamethoxam (150 g a.i./ha) drench application, and diafenthiuron (400 g a.i./ha) and pymetrozine (400 g a. i./ha) five foliar application.
Index terms: white fly, nymphs, diafenthiuron, pymetrozine

[2819] EFFECT OF THIAMETHOXAM ON SEED TREATMENT ON NYMPHS OF *ENNEOTHRIPS FLAVENS* (THYSANOPTERA: THRIPIDAE) ON PEANUTS

J. R. Scarpellini[1], [1]Laboratório de Sanidade Animal e Vegetal de Ribeirão Preto – Instituto Biológico – Rua Peru nº 1472-A, Zip code 14075-310 Ribeirão Preto, SP. E-mail jrscarpellini@netsite.com.br

The objective of this work was to verify the effect of thiamethoxam applied as seed treatment on nymphs of *Enneothrips flavens* Moulton, 1941 (Thysanoptera: Thripidae). The statistical design was random blocks, with six treatments and four replicates, conducted in field conditions at Dumont, São Paulo State, Brazil. The seed treatment was made on October 20, 1998 and it was planted on October 30, 1998. The treatments (g a i./100 kg of seed) were: thiamethoxam (52.5; 70.0; 87.5 and 105); Imidacloprid (105) and an untreated check. It was counted the number of alive nymphs at 13, 19, 25, 31 and 40 days after planting on 30 leaves per plot with the help of a 5X magnifying lens. The best performances were obtained by thiamethoxam (52.5; 70.0; 87.5 and 105/100 kg seeds) and imidacloprid (105 g a.i./100 kg seed). The highest yield was obtained by thiamethoxam at 87.5 and 105/100 kg seeds.
Index terms: Thrips, nymphs, thiamethoxam, imidacloprid.

[2820] WHY AND HOW HETEROPTERANS ARE DIFFERENT AS PESTS

C. W. Schaefer, Dept. Ecology & Evolutionary Biology, University of Connecticut Storrs, CT 06269-3043, USA, e-mail:schaefer@uconnvm.uconn.edu

The two groups in Hemiptera, Heteroptera and Homoptera, are alike in the way they feed, and unlike in where they feed. Hemipterans feed by puncturing other organisms and removing fluids. All homopterans and very many heteropterans feed on plants; many heteropterans feed on animals--other insects mostly, but a few feed on vertebrates. This manner of feeding tends to protect hemipterans from pesticides on the surfaces of plants, as well as from structural defenses plants bear on their surfaces as defenses against chewing herbivores. Homopterans take fluids from plant somatic tissues and cells; they thus may weaken the plant and may introduce pathogenic microvrganisms into the plant_s circulatory system. Heteropterans are more likely to feed on the reproductive structures of the plant--flowers, fruits, ripe and unripe seeds; some heteropterans feed on somatic tissue but in so doing cause the plant to mobilize soluble nitrogen. Heteropterans_ damage is thus caused by reducing available nitrogen of the plant. Moreover, humans too prefer reproductive parts, and thus are in direct competition with heteropterans. Being larger than homopterans has preddapted heteropterans for the advantages of aposematicism and the use of scent for defense; being larger has also rendered heteropterans more mobile, which enables them to find more readily newly planted crops.
Index Terms: Heteroptera, Homoptera, Hemiptera, feeding, damage

[2821] STUDY OF BIOLOGY, DAMAGE AND CULTURAL CONTROL OF CITRUS LEAF MINER IN KHUZESTAN STATE

A. A. Seraj, Plant Protection Department, Shahid Chamran University, Ahvaz, I. I. Iran. E-mail: aseraj@ahvazuni.neda.net.ir

The population fluctuation and control of citrus leaf miner (CLM) *Phyllocnistis citrella* (Lepidoptera: Gracillaridae) was evaluated on citrus cultivars (*Citrus sinensis* (Rutales: Rutaceae); *C. reticulata* Blanco King Variety; *C. reticulata* Blanco Willow leaf Variety; *C. aurantifolia*; *C. paradisi* Macfadyen Red Blush Variety) in Khuzestan district during three years (1995-98). During the seasons citrus leaves containing mines of the CLM. The major population peaks of CLM are observed during early spring till mid-autumn and declined in winter. Under Khuzestan conditions citrus leaf miner had between 8 to 11 generations per year. Total generation time can fluctuate between 2-8 weeks depending on temperature, with the following stage-specific developmental times: 2-13 days for egg hatching; 4.5-23 days for larval development; and 5-24 days for pupal development. Some cultural methods e.g. fertilizing and pruning trees in winter suppressed leaf miner infestations, whereas the planting of lombardy popular (*Populus nigra var. pyramidalis*) in nursery has not effective on larvae and adults population of CLM.
Index terms: Citrus leaf miner, biology , behaviour

[2822] A STUDY ON *LIRIMYZA SATIVAE*

B. Shi, Z. Zhang, H. Lu, Y. Gong & J. Wang, Inst. of Plant and Environmental Protection Beijing Acad. of Agric. and Forestry Sciences Beijing 100089, China

Liriomyza sativae was firstly found in Beijing in 1995. There is a big loss in vegetable production in Beijing. We studied its ecology, biology and integrated management from 1995 to 1998. The results are as follows: (1) Now, this pest widely distributes in Beijing, and infests throughout vegetable, cereal-vegetable, orchard-vegetable and crop-orchard-vegetable areas; (2) The developing period at 15, 19, 23, 27, 31, 35 degree of centigrade are respectively 7.7, 5.7, 5.0, 3.7, 2.7, 2.3 days for eggs; 11.2, 7.3, 3.9, 3.6, 3.1, 3.1 days for larvae; 24.8, 20.7, 11.4, 8.2, 6.3 days for pupae; 43.7, 33.6, 20.3, 15.5, 17.2 days from eggs to pupae. The emerging rate of adults at above temperature are respectively 6.8, 37.6, 72.7, 63.2, 61.5, 0 in terms of percentage. (3) Host selecting trials showed that the parent adults from 4 vegetables could lay eggs on 8 given vegetables. The adults have preferred to green bean, squash, eggplant, watermelon, tomato, towel gourd, cucumber and Chinese cabbage in order, but they never laid eggs on green pepper wherever the parent adults came from. (4) There are 8 species parasites on *L. sativae*, which are *Hemiptarsenus sp.*, *Diglyphus sp.*, *D. isaea*, *Neochrysocharis sp.*, *Chrysoccharis sp.1*, *C. sp.2.*, *Diaulinopsis arenaria*, *Halticoptera sp.* (5) 18 insecticides were tested within 8 trials. The best pesticides selected are Abamectin and its mixture, mixture of toosendanin, nicotine and stemona; Cascade, Fastac 10EC and Lorsban are less active. (6) The active pest management was studied in this project. We found that it was the key to control pest within the heated greenhouse in Beijing. the seedling is important control period. the integrated control technique should pay attention to conserve natural enemies, and to use agricultural (crop rotation) and physical (yellow board) methods, and alternately to spray different active insecticides.

Index words: IPM, Parasites, Insecticides

[2823] EFFICIENCY OF THE INSECTICIDE LAMBDACYHALOTHRIN 50 CS, 250 CS, 50 EC AND ASSOCIATE WITH CHLORPYRIFOS 480 BR, FOR THE CONTROL OF " LEAF MINER" *LEUCOPTERA COFFEELLA*, IN COFFEE CROP.

A.C. Silva [1]; L. O Salgado[1] & A. J. Ferreira[2], [1]Agroteste - Pesquisa e Consultoria Praça Leonardo Venerando, 284 C.P 201 Lavras/MG 37.200-000 Brazil E-mail agrotest@ufla.br; [2]Universidade Federal de Lavras/UFLA C.P 37 Lavras/MG 37.200-000 Brazil

The damage caused by "Leaf miner" in coffee crop is highly significant in Brazil. The objective of present wrk was demonstrate the efficiency of the insecticide Lambdacyhalothrin on, "Leaf miner". The trial was realized a Gambá farm , in Lavras/Minas Gerais State – Brazil. The trial was set up in a 20 years old coffee cv. "Catuaí" crop, planted in 4,0 x 1,0 m spacing, during 18/07/97 and 22/09/97. The experimental design used was randomized blocks, with 8 treatments replicated 4 times, each with 28 m^2/plot. The treatments were aplicated in spray with volume of 450L/ha at 11/08/97 (all treatments) and 25/08/97, (treatments 1, 2 and 3). The treatments were in g.i.a/ha: **1.** Lambdacyhalothrin 50 CS - 5,0; **2.** Lambdacyhalothrin 250 CS – 5,0; **3.** Lambdacyhalothrin 50 EC – 5,0; **4.** Lambdacyhalothrin 50 CS + Chlorpyrifos 480 BR – 5,0 + 480; **5.** Lamdacyhalothrin 250 CS + Chlorpyrifos 480 BR – 5,0 480; **6.** Lambdacyhalothrin 50 EC + Chlorpyrifos 480 BR - 5,0 + 480; **7.** Chlorpyrifos 480 BR – 480 and **8.**Check.Were realized 6 evaluations weekly at 18/08/97 – 22/09/97, evaluating 50 leaves/plot with feasible lesions and established the number of larvae lives. The means were separate with Tukey test ($p<0,05$) and the efficiency established with Abbott formula. The insecticide Lambdacyhalothrin 50 CS lonely and with Chlorpyrifos 480 BR showed an efficiency of 100,00%. The insecticide Lambdacyhalothrin 250 CS lonely and with Chlorpyrifos 480 BR showed an efficiency of 100,00%. The insecticide Lambdacyhalothrin 50 EC lonely and with Chlopyrifos 480 BR showed too an efficiency of 100,00%.
Index terms: Pesticides, pest management, chemical control.

[2824] EFFECT OF THIAMETHOXAM ON THE POPULATION OF *COCCUS VIRIDIS* (HOMOPTERA:COCCIDAE) IN CITURS PLANTS IN ARARUAMA CITY, RJ, BRAZIL

R. Silva-Filho[1], O.R.F. Azevedo[1], P.R.R. Silva[1,2], P.C.R. Cassino[1,3] & M.A. Diodato[4], [1]Dept. de Entomologia e Fitopatologia, IB, Centro de Manejo de Pragas "Cincinnato Rory Gonçalves" - UFRRJ, BR 465 Km 07, Seropédica, RJ, Brazil, CEP 23890-000 E-mail: cimp@ufrrj.br, [2]E-mail:pramalho@fst.com.br; [3]E-mail: pr.cassino@uol.com.br; [4]Entomologia Florestal Universidade do Contestado, Canoinhas, SC, Brazil, E-mail: diodato@yahoo.com.br.

This study was performed as a part of a program of ecological management of pests that has been carried out in the citrus-producing region of the Rio de Janeiro state. A experiment was conducted in São Vicente de Paulo county, in Araruama city (RJ), Brazil, from September, 1999 to November, 1999, with aim of evaluating the effect of Thiamethoxam (ACTARA) in the control of *Coccus viridis* in a true lime orchard (cultivar "Tahiti") with 8 years old, and planted in low topography. The treatments were: control (0g a.i/plant), ACTARA at 50, 75, and 100g/plant, and TEMIK at 130g/plant. The experimental design was a randomized block design with 5 treatments replicated 4 times. The experimental area was consisted of 210 plants. Twenty-five plants were evaluated at 15, 30 ,45 and 60 days after the application of the treatments. The results showed that there was significant difference between treatments according to Duncan's test ($P\leq0.05$). ACTARA at 100 and 50g/plant was more effective (at 15 days after the application), than ACTARA at 75g/plant (at 60 day after the application) however it was similar to the control. Concerning to the predators, the selectivity of the insecticides was of 30% for *Pentilia egena*, 100% for *Crysoperla*sp., and 20% for *Cycloneda sanguinea*.
Index terms; Thiamethoxiam – Actara, *Coccus viridis*, *Pentilia egena*, *Chrysoperla* sp, *Cycloneda sanguinea*.

[2825] SURVEY OF PRACTICES AND PERCEPTIONS OF SMALL HOLDER FARMERS RELATING TO PEST MANAGEMENT ON VEGETABLE CROPS IN EASTERN AFRICA

S. Sithanantham[1], M. Waiganjo[2], C. Akemo[3], C. Sskyewa[3], I. Swai[4], A. Gashawbeza[5], Y. Mohamed[5], J. Kibaki[2], S.B. Wepukhulu[2], [1]International Centre of Insect Physiology & Ecology, P.O. Box 30772, Nairobi, Kenya ssithanantham@icipe.org; [2]Kenya Agricultural Research Institute (KARI) P.O. Box 220, Thika, Kenya; [3]Kawanda Agricultural Research Institute (KARI) P.O. Box 7065, Kampala, Uganda; [4]Horti-Tengeru, P.O. Box 10 Duluti, Arusha, Tanzania; [5]Ethiopian Agricultural Research Organisation (EARO), P.O. Box 2003, Addis Ababa, Ethiopia.

A survey of small holder vegetable farmers (60 per country) was undertaken in four countries - Ethiopia, Kenya, Tanzania and Uganda - in Eastern Africa during 1998-99. While more than two-thirds of the farmers were knowledgable on the name or symptom of at least one pest on tomato, only a third or less of farmers could recognise any insect pest by name or symptom on seven other vegetable crops of importance in the region – French bean, brassica, onion, eggplant, okra, capsicum and cucurbits. There were also substantial differences in the extent of farmers in the four countries recognising by name or symptom the pests known to damage the eight vegetable crops. Most farmers resorted to use of chemical pesticides as the predominant pest control option. Men, rather than women, were involved in pesticide application as well as in the decision of purchase and use of pesticides in the crops. The majority of farmers accessed the information on choice and dose of pesticides for different pests from agro-input retailers, pesticide labels and neighbours, and only a minority had access through extensionists. Almost all the farmers perceived that the use of chemical pesticides is becoming more expensive over time. They felt that the regularly used pesticides have tended to become less effective over a three year span. Nearly half or more of the farmers were aware of the harmful effect of pesticides on natural enemies and pollinators, as well as the health risk to operators and consumers of the produce. The farmers identified the important topics in which they required technical guidance. These included improved crop management practices, correct identification of pests, appropriate choice of pesticides, safe use of pesticides, safer alternatives to pesticides, capacity to monitor pests, and how to adopt action thresholds, botanicals, biocontrol agents and cultural practices. The survey results helped in suitably focussing the contents of local training sessions to create IPM awareness through farmer-participatory and group learning initiatives.
Index terms: Survey, practices, perceptions, vegetables, farmers, Eastern Africa

[2826] STRAWBERY: IMPORTANCE OF PESTICIDES AND NONCHEMICAL CONTROL MEASURES.

K. A. Sorensen, Dept. of Entomology, North Carolina State Univ., P. O. Box 7626, Raleigh, NC 27695-7626, USA, E-mail: kenneth_sorensen@ncsu.edu

Strawberries, *Fragaria x ananaxsa*, are one of the most important and widely distributed fruit crops in the United States and the World. Approximately 1.4 billion pounds are grown annually in the United States on 46,740 acres, with an average yield of 29,740 pound per acre. The crop is valued at over $708 million. California accounts for over 49% of the acreage and 80% of the national yield. Other major states include Oregon, Florida, New York, North Carolina, Michigan, Washington, Pennsylvania, Ohio and Wisconsin. Major varieties are Chandler, Camarosa, Pajaro, Selva and Sweet Charlie on annual, plasticulture systems and Earliglow on perennial, matted row systems. Strawberries are susceptible to a variety of diseases, insects and weeds, which can seriously reduce yield and quality. Nationally, some 50 invertebrate species in the groups, Mollusca, Symphyla, Arachnida and Insecta are known to cause damage to strawberries that directly impact yield and quality, as pests attack the foliage, crown, roots and fruit. Mites are most important, followed by aphids, lygus bugs, root weevils, slugs and several worm species. Agrimek ranks first followed by malathion, Lorsban, Lannate and Sevin based on treated acres. Without Agrimek an 8% yield loss would result. If all insecticides were lost a yield loss of 53.4% would result. Nonchemical insect control practices include crop rotation, certified plants, sanitation, preplant chilling, predatory mites and scouting and monitoring. One of the major factors restricting nonchemical practices use and adoption is there limited effectiveness. Strawberry production is threatened by 26 fungal and 1 bacterial disease. Nematodes and 64 genera of weeds also attack strawberry. Rovral, captan, Devrinol, paraquat and methyl bromide plus chloropicrin are other widely used pesticides. The largest impacts on strawberry production from losing the single use of a pesticide would result from abamectin (Agrimek) or methyl bromide/chloropicrin at approximately $60 million from losing either of these chemicals. Overall, the loss of major groups of pesticides would cause much larger losses than the loss of any single pesticide: $400 million for fungicides, $360 million for insecticides, $250 million for fumigants, and $220 million for herbicides. Integrated Pest Management practices are used on some 90% of the harvested acres of strawberries in the United States.
Index terms: predatory mites, Agrimek, Integrated Pest Management

[2827] EFFICIENCY OF THIAMETHOXAM 10 GR IN THE CONTROL OF THE COFFEE LEAF MINER

J.C. de Souza, P.R. Reis[1], [1]EPAMIG-CTSM P.O. Box 176, Lavras, MG, Brazil, 37200-000. E-ail: epamig@ufla.br.

The miner worm of the coffee tree leaves, *Perileucoptera coffeela* (Lepidoptera: Lyonetiidae) is the main pest of the coffee tree in Brazil with loss of up to 70% in coffee yield. Aiming to know the efficiency of the neonicotinoid insecticide thiamethoxam 10 GR applied into the soil in the control of the coffee leaf miner worm, inclusively its control period which would avoid additional sprayings in the drought, undesirable for coinciding with the coffee harvest but indispensable and up to now achieved in applying any other product in the soil, an experiment was set up in February of 1999 on the Experimental Farm of Patrocínio of EPAMIG in Alto Paranaíba region, Minas Gerais, in an adult coffee crop with a cultivar Catuai Vermelho, 4.0 x 0.70 m between plants, comparing it with the standard aldicarb. It was also designed to know the possible influence of those insecticides upon the pest's natural enemies. The insecticides thiamethoxam 10 GR (10.5 g and 15.0 g/hole) and aldicarb 150 GR (7.0g/hole) were applied into the soil in two times, February and March, in addition to a standard treatment with two sprayings and a check (without insecticides). The evaluation of the efficiency of the treatments took place through the parameters: percentage of mined leaves, percentage of efficiency, visual score scales relative to the miner worm infestation, vigor and leaving of the coffee trees and the percentage of parasitism. It follows that thiamethoxam 10 GR (15.0 g/hole) applied in March was the best treatment since it kept the pest infestation below 10% of mined leaves on the medium third and 20% on the upper third of the coffee trees (level of control by spraying) throughout the conduction of the experiment, discarding so any complementary spraying over a control period of 171 days or more. Its control period was longer than that presented by the standard aldicarb applied in February, which was the second better treatment. The aldicarb applied in March due to its lack of humidity did not prove efficient. To thiamethoxam 10 GR (15.0 g/hole) and aldicarb 150 GR (7.0g /hole), applied in February, there would be the need for complementary spraying. As regards the natural enemies to the miner worm, the same one occurred in all the treatments and evaluations, in a great variation of values due to other factors except the insecticides applied into the soil and in spraying. The highest average percentage of parasitism in all the evaluations conducted were obtained in the best treatments.
KEY WORDS: *Perileucoptera coffeella*, *Coffea arabica*, chemical control, natural enemies

[2828] EFFECTS OF INFECTION BY THE PARASITIC NEMATODE *THRIPINEMA FUSCUM* ON *FRANKLINIELLA FUSCA* POPULATION DYNAMICS AND TOSPOVIRUS EPIDEMIOLOGY IN PEANUT

J. Stavisky, J.E. Funderburk, D.W. Gorbet & M.T. Momol, Univ. of FL, NFREC-Quincy, 30 Research Road, Quincy, FL, 32351-9500, USA, E-mail: jsta@gnv.ifas.ufl.edu.

Nematodes in the genus *Thripinema* are parasites of thrips that render females sterile. A new species, *T. fuscum*, was recently described as a parasite of *Frankliniella fusca* in peanut. The effects of parasitism on population dynamics of the thrips vector and on the epidemiology of tomato spotted wilt tospovirus were investigated in field experiments in 1997, 1998, and 1999. Populations of thrips were very great on seedling peanuts each year, but as parasitism increased, numbers of thrips adults and larvae were suppressed. Treatments of several broad-spectrum and biological insecticides for thrips control were evaluated in 1997 and 1998. Insecticides for thrips control had little influence on incidence of thrips parasitism, and application early in the season suppressed populations of thrips larvae, which reduced secondary spread of tospovirus. In 1999, resistant and susceptible cultivars were planted on different dates to further examine the role of thrips parasitism in influencing thrips population dynamics and disease epidemiology. Thrips populations on peanuts in the early-season (April) and mid-season (May) plantings rapidly declined when approximately 60% of *F. fusca* were parasitized by *T. fuscum*. Cultivar and planting date did not affect patterns of adult abundance, but few larvae developed in the late-season (June) planting of either the resistant or the susceptible cultivar. Incidence of tomato spotted wilt tospovirus was nearly twice as great on the susceptible cultivar versus the resistant cultivar across all planting dates. Disease incidence was slightly greater on peanuts in the mid-season (May) planting. Temporal changes in parasitism and population abundance of thrips between planting date treatments in 1999 revealed that parasitism and not environmental changes were responsible for observed declines in thrips populations. Our experiments showed that this natural enemy plays a crucial role in preventing secondary spread of tomato spotted wilt tospovirus during mid and late season.
Index terms: thrips, biological control, IPM, tospovirus, insect pathogenic nematodes

[2829] ANTIBIOSIS OF POTATO CLONES TO POTATO TUBER MOTH

C. P. Stein[1] & J. D. Vendramim[2], Centro de Fitossanidade, Instituto Agronômico de Campinas, Caixa Posta 28, 13001-970, Campinas, SP, Brasil, E-mail: cpstein@cec.iac.br; [2]Departamento de Entomologia, ESALQ/USP, Caixa Postal 9, 13418-900, Piracicaba, SP, Brasil

The potato tuber moth, *Phthorimaea operculella*, is a common species in almost all regions where the potato is cultivated, causing several damage under both field and storage conditions. Wild species and primitive cultivars of potato tuber in breeding program has been shown the possibility to obtain resistant cultivars to attack of this tuber moth. Potato tubers of the cultivars Achat, Aracy, Itararé and Apuã (*Solanum tuberosum*) and of the clones NYN 140-201 and NYL 235-4 (originated of the breeding within *S. tuberosum*, *S. berthaultii* and *S. andigena* – Cornell University's Potato Insect Resistance Breeding Program) were assessed for the development of *P. operculella* under laboratory conditions (temperature changed from 24 to 27^0 C and 14-hours photophase). For larval development time was used nearly hatched larvae and for assisting the larval penetration, the tubers were previously punctured, keeping on at least the proportion of 5 g of tuber per larva. The viability larval decreased (Achat, 70.5; Apuã, 66.5; Aracy, 62.8; Itararé, 56.1; NYL 235-4, 23.8; NYN 140-201, 44.8%) and the development time increased (Achat, 16.7; Apuã, 16.9; Aracy, 16.7; Itararé, 17.4; NYN 140-201, 19.8; NYL 235-4, 20.9 days) when the larvae were fed with potato tuber of the clones, showing that antibiosis occurs among them. There were no significant differences in viability (91.7 – 100.0%), development time (7.0 – 7.6 days) and weight (8.7 – 9.1 mg) in the pupal stage. The longevity of the females (12.5 - 14.0 days) was longer than males (6.4 - 8.2 days) but there was no difference among the genotypes.
Index terms: *Phthorimaea operculella*, *Solanum*, host plant resistance.

[2830] PEST AND DISEASE MANAGEMANT IN HYBRID RICE

S.Suresh &R.Rabindran, TamilNadu Agricultural University, Coimbatore-641 003, Tamil Nadu, India.

Several Pest Management practices were developed individually for the insect and diseases. Integrated Pest and Disease Management practices were already developed for conventional rice and so far no comprehensive study has been made in Hybrid rice. Hence a replicated large scale field trial was laid out with CORH1 with the following treatments. A: Seed Treatment,nursery and field application of *Psuedomonas flourescens* , Pheromone installation for stemborer,Release of *Trichogramma chilonis* @6cc/ha and one round ofneed based insecticide and fungicide B.one round of Need base insecticide and fungicide application.C. Unreated control Observations were made on the incidence of pest and diseases following the standard procedure in ten randomly selected hills at regular intervals and the mean incidence along with natural enemy population and yield indicated that IPM plot recorded lowest incidence of stem borer, green leafhopper, brown plant hopper, Sheath rot, Sheath blight and brown spot and recorded more number of spiders and mirids . Yield was also maximum in IPM plot (4734 Kg/ha) followed by Need based application and control.. Cost : Benefit ratio was also maximum in IPM compared to Need based pesticide applied plot.
Keywords: Rice IPM Pests & Diseases

[2831] RICE CULTURES AGAINST MAJOR PESTS UNDER PROTECTED AND UNPROTECTED CONDITION

S.Suresh, Department of Agricultural Entomology, TamilNadu Agricultural University, Coimbatore- 641 003.,TamilNAdu, India

Promising cultures evaluated through All India Coordinated Rice Improvement Programme (AICRIP) were field tested for their reaction to major insect pests viz., leaf folder and stem borer during the peak infestation with and without plant protection in order to select a suitable variety for the local condition. Seven promising rice cultures were evaluated for their reaction to stem borer and leaf folder with and without plant protection in the field in a replicate trial. One need based spray of insecticide was taken for the control of leaf folder. Regular observations on the incidence of leaf folder and stem borer were made following the standard procedure. Results indicated that the lowest stem borer (Dead heart (8.40%) & white ear (7.53%)) infestation was recorded in IET11689 while leaf folder infestation was lowest in IET11771 & IET 11768 (18.39-20.41%)and after treatment it became 3.85% within a week. However, yield was maximum in IET9925 (3899Kg/ha) followed by IET 11771 (3586 Kg/ha) ,RP4-14 (3576 Kg/ha) and the standard check ASD20. Generally plant protection treated plot recorded lower number on insects and higher yield. The insecticide treated plot yield was 3533Kg/ha compared to 2871Kg/ha in untreated check. In this study IET 11771 cultivar was found to be promising

Index terms: Rice cultivars, stemborer, Leaffolder, Plant Protection.

[2832] THE EFFICACY OF NEEM SEED EXTRACTS AND COMMERCIAL NEEM PRODUCTS IN CONTROLLING THE SMALL RICE STINK BUG

J. P. Sutherland[1], D. Permaul[2] & R. T. Adrian[1]. [1]Dept. of Entomology, Guyana Rice Development Board, Rice Research Station, Mahaicony, East Coast Demerara, Guyana, E-mail: suthjamie@hotmail.com; [2]Faculty of Agriculture, University of Guyana, Turkeyen, Georgetown, Guyana.

The small rice stink bug, *Oebalus poecilus* (Dallas) (Hemiptera: Pentatomidae) is the principal insect pest of rice in Guyana and many other South American countries. Both adults and nymphs feed on the grains and the damage caused can severely affect the yield and quality of the harvested grain. In Guyana, stink bug control is wholly achieved through spraying with insecticides, typically with the organophosphate, monocrotophos. Monocrotophos has been used almost exclusively for 30 years to control stink bug in Guyanese rice. However, the FAO and UNEP is likely to suggest withdrawal of this insecticide in the near future and the major pesticide companies will probably cease production of the active ingredient. With this in mind, research is underway to find cost effective, safer alternatives. One such alternative is the use of products derived from the neem tree, *Azadirachta indica* which grows commonly in Guyana. The active ingredient, azadirachtin is a complex tetranortriterpenoid and has a low mammalian and non-target organism toxicity. Research into the use of neem in controlling rice pests has naturally been focused on South Asian countries, with very little attention being paid to its use in South America. The prospects for use of neem against the small rice stink bug were evaluated. Both bioassays and field tests were used to examine the efficacy of crude neem seed kernel extracts and these were compared with the activity of several commercially available products. Bioassays revealed that the kernel extracts exhibited a low contact kill as against the commercial product. Anti-feedant and ovipositional deterrent tests demonstrated good activity of both the crude extracts and commercial product in reducing stink bug feeding on the grains and ovipositing, respectively. Field testing of all compounds highlighted that the commercial product showed promise in reducing stink bug damage when applied at a high rate (2.5 l ha^{-1}), although at this rate this makes neem significantly more expensive than current insecticidal treatments. The prospects for possible inclusion into an IPM programme are discussed.
Index terms: *Oebalus poecilus*, *Azadirachta indica*, anti-feedant, IPM

[2833] TOWARDS THE INTEGRATED PEST MANAGEMENT OF THE SMALL RICE STINK BUG IN GUYANA: MONITORING

J. P. Sutherland, & R. T. Adrian. Dept. of Entomology, Guyana Rice Development Board, Rice Research Station, Mahaicony, East Coast Demerara, Guyana, E-mail: suthjamie@hotmail.com.

The small rice stink bug, *Oebalus poecilus* (Dallas) (Hemiptera: Pentatomidae) is the principal insect pest of rice in Guyana and many other South American countries. Both adults and nymphs feed on the grains and the damage caused affects the yield and quality of the harvested paddy. Currently in Guyana, stink bug control is wholly achieved through aerial spraying or knapsack/motorblower spraying with insecticides, typically the organophosphate, monocrotophos. A vast majority of farmers use insecticides (99%) and as many as four sprays are applied each season, typically by calendar application. The extensive use of plant protection products is a major cause of increasing costs of rice production in Guyana and decreasing profitability for the farmers. Therefore a more balanced and cost effective Integrated Pest Management (IPM) programme needs to be implemented and adopted by Guyanese rice farmers. Monitoring of pest status is an essential component of any IPM system, although one often overlooked by many farmers. The current technique of sweep netting which is practiced throughout the Americas is time-consuming and often unreliable. A suitable simple monitoring tool for insect pests of rice seems to be absent. Research described herein is attempting to develop a simple on-farm monitoring tool to monitor stink bug numbers. Light trapping has been found to provide unreliable information on pentatomid bug abundance in South America, despite being widely used in Asia. In the current study, a number of different sampling techniques for the stink bug are considered and compared. The effect of coloured traps was tested as to their effectiveness in trapping stink bugs, as it is known that a sensitivity to yellows and greens by many pest insects enables them to detect host plant foliage. These data are compared to trap catches from a continuous light trap and sweep netting. The possible integration into an IPM programme of such a monitoring system for the small rice stink bug is discussed.
Index terms: *Oebalus poecilus*, Pentatomidae, sweep netting, trapping, IPM

[2834] SEASONAL OCCURRENCE OF MAJOR INSECT PESTS AND ESTIMATION OF THE LEAF DAMAGES ON GLOSSY-LEAVED AND NORMAL VARIETIES OF *BRASSICA NAPUS* L

K. Takashino & T. Noda, Lab. of Insect Pest Control, Dept. of Biology and Environmental Sciences, Tohoku National Agricultural Experiment Station, 4 Akahira, Shimo-kuriyagawa, Morioka, Iwate 020-0198, JAPAN, E-mail kenzi@tnaes.affrc.go.jp.

Some glossy-leaved varieties of *Brassica*, which lack the wax bloom, have been shown to possess resistance to insect pests in the field. Although some recent findings suggest that the one of the reasons for the field resistance in glossy lines may be due to increased predation of phytophagous insects by predatory insects, the detailed mechanism is still unknown. The rape, *Brassica napus* L., also has glossy-leaved varieties. To examine the field resistance of the glossy-leaved rape, seasonal occurrence of major insect pests on two glossy and three normal varieties were recorded and the leaf damages that might be caused by them were measured in Morioka, northern Japan. In *Plutella xylostella*, glossy-leaved varieties had more eggs than normal varieties. But the numbers of larvae and pupae on the former were fewer than the latter. In *Pieris rapae crucivora*, the numbers of eggs on both types of varieties were similar, but the glossy-leaved varieties had fewer larvae and pupae than normal ones. The numbers of adult *Myzus persicae* were not different in varieties during the early days when the migration from out of the field may occur. But after that, the aphid rapidly increased on normal varieties. It was shown that the leaf damages of normal varieties, which were measured as the lost area assumed to feed by phytophagous insects, were more serious than those of glossy ones. These results lead to the conclusion that the glossy-leaved varieties of rape have resistance in the field in northern Japan.
Index terms: plant resistance, *Brassica napus*

[2835] EVALUATION OF INSECTICIDES AGAINST THE *THRIPS PALMI* (THYSANOPTERA, THRIPIDAE) IN BEAN CROP (*PHASEOLUS VULGARIS*)

A. P. Takematsu[1] , T. Jocys[1] & A.J.T. dos Santos[2], 1. Instituto Biológico Centro de Sanidade Vegetal, Av. Conselheiro Rodrigues Alves, 1252, Vila Mariana, CEP 04014-002 São Paulo, Brasil. E-mail jocys@biologico.br 2. PLANTEC. Rua Filipe Bandeira, 34. CEP 02126-020, São Paulo, SP

Among the insects that attack the bean plant the thrips are among the most important. The species *Thrips palmi*, as the other species of that insect is poliphagous, it presents discharge it rates reproductive and it lowers sensibility to several insecticides. The objective of this work was lately to verify the efficiency of some products in the control of that insect, that it has been causing serious problems in several cultures. The experiment was carried out in Bragança Paulista city São Paulo State, Brasil, in the period from 03/03/98 to 15/03/98, being used a knapsack sprayer with constant pressure (CO_2), with 40 lb/pol^2 A randomized complete block was used, with 12 treatments and 4 replicates. The treatments and respective doses in g of i.a. /ha were: 1. Fastac CE (alpha-cypermethrin)- 15,0; 2. Fastac CE (alpha-cypermethrin)- 20,0; 3. Fastac CE (alpha-cypermethrin)- 30,0; 4. Fastac CE (alpha-cypermethrin)- 50,0; 5. Pirate (chlorfenapyr) 72,0; 6. Pirate (chlorfenapyr)- 120,0; 7. Pirate (chlorfenapyr) - 180,0; 8. Pirate (chlorfenapyr)- 240,0; 9. Decis 25 CE (deltamethrin)- 7,5; 10. Tamaron BR (methamidophos)- 600,0; 11. Confidor 700 GRDA (imidacloprid) - 70,0; 12. Control. It was made a previous evaluation and to the 3, 7, 12 days after the only treatment (DAT). The best treatments were 7, 8, 6 and 11. To the 7 and 12 DAT, the insecticides that provided better control were the 8, 7, 6 and 11. The other products didn't present efficiency.
Index terms: *Thrips palmi*, bean, insecticides, control

[2836] ADAPTATION OF THE BROWN PLANTHOPPER TO RESISTANT RICE VARIETIES: ESTIMATION OF HERITABILITY AND EVOLUTIONARY RATE

K. Tanaka, Lab. of Population Ecology, National Inst. of Agro-Environmental Sciences, 3-1-1 Kannondai, Tsukuba 305-8604, Japan, E-mail tanaka@niaes.affrc.go.jp.

Resistant rice varieties have been bred and released since the 1970s for controlling the brown planthopper (BPH) *Nilaparvata lugens*. Some BPH populations (so-called 'biotypes') have, however, adapted and become virulent to the previously resistant varieties. To effectively utilize the resistant rice varieties, we have to understand the genetic variation in host adaptation of BPH and to predict its evolutionary rate. The virulence of BPH is under polygenic control, and is a threshold character exhibiting two distinct phenotypes, i.e., virulent and avirulent. I estimated heritability of the virulence of BPH to resistant rice varieties using two methods: One is selection of the BPH nymphs surviving on the rice varieties, which provides realized heritability, and the other is an analysis of parent-offspring regression using the family values, i.e., the percentages of virulent females in a full-sib family. Estimates of the heritabilities were 0.24 to 0.41 on the rice varieties Mudgo and Saikai 190 carrying the resistance gene *Bph 1* and 0.28 to 0.55 on ASD7 carrying the *bph 2* gene. These results indicate that the BPH population has substantial genetic variation in virulence. In the parent-offspring regression analyses, when the parental families were examined on Saikai 190 and the progeny on ASD7, the regression coefficient approached zero. Additionally, selection on the BPH population by Mudgo had no positive or negative effect on virulence to ASD7, and vice versa. These results suggest that there is a low genetic correlation between virulences to the two resistance genes, *Bph 1* and *bph 2*. Thus, the virulences to the two genes may evolve independently of each other. From the heritability estimates, I predicted changes in proportion of virulent individuals in a BPH population using a quantitative genetic model. The model predicts that the proportion of virulent BPH individuals will increase from 0.1% to over 50% in only four to eight generations under monoculture (planting a single resistant rice variety), while its increase rate will be delayed by patchwork management (planting a resistant rice variety in some paddy fields and a susceptible variety in other fields).
Index terms: *Nilaparvata lugens*, virulence, quantitative genetics, host adaptation.

[2837] INFLUENCE OF PHOSPHORUS GRADES IN DIFFERENT VARIETIES OF CORN (*ZEA MAYS*) ON THE FALL ARMYWORM [*SPODOPTERA*) GROWTH

M.A.G.C. Tavares, M. Schiavetto, J.L. Florcovski & M.H. Calafiori, Agronomic Engineering Course. CREUPI. Postal Box 05. 13990-000 - Espírito Santo do Pinhal – SP – Brazil. E-mail: cpagrpin@rantac.com.br

The effect of nutrients in corn on the fall armyworm growth is confirmed by the research. This test was realized to know the influence of phosphorus in different varieties of corn on that insect growth, in greenhouse of Agronomic Engineering Course – CREUPI, in April, 1999. Treatments were arranged in a completely randomized block with 7 replications. The treatments were: A- Variety AG 9012; B- Variety AG 6018; C- Variety AG 9012 + NPK (ammonium sulphate, simple superphosphate, potassium chloride); D- Variety AG 6018 + NPK; E- Variety AG 9012 + NPK + P; F- Variety AG 6018 + NPK + P; G- Variety AG 9012 + NPK + 2P; H- Variety AG 6018 + NPK + 2P; I- Variety AG 9012 + NK; J- Variety AG 6018 + NK. The fertilization was based on soil analysis. The plots were shaped by 2 plants and 3 larvae. The evaluations were realized to weight and length of larva and larva mortality. The results allowed to conclude: a) the greatest weight and length of larva were obtained in the variety AG 9012 + NPK + P and the smallest, in both varieties without fertilizers and in the variety AG 9012 + NK; b) the greatest mortality occurred in both varieties without fertilizers and with NK; c) the plant was more susceptible with excess of phosphorus; d) variety AG 9012 was more susceptible, too.
Index terms – corn, resistance, phosphorus, *Spodoptera frugiperda.*

[2838] STERILE INSECT RELEASE IN CANADA: FROM ERADICATION TO AREA-WIDE MANAGEMENT

H.M. Thistlewood[1,2] & G.J. Judd[2], [1]Okanagan-Kootenay Sterile Insect Release Program, P.O. Box 1080, Osoyoos, B.C. Canada V0H 1V0 Email: hthistle@bctree.com; [2]Pacific Agri-Food Research Centre, Agriculture & Agri-Food Canada, Summerland, B.C. Canada V0H 1Z0 Email: juddg@em.agr.ca.

Sterile insect release (SIR) has been employed successfully in the eradication or management of a small number of insects, and is being considered for use against moths in several countries at this time, but the only commercial experience for codling moth is from Canada. Research and pilot studies in the control of codling moth over a 20-year period led to the establishment in 1992 of an SIR program for its eradication from fruit-growing areas in mountainous valleys in the interior of British Columbia. Although achieving considerable success, the program experienced very serious difficulties in staying on budget and on time, or achieving its goals, and was reviewed externally in 1996 and 1998. In 1999, area-wide management became the primary goal, with control by the SIR method being integrated with many other management tools to reduce pesticide use and provide other benefits. We present a critical appraisal of the results in orchard and urban settings from the beginning of the program to the 1999 season, and discuss the biological and ecological factors which may have led to the success in codling moth management but failure to eradicate. These include: assumptions concerning the dispersal and movement of moths by Man and nature; treatment of different habitats of orchards, homes, and other lands, in a homogeneous fashion rather than as a series of ecological islands; aspects of diapause biology; opportunistic pests and levels of biological control; moth quality, and diseases in rearing. Operational difficulties have arisen from the absence of a workable plan for urban, private, or aboriginal lands, owing to most of the research for codling moth IPM or SIR occurring in commercial crops; the interplay between populations in adjacent orchard and urban areas; decisions based on indirect measures of populations, and lack of a cost-effective system for monitoring and management of very low population densities; technology problems in rearing and release; underestimation of regulatory or quarantine controls, and absence of a valid protocol for prevention of re-infestation in a free trade zone. The solutions to some of the above problems are discussed, and we describe briefly the present form of a community-funded and area-wide pest management program serving over 6,500 ha of apple and pear production, and aimed at providing major savings in pesticide use and in costs to the growers, and new market opportunities.
Index terms: *Cydia pomonella*, sterile insect release, area-wide IPM, review

[2839] EVALUATION OF TRAPS FOR MONITORING *BACTROCERA OLEAE* ADULTS, IN INTEGRATED PEST MANAGEMENT

L.M.Torres [1], A A Bento [2] & J. Passos-Carvalho [3], [1] Univ.Trás-os-Montes e Alto Douro. P.O. Box 202. 5000-911 Vila Real. E-mail: ltorres@utad.pt. [2] Escola Superior Agrária de Bragança. P.O. Box 172. 5300-855. Bragança. E-mail: bento@ipb.pt. [3] I.N.I.A. R.Barata Salgueiro, 37. 1250-042 Lisboa.

A field trial was carried out at Terra Quente Transmontana (northeastern Portugal), from June to December 1999, to compare five trap types to capture the olive fly, *Bactrocera oleae* (Gmel.). Chrysopid captures were also compared, as those insects are important predators in olive at the region. The traps included a McPhail Dome type trap and a Tephri trap type with four holes (22 mm diam) in the trap body. The first was tested in three colours (yellow, green and black), while the second one was tested in two colours (yellow and black). All traps were baited with protein hydrolisate, 49,8% ("Endomosyl" from Hoechst) and an aqueous solution of 4% ammonium dihydrogen phosphate (w:v). A randomized block design, with five replicates was used. The distance between traps was 15-20 m and between blocks was 40-50 m. The record of captures was done weekly, distinguishing among those of *B.oleae*, the total number, the males and the females. The data were transformed into the corresponding log (x+1) values and after subjected to the variance analysis, followed by the Tukey test (P=0.05) for mean separation. The total number of adults of *B.oleae* captured was significantly lower in the black McPhail type trap than in the other types of traps, with no differences between the latter ones. Neverthless, the number of females captured was also significantly lower in the yellow Tephri trap than in the yellow McPhail type trap. No significant differences were detected, in the sex-ratio of trapped flies, in the black and in the green Tephri traps, but the other traps caught significantly more females than males. Females accounted for 60-70% of the total capture in these traps. The peak of captures occurred earlier in the two McPhail type traps and in the yellow Tephri trap (middle of October), than in the green and black Tephri traps (beginning of November). The number of captures at the peak, was significantly lower in the black McPhail type trap than in the other traps, except for the yellow Tephri traps. This number reached an average of 19.05 flies/trap/week. There was no significant differences between traps in the total number of chrysopids captured, nor in the number captured at the peak, which was, on average, 5.56 insects/trap/week. However, seasonal changes in the number of captures were apparent, for both, olive fly and chrysopids.
Acknowledgements: Work supported by the project PAMAF IED nº 2043
Index terms: olive; olive-fly; Tephri trap; McPhail trap; chrysopids.

[2840] OVIPOSITION PREFERENCE OF SILVERLEAF WHITEFLY (HEMIPTERA: ALEYRODIDAE) FOR SQUASH GENOTYPES

L. C. Toscano[1], A. C. S. Lima[2], E. L. L. Baldin[3], F. M. Lara[1] , A. L. Boiça Junior[1] & M. F. Batista[4], [1] Deptº de Fitossanidade, UNESP, Via de Acesso Prof. Paulo Donato Castellane, Jaboticabal, SP, 14884-900, Brasil, E-mail ltoscano@fcav.unesp.br; [2]Deptº de Fitotecnia, UFRR, BR 174 s/n, Boa Vista, RR, Brasil, E-mail acslima@fcav.unesp.br; [3] Deptº de Biologia, USP, Avenida Bandeirantes, 3900, Ribeirão Preto, SP, 14040-901, Brasil, E-mail elbaldin@usp.br; [4] Embrapa/Cenargen, E-mail fatima@cenargen.embrapa.br.

The silverleaf whitefly, *Bemisia tabaci* B biotype, as polyphagous insect presents a wide variety of host plants including the Curcubitaceae that show the silverleaf as tipical symptoms. There are many control methods of this pest, but the resistant plants may be used associated with another methods, efficiently. The objective of this work was selected some squash genotypes less laid by females of *B. tabaci* B biotype. Ten squash genotypes (*Cucurbita moschata*), being BRA015008, BRA015113, BRA003531, BRA003638, BRA003671, BRA014702, BRA014770, BRA014788, BRA014915 and BRA014940, from CENARGEN/EMBRAPA germoplasm bank were evaluated. The silverleaf whitefly oviposition preference was accomplished under greenhouse conditions. Two seeds of each genotypes were sowed in plastic glasses (300 ml) over substratum. By the fifteenth day after sowing only one plant per glasses was left; with thirty days the glasses were conducted to silverleaf withefly rearing cages, where stayed per one day, being after conducted to the lab. The eggs' number was counted with a stereomicroscope, observing two sections of 1 cm^2 located at side of principal vein, on abaxial face of two true leaves. Six replications (once a week) in a randomized block design were realized. The results showed that the BRA003531 genotype was the least preferred (48.21 eggs/cm^2); BRA014788 and BRA003671 presented 132.73 and 126.80 eggs/cm^2, respectively, indicating to be more preferred to oviposition by the *B. tabaci* B biotype.
Index terms: *Bemisia tabaci* B biotype, *Cucurbita moschata,* host plant resistance.

[2841] DELTAMETHRIN RESIDUES ON/IN WHEAT GRAIN AND IN SOME OF THEIR PROCESSED PRODUCTS DETERMINED BY GAS CHROMATOGRAPHY

L.R.P. Trevizan, G.C. de Baptista & O. Bahia Filho, [1] Departamento de Entomologia, Fitopatologia e Zoologia Agrícola, ESALQ/USP, Av. Pádua Dias, 11, 13418-900 Piracicaba, SP, Brazil, E-mail lrptrevi@carpa.ciagri.usp.br.

The objetive of this study was to evaluate the degradation/persistence of the residues of the pyrethroid insecticide deltamethrin on/in wheat grain and some of their processed products, such as: bran, white flour, whole meal flour and bread. The grains were treated with the recommended dose of 0.35 mg . kg^{-1} (ppm) of a.i. deltamethrin for the control of the lesser grain borer (*Rhyzopertha dominica*) and weevils (*Sitophilus* spp) with the use of K-Obiol 25 CE (25 g deltamethrin + 250g PBO/L) commercial product. The experimental design was completely randomized with three replicates; Samples were taken at zero, 15, 30, 60 and 90 days after treatment. The analytical method consisted of extraction of residues with a mixture of hexane + ethyl ether (1/1, v/v), clean-up by partition with acetonitrile/hexane followed by silica gel column chromatography eluted with a mixture of hexane + ethyl ether (9/1, v/v). Quantitative measurements of the residues were made by gas chromatography, equipped with an electron capture detector (μ-ECD, Ni^{63}). A total of 150 samples (30 grains and 120 processed products) was analyzed. The limit of the method quantitation was 0.01 mg . kg^{-1} (0.05 mg . kg^{-1} for the bran). Deltamethrin residues were persistent and stable on grain during the entire storage period (90 days). Most of the residues were found in wheat bran (2 times higher than in grain) and less in white and whole flours; dough baking caused loss of deltamethrin residues.
Index terms: *Rhyzopertha dominica*, *Sitophilus* spp., lesser grain borer, weevil

[2842] INTEGRATED PEST MANAGEMENT (IPM) AND ECOLOGICAL PEST MANAGEMENT (EPM)

W. B. Tshernyshev, Dept. of Entomology, Faculty of Biology, Moscow State Univ., Moscow 119899, Russia, E-mail tshern@3.entomol.bio.msu.ru

The EPM is a direct result of the IPM development. However, their general strategies are quite different. The EPM bases on keeping and supporting of natural stability of agroecosystem and rejects any chemical pesticides and other methods of plant protection which can destroy natural balance. The EPM is not able to use directly the Economic Injury Threshold, because, when the pest outbreak development has already reached this level, only hard measures can save the yield. The decision to take measures should be based in EPM on the combination of two parameters: the abundance of pest and of its natural enemies. We have in EPM at least 4 barriers for pests. 1) Natural predators and parasites. All natural enemies should be provided by food during such periods when there are no pests in the field. In their turn, the alternative preys need in their feeding plants. Therefore we have to regulate complexes of wild plants near the field. We have to provide also the shelters for overwintering. 2) Mowing the nearest perennial herbs, meadows or grassy margins to increase the number of natural enemies in the field. 3) Release of some artificially reared enemies. However, too mass release may be dangerous for agroecosystem stability due to competition with natural enemies and eradication of alternative preys (hosts). 4) Soft, e.g. microbiological, pesticides may be used. The advantages of EPM: 1) no pollution of environment and food products; 2) no problems with resistance to chemical pesticides, 3) support of maximal biodiversity and conservation of rare species; 4) favourable conditions for pollinators; 4) long-term effect of agrolandscape management; 6) low expenses. The shortcomings of EPM: 1)The main hindrance is a psychological barrier. All persons engaged in production are sure that it is impossible to grow the yield without chemical pesticides; 2) relatively lower reliability especially in the beginning of landscape management procedure, therefore the replacement of the IPM by the EPM should be made by degrees; 3) much more complex monitoring both the pests and the beneficial arthropods including also their alternative preys, both in the field and around it; 4)elaboration of the EPM-system for such pests, which can also decrease the quality of production, e.g. many orchard pests. In this case the economic injury level may be very close to the level of population slipping out of the control, 5)elaboration of EPM-system for long distance migrants like some locusts; 6)elaboration such system for new alien species, because their complex of natural enemies has not been formed yet . EPM is supposed to replace IPM in the future.
Index terms: pests, agroecosystem, ecological control, natural enemies

[2843] FIRST SURVEY ON FRUIT FLIES, FRUGIVOROUS LONCHAEIDAE (DIPTERA: TEPHRITOIDEA) AND THEIR HOST FRUITS IN THE SOUTH PANTANAL, MATO GROSSO DO SUL STATE, BRAZIL

M. A. F. Uchôa & J. N. Nicácio, Laboratório de Controle Biológico de Insetos, Universidade Federal de Mato Grosso do Sul, Caixa Postal 04, CEP 79200-000 Aquidauana, MS, Brazil. E-mail <uchoa@nin.ufms.br>

The true fruit flies, *Anastrepha* spp. and *Cetatitis capitata* (Tephritidae) and the frugivorous Lonchaeidae, *Neosilba* spp., are important widespread pests of crop fruits and vegetables. They infest a great variety of native and exotic fruits. It is important to establish the species composition of these flies and the host fruits in the ecosystems as a basis for strategies of population management. The objetive of this survey was to know the species of frugiverous flies in hosts in the Pantanal of Mato Grosso do Sul State. From April, 1998 to February 2.000, 75 species of fruits were collected from 34 Families. The adults were obtained in the laboratory from last instar larvae, leaving the fruits to pupate. The host fruits and the infesting flies were as follows: Anacardiaceae: *Anacardium humile – Anastrepha obliqua* and *Neosilba* sp.; *Anacardium othonianum – Neosilba* sp.; *Mangifera indica – A. obliqua, Ceratitis capitata* and *Neosilba* sp.; *Spondias dulcis – Neosilba* sp.; *Spondias purpurea – Neosilba* sp.; Annonaceae: *Annona crassifolia – Neosilba* sp.; *Duguetia furfuracea – Neosilba* sp.; Apocinaceae: *Hancornia speciosa – Neosilba* sp.; Combretaceae: *Buchenavia* sp. – *Neosilba* sp.; Convovulaceae: *Operculina* sp. – *Neosilba* sp.; Ebenaceae: *Diospyros hispida – Neosilba* sp.; Fabaceae: *Andira cuyabensis – A. turpiniae* and *Neosilba* sp.; Flacourtiaceae: *Banara arguta – A. fraterculus* and *Neosilba* sp.; Clusiaceae: *Rheedia braziliensis – A. rheediae*; Hippocrataceae: *Salacia elliptica – Neosilba* sp.; Malpighiaceae: *Byrsonima crassifolia – A. sororcula* and *Neosilba* sp.; Melastomataceae: *Mouriri elliptica – A. zenildae, A. rheediae, C. capitata* and *Neosilba* sp.; Mimosaceae: *Inga laurina – A. distincta* and *Neosilba* sp.; Moraceae: *Ficus insipida – Neosilba* sp.; *Sorocea sprucei – Neosilba* sp.; Myrtaceae: *Eugenia malecenais – A. fraterculus, C. capitata* and *Neosilba* sp.; *Psidium guajava – A. obliqua, A. sororcula, A. striata, A. turpiniae, C. capitata* and *Neosilba* sp.; *Psidium* spp. – *A. obliqua, A. sororcula, A. striata* and *Neosilba* sp.; *Syzygium* sp. – *Neosilba* sp.; Oleaceae: *Shoepfia* sp. – *Neosilba* sp.; Passifloraceae: *Passiflora coccinia – Neosilba* sp.; *Passiflora edulis – Neosilba* sp.; Sapotaceae: *Chrysophyllum gonocarpum – C. capitata; Pouteria ramiflora – C. capitata; Pouteria torta – A. serpentina, A. leptozona* and *Neosilba* sp.; Solanaceae: *Physalis angulata – A. sororcula* and *Neosilba* sp.; *Solanum sisymbriifolium – Neosilba* sp.; Rubiaceae: *Alibertia edulis – Neosilba* sp.; *Genipa americana – Neosilba* sp.; *Tocoyena formosa – Neosilba* sp.; Rutaceae: *Citrus sinensis – Neosilba* sp.

Index terms: Frugivorous flies, *Anastrepha* spp., *Ceratitis capitata*, *Neosilba* spp., native fruits

Ten species of *Anastrepha* were reared in 14 species of fruits. *Ceratitis capitata* occurred in six hosts. *Neosilba* spp. were obtained from 33 species of fruits. The species of *Neosilba* were not identified due to a lack of a revision for the Neotropica Region.

[2844] FRUIT FLIES AND FRUGIVOROUS LONCHAEIDAE (DIPTERA: TEPHRITOIDEA) ON URBAN HOSTS IN TWO CITIES OF THE STATE OF MATO GROSSO DO SUL, BRAZIL

M. A. F. Uchôa, J. N. Nicácio, C. S. Caires & M. F. R. Pereira, Laboratório de Controle Biológico de Insetos, Universidade Federal de Mato Grosso do Sul, Caixa Postal 04, CEP 79200-000 Aquidauana, MS, Brazil. E-mail <uchoa@nin.ufms.br>

The larvae of fruit flies (Tephritidae) and frugivorous Lonchaeidae are commonly encountered in the fruits of urban hosts. Mato Grosso do Sul State has frontiers with three countries (Argentine, Bolivia, Paraguay), being able to serve as an entrance point for frugiverous flies of economic importance. The objetive of this study was to evaluate the attack of flies in fruits of plants used in the arborization of the cities of Aquidauana (20° 30' S / 55° 47° 40" W, 173 m) and Campo Grande (20° 26' 34" S / 54° 38' 47" W, 532 m), MS, Brazil. From 17.12.1998 to 29.12.1999 fruits of 11 species were sampled, belonging to nine Families. The adults were obtained in the laboratory from larvae of the last instar, leaving fruits to pupate. Frugiverous flies were found in the following urban hosts: (Anacardiaceae) *Mangifera indica – Anastrepha obliqua, Ceratitis capitata* and *Neosilba* spp.; *Anacardium humile – A. obliqua* and *Neosilba* sp.; (Chrysobalanaceae) *Licania* sp. – *A. sororcula, A. zenildae, C. capitata* and *Neosilba* sp.; (Combretaceae) *Terminalia catappa – A. sororcula, A. zenildae, C. capitata* and *Neosilba* sp.; (Lauraceae) *Persea americana – Neosilba* sp.; (Mimosaceae) *Inga laurina – C. capitata* and *Neosilba* sp.; (Myrtaceae) *Psidium guajava - A. obliqua, A. sororcula, A. striata, A. turpiniae, C. capitata* and *Neosilba* sp. The following urban plants did not show infestations: *Genipa americana* (Rubiaceae); *Melicoccus lepidopetalus* (Sapindaceae), *Pachira aquatica* (Bombacaceae) and *Syzygium* sp. (Myrtaceae). It was noted that *C. capitata* was the species with the highest index of infestation (88,96% of the total of flies), colonizing five fruit trees. The species of *Anastrepha* occurred in five urban hosts, representing 4,33% of the total of frugiverous flies. The species of *Neosilba* colonized the largest number of fruit trees (seven) and apresented an overall index of infestation of 5,89%. *C. capitata* showed to be the most important fruit fly colonizing fruits on urban hosts.

Index terms: *Anastrepha* spp., *Ceratitis capitata*, *Neosilba* spp., Tephritidae, Lonchaeidae

[2845] SCREENING FORAGE GRASSES OF THE GENUS *BRACHIARIA* FOR RESISTANCE TO THE SPITTLEBUGS (HOMOPTERA: CERCOPIDAE)

J. R. Valério[1], I. R. Barbosa[2], M. A. G. Rocha[2], C. L. Emiliani[2] & M. C. M. Oliveira[3], [1]Embrapa-Gado de Corte, P. O. Box 154, CEP 79002-970, Campo Grande, MS, Brazil, E-mail jraul@cnpgc.embrapa.br; [2]CNPq scholarship holder; [3]EMPAER-MS.

Spittlebugs are the most damaging pasture pests in tropical America where extensive monocultures of Signal grasses, especially *Brachiaria decumbens* cv. Basilisk, have favored the buildup of spittlebug populations. Under severe spittlebug attack, the entire above-ground portion of the plant dries and eventually dies, thereby reducing the carrying capacity of infested pastures. Host plant resistance is a low-cost method of controlling spittlebugs. High level of spittlebug resistance is found in the cultivar Marandu (*B. brizantha*), but it requires more fertile soils. *Brachiaria* germplasm, provided by the International Center for Tropical Agriculture (CIAT), is available at Embrapa's National Beef Cattle Research Center and it is being screened for spittlebug resistance. In the present study, 24 accessions of *Brachiaria* were evaluated for resistance to the spittlebug *Notozulia entreriana*, based on the parameters: nymphal survival and nymphal period. The assay was conducted in the greenhouse (26.2±1.6 °C; 75.2±6.3% RH). The accessions were initially established in jiffy pots and, posteriorly were transferred to plastic pots. Each of these pots were covered with aluminum tops, which have a central opening for the grass stems. This is done in order to stimulate abundant superficial rooting at the soil surface and hence provide enough feeding sites for the newly hatched nymphs. The plants were infested two and half months after planting with five eggs per pot. After infestation, pots were kept individually caged. There were ten replications for each accession in a complete randomized assay. The emerging adults were collected daily. As screening criterium, only the accessions presenting, simultaneously, percentage of nymphal survival below the average for the group, minus the correspondent standard deviation and, nymphal period above the average for the group plus the respective standard deviation, are selected as resistant. The cultivar *B. decumbens* cv. Basilisk was included as the susceptible check, while *B. brizantha* cv. Marandu, as the resistant one. In accordance with adopted screening criterium the accessions CIAT 26017 and CIAT 26644, were the ones selected as resistant in this test. Given the great number of available accessions and hybrids, tests like this have been conducted routinely at Embrapa's Beef Cattle Center. Other 551 accessions and hybrids have already been screened in the past few years. As a result 40 accessions and 11 hybrids were found resistant. The aim of continuing evaluations is to release new, spittlebug resistant *Brachiaria* cultivars.

Index terms: *Notozulia entreriana*, *Zulia entreriana*, froghopper, pasture

[2846] EFFECT OF INSECTICIDES ON NYMPHS OF *BEMISIA TABACI* B BIOTYPE

G. E. Valle[1], A. L. Lourenção[1], J. P. S. Novo[1] & A. J. Peretto[2], [1]Instituto Agronômico de Campinas (IAC), Caixa postal 28, 13001-970 Campinas, SP, Brasil, E-mail: andre@cec.iac.br; [2]Hokko do Brasil, Av.Indianópolis 1597, 04063-003 São Paulo, SP, Brasil.

The effect of the insecticides buprofezin (150 g/100 L), pyriproxyfen (75 ml/100 L), acephate (100 g/100 L), fenpyroximate (200 ml/100 L) and cartap (200 g/100 L) on nymphs of first instar of *Bemisia tabaci* B biotype was evaluated under laboratory conditions. The insects used in the experiments were reared on soybean plants, in greenhouse. Soybean plants with the first trifoliolate completely developed were infested during 24 h with adults of whitefly for oviposition. After that period, the adults were removed from the plants. After seven days, a leaf area containing ten nymphs newly hatched was marked in each plant. Insecticides were, then, sprayed on the upper surface of the leaves at a rate of 184 L/ha. Development of the nymphs was followed until the emergency of the adults. In a second experiment the insecticides were sprayed in both surfaces of the leaves. The two experiments were conducted in laboratory, under a photophase of 12 h and temperature of 25±2 °C. In both experiments, a complete randomized block design, with six treatments and ten replications was used. Each plot consisted of a leaf area with ten nymphs. In the first experiment, only pyriproxyfen presented efficiency in the suppression of the emergency of adults, of around 85%, differing significantly from the others. Buprofezin and acephate (34%), cartap (17%) and fenpyroximate (16%) were considered not efficient. In the second experiment, pyriproxyfen and buprofezin induced supression of adult emergence above 80%, respectively 85 and 83%, differing from the others, cartap (26%), acephate (20%) and fenpyroximate (10%). It was observed that, due to its translaminar activity, pyriproxyfen was efficient when applied on the upper surface of the leaves as when was sprayed on both surfaces. This study also indicated that buprofezin presents efficiency in the control of nymphs of *B. tabaci* when applied in the lower surface of the leaves.

Index terms: Aleyrodidae, *Bemisia argentifolii*, silverleaf whitefly, chemical control.

[2847] WEEDS AS HOSTS FOR *BEMISIA TABACI* STRAIN B (= *B. ARGENTIFOLII*) (HEMIPTERA: ALEYRODIDAE) IN THE SEMI-ARID REGION OF BRAZIL

S. D. Vasconcelos, M.A S. Bezerra & G. M. Cavalcanti, Mestrado em Biologia Animal, Depto. de Zoologia, Universidade Federal de Pernambuco. Av. Prof. Moraes Rego, s/n, Recife - PE, 50670-420, BRAZIL. E-mail: simao@npd.ufpe.br

One of the most remarkable characteristics of the "new" complex of *Bemisia tabaci* strains/species is its incredibly wide host range: over 540 plant species of 74 families, from weeds to cultivated plants. While the discovery of new hosts is biased towards plants of economic importance, the role of weed as reservoir for whitefly populations has been blatantly ignored. In this study, a survey on non-commercial plants in the semi-arid region in Brazil was carried out in 1999, in order to identify potential hosts for *B. tabaci*. In and around plots cultivated with either tomato, melon or beans, weeds were sampled at every fifty metres. Twelve replicates (plants) were made for each species. The whole plant was inspected in the field for the presence of adults and taken to the laboratory. One leaf from the apical region, one form the middle and one from the base of the plant were removed and inspected under estereoscope. The numbers of eggs and nymphs were counted, so that the frequency of infestation (% of plants positive for whitefly out of the total number inspected) and the level of infestation (mean number of immature stage whiteflies per leaf) were recorded. A total of 30 weed species were analysed, and all of them had the presence of whiteflies. Six species were recorded as whitefly hosts for the first time, namely: *Amaranthus deflexus*, *Phyllanthus tenellus*, *Herissantia crispa*, *Pavonia cancellata*, *Diodia teres* and *Solanum ambrosiacum*. Two genera *Centratherum* and *Waltheria* are also reported for the first time. Leaves from the middle and base of the plant contained higher proportions of eggs and nymphs. Results suggest that the role of weed has been underappreciated, so that whiteflies can easily use them as food and shelter in the absence of cultivated hosts.

[2848] CONTROL OF *ASCIA MONUSTE ORSEIS* BY PYRETHROID INSECTICIDES IN COLLARD

M.U. Ventura[1], A. Pasini[1] & P.M.O.J. Neves[1], [1]Departamento de Agronomia, Universidade Estadual de Londrina, Caixa Postal 6001, Londrina, PR 86051-970, BRASIL. E-mail mventura@uel.br.

Ascia monuste orseis is a key pest in collard in Brazil. Gregarious caterpillars eats all leaves of the plant destroying it completely. This research was carried out to study the efficiency of pyrethroids insecticides to control the pest. Plots size was 10 m^2. Cultivar Manteiga was used (0.5 X 0.5 m). Insecticide treatments [Deltametrina CE (Decis 25 CE) 0.75 g ia/ha, Methomyl (Lannate 215 SC) 21.5 g ia/ha, Permethrin CE (Ambush 500 CE) 1.0 g ia/ha, Lambdacyhalothrin CS (Karate 50 CS) 1.5 g ia/ha) and Lambdacyhalothrin CE (Karate 50 CE) 1.5 g ia/ha)] and control (only water) were sprayed in 3/14/99. Spraying volume was 200 l/ha. Decis 25 CE and Lannate 215 SC were considered standard treatments. Six plants per plot were assessed. Caterpillars number was assessed 1, 3, 5 and 7 days after spraying. Significant differences were obtained in all assessments between insecticide treatments and control. Control efficiency were almost 100% in all insecticide treatments.

Index terms: Lepidoptera, Pieridae, chemical control

[2849] CONTROL OF *THRIPS TABACI* BY PYRETHROID INSECTICIDES IN ONION

M.U. Ventura[1], A. Pasini[1] & P.M.O.J. Neves[1], [1]Departamento de Agronomia, Universidade Estadual de Londrina, Caixa Postal 6001, Londrina, PR 86051-970, BRASIL. E-mail mventura@uel.br.

Thrips tabaci is the most important pest in onion in Brazil. Recent research revealed that yields might be significantly reduced under severe thrips infestation. This research was carried out to study the efficiency of pyrethroids insecticides to control the pest. Onion was planted in 3/5/99. Cultivar Mercedes was used (0.3 X 0.1 m). Plots size were 12 m^2. Insecticide treatments [Deltametrina CE (Decis 25 CE) 5 g ia/ha, Parathion methyl CE (Folisuper 25 CE) 420 g ia/ha, Permethrin CE (Ambush 500 CE) 50 g ia/ha, Lambdacyhalothrin CS (Karate 50 CS) 5 g ia/ha) and Lambdacyhalothrin CE (Karate 50 CE) 5 g ia/ha)] and control (only water) were sprayed in 8/23/99. Spraying volume was 190/h. Decis 25 CE and Folisuper 25 CE were considered standard treatments. Thrips number was assessed 2, 5, 7 and 14 days after spraying. Ten plants per plot were assessed (adults + nymphs per plant). Significant differences were obtained in all assessments among insecticide treatments and control. Control efficiency (Abbott) were greater in Karate 50 CS treatment (95, 85, 92 and 84%, respectively) and lower in Folisuper one (77, 77, 76 and 74%, respectively).

Index terms: Thysanoptera, Thripidae, *Allium cepa* L., chemical control

[2850] MANAGEMENT OF THE COTTON STEM BORER *EUTINOBOTHRUS BRASILIENSIS*

M. U. Ventura[1], [1]Departamento de Agronomia, Universidade Estadual de Londrina, Caixa Postal 6001, Londrina, PR 86051-970, BRASIL. E-mail mventura@uel.br

The cotton stem borer *Eutinobothrus brasiliensis* damages seriously cotton crops in southern and southeastern Brazil and northern Argentina. Stem borer occurrence, early in season, makes IPM strategies difficult to be applied. Two field trials were carried out to study chemical control in cotton crops. The field had been cultivated with cotton plants during several years. So, infestation levels were very high. In the first trial, seeds were treated with Thiametoxan (1.5 and 3.0 g/kg of seeds), Imidacropid (2.0 g) Orthene (10 g), Fipronil (2 ml) and water (control). Crop was sowed in 10/8/99 (cultivar Coodetec 401) (four replicates). Plots had 45 m^2. Assessments were carried out 30, 42 and 53 days after plant emergence. Stems were opened and bores and larvaes counted. In the first and third assessments no statistical differences were found. In the second assessment significant differences were observed among insecticide treatments and control, except Orthene. Thiametoxan (1.5 and 3.0 g), Imidacropid, Fipronil and Orthene provided 71, 72, 73, 72 and 26% of control. In a second experiment, treatments were Thiametoxan (1.5), Orthene (10 g) and control. In the Orthene treatment, plants were also sprayed with methyl-parathion 10, 20 and 30 days after emergence. Field cotton crop strips (1000 m^2) were sowed in 10/19/99. Thirty plants per plot were assessed 35, 47 and 60 days after plant emergence. Lesser infestations levels were found in insecticide treatments in which control levels were similar. Our results revealed that seed treatments with new insecticides substances can provide improvement in stem borer control. Research toward management strategies shall use them together with other measures to avoid or diminish spraying wide spectrum insecticides.

Index terms: Coleoptera, curculionidae, integrated management, chemical control

[2851] WHITEFLY (HEMIPTERA: ALEYRODIDAE) OCCURRENCE ON PAPAYA TREE (*CARICA PAPAYA*) IN PROTECTED ENVIRONMENT

M. R. Vieira[1] & L. S. Correa[2], [1]Depto. de Biologia, UNESP, P.O. Box 31, 15385-000, Ilha Solteira, SP, Brazil, E-mail marineid@bio.feis.unesp.br; [2]Depto. de Fitotecnia, Economia e Sociologia Rural, UNESP, P. O. Box 31, 15385-000, Ilha Solteira, SP, Brazil.

In february and october 1998 was registred the whitefly occurrence on plants of papaya tree in an assay localized in UNESP farm area, in Selvíria city, State of Mato Grosso do Sul (22° 22' S, 51° 22' W, 335 m) whose objective was to evaluate of cultivation in screened effect about Improved Sunrise Solo line 72/12 and Baixinho de Santa Amália varieties. Three environments were researched : natural environment and two screened with mesh of 2 x 2 mm and 2 x 1 mm providing a incidence of solar radiation reduction of 30% and 40% respectively. In the two ocasions the insects were sent to the CENARGEN/EMBRAPA for identification. The material in the first infestation was identified as *Trialeurodes* sp. and its occurrence was more significated on Baixinho de Santa Amália variety, in the two protected areas, where were found adults on new leaves and nymphs on mature leaves, both in high quantity. In october infestation it was *Bemisia tabaci* B biotype (=*B. argentifolii*) with adults and nymphs higher populations in screened 2 x 2 mm, lower incidence in screened 1 x 1 mm and absence in natural environment. This second infestation was controled by coccinellid *Delphastus pusillus* worms and adults that feed of present nymphs intensily. For both whitefly species, the infestation resulted in high sooty molds development that recovered all foliar surface.
Index terms: *Bemisia tabaci* B biotype, *Bemisia argentifolii*, *Trialeurodes* sp, *Delphastus pusillus*.

[2852] BIOLOGICAL STUDIES ON THE ARG1 BIOTYPE OF THE *BEMISIA TABACI* COMPLEX (HEMIPTERA: ALEYRODIDAE)

M. M. Viscarret, S. N. López &E. N. Botto, Insectario de Investigaciones para Lucha Biológica. IMYZA-CNIA-INTA Castelar. C. C. 25 (1712), Buenos Aires Argentina. E-mail: mviscarret@ciudad.com.ar.

The characterization of biotypes in the *Bemisia tabaci* complex is of upmost importance worldwide. In this work we describe the biology of the biotype ARG1 of the *B. tabaci* complex, a local biotype associated to cotton crops in Argentina. Biological parameters as developmental time, survival, sexual proportion, longevity, fecundity, r_m (intrinsic rate of increase), R_0 (net reproductive rate), T (generation time), t (doubling time) and phytotoxic damage induction, were estimates from life and fecundity tables constructed on cotton, under controlled laboratory conditions (T, mean±SE: 24.05C°±0.26C°; RH, mean±SE: 65.58%±1.93%; 14L:10D). The developmental time for the inmature stages in days were: egg + nymph 1: 7, nymph 2: 6, nymph 3: 5 and nymph 4: 12. The developmental time (days, mean±SE), for females and males was: 27.17±0.21 and 26.75±0.22, respectively. The survival rate was for nymph 3: 0.79, nymph 4: 0.72 and for the adult: 0.68. The survival rate for the female adult decayed drastically during the first seven days of her reproductive life, being the $l_{50} = 5$ days. The estimated sexual proportion resulted in 0.53. The longevity for the female adult (days, mean±SE) was: 22.18±2.76. The average number of eggs (±SE) laid by a female over its life span was 34.36±7.26. Fecundity was reached a maximun when the female adult is 13 days old. The r_m (eggs/female/day) was 0.072. The R_0 (eggs/female) was 15.12. The T (days) was 37.99 and the t (days) was 9.63. The adults of the ARG1 biotype of the *B. tabaci* complex did not produce phytotoxic damage on the host plant tested (*Cucurbita maxima*). Results obtained on biological parameters assesed for the ARG1 biotype of the *B. tabaci* complex are discussed regarding those observed on other biotypes of the same complex.
Index terms: biotype ARG1, *Bemisia tabaci* complex, biological parameters

[2853] MANAGEMENT OF FRUITSPOTTING BUGS IN TROPICAL AND SUBTROPICAL FRUIT CROPS

G. K. Waite, Queensland Horticulture Inst., Maroochy Research Station., PO Box 5083 SCMC, Nambour 4560, Queensland, Australia. E-mail:waiteg@dpi.qld.gov.au.

The fruitspotting bugs, *Amblypelta nitida* and *A. lutescens lutescens* (Heteroptera:Coreidae), are major pests of most tropical and subtropical fruit crops grown in coastal Queensland, Australia. Damage inflicted on green fruit as a result of the bugs' feeding leads to fruit abscission and its loss on the ground, or lesions and scars on fruit that is retained on the tree, making them unmarketable. If the bugs are not controlled, losses in excess of 90 percent may be expected in the most susceptible orchards. Such orchards are most often situated close to the natural forest breeding areas of the bugs. Adult fruitspotting bugs continuously fly into orchards and cause damage over a period of several months in crops such as avocados and macadamias. Recent research has concentrated on learning more about the ecology and behaviour of *Amblypelta* species in order to attempt to modify current management strategies that rely totally on frequent cover sprays of endosulfan. This chemical will most likely be unavailable for such use within a few years so that alternative adult knockdowns and perhaps behavioural modifiers, will be necessary to manage the problem. Mark/recapture experiments have shown that bugs tend to move into and out of the orchard continuously, and that the period of residence of individual bugs may be less than five days in some crops such as litchis and longans. However, in macadamias and avocados where the fruit is more sheltered, they may remain for longer periods, causing proportionately more damage. Surveys have determined that most damage tends to occur in defined areas of an orchard termed 'hotspots'. These areas are generally in sheltered areas adjacent to scrub or forest. Unless some form of chemical control is applied, damage increases over time and is exacerbated by increasing numbers of nymphs hatching from eggs laid by the immigrant adults. It is proposed that spraying only hotspots and planting attractive alternative hosts such as *Murraya paniculata* (Rutaceae) as trap trees could provide acceptable and sustainable control.
Index terms: *Amblypelta nitida*, *Amblypelta lutescens lutescens*, hotspots, avocados, macadamias

[2854] OPTIONS FOR THE MANAGEMENT OF SPIDER MITES IN FIELD-GROWN STRAWBERRIES

G. K. Waite, Maroochy Horticultural Research Station, PO Box 5083 SCMC, Nambour 4560, Queensland, Australia. E-mail: waiteg@dpi.qld.gov.au.

As in other parts of the world spider mites, *Tetranychus urticae*, are the major pests of strawberries in Australia. In the subtropical climate of southeast Queensland, field-grown strawberries produce a winter crop and spider mite outbreaks often occur during late winter and spring. Over the years, chemical control has achieved variable results because of problems with spray coverage and mite resistance. In 1984, a commercially viable biological control strategy using the phytoseiid *Phytoseiulus persimilis*, was introduced. This system employed the semi-random release (RR) of predators at the rate of two per plant when spider mite numbers reached an average of five per leaf. At the same time, it was recommended that growers should try using the 'pest in first' (PIF) technique, as this had also proven viable in trials. However, there was no interest in the latter at that time and it was not until 1994, following disastrous losses to spider mites by a leading strawberry grower in the preceding season, that PIF found its first commercial use. The approach was immediately successful and in subsequent seasons other growers assisted by a consultant, have adopted the technique. Commercial suppliers of predatory mites in Australia have had difficulty supplying sufficient spider mites and predators demanded by the technique. As a result, local on-farm rearing systems have been used to augment commercial supplies. These crude open-air crops of leguminos species such as *Dolichos lablab* do not allow for segregation of predators and prey and their separate release, as is required for PIF. Consequently the next stage, simultaneous release (SR), has evolved. Although SR is more difficult to manage than PIF, it has the advantage that relatively cheap and good supplies of local mites can be used. Provided the situation is properly managed by a competent consultant, SR provides excellent spider mite control. Queensland strawberry growers using any of these three biological control strategies to manage their spider mite problems have achieved superior control to that afforded by chemicals, and PIF and SR have increased the success rate over that achieved by the random release technique.
Index terms: *Tetranychus urticae*, *Phytoseiulus persimilis*, pest in first

[2855] ARMORED SCALES POPULATION DYNAMICS IN SÃO PAULO STATE CITRUS REGION

M. A. Watanabe[1], F. J. Tambasco[1], V. A. Costa[2], E. A. B. De Nardo[1] & R. Facanali[1]. [1]Laboratório de Quarentena Costa Lima, Embrapa Meio Ambiente, P. O. Box 69, 13820-000 Jaguariúna, SP, Brazil. E-mail watanabe@cnpma.embrapa.br; [2]Seção de Controle Biológico de Pragas, Instituto Biológico, P. O. Box 70, 13001-970 Campinas, SP, Brazil.

During the year of 1997, a survey on the incidence of armored scales in citrus leaves was carried on in São Paulo State citrus region. A random sample of 100 leaves was collected from each orchard, at monthly or fortnightly intervals. Each leaf was examined under stereomicroscope for scale species identification and counting. It was found *Selenaspidus articulatus, Parlatoria ziziphi, Mycetaspis personata, Cornuaspis beckii and Chrysomphalus ficus,* the first species being the dominant. Percentage parasitism and mortality rates was determined for *S. articulatus*. The high scale incidence is attributed to chemical insecticides sprayings which are harmful to natural enemies represented mainly by Hymenopteran parasitoids. Scale predators like Coccinellids occur in the orchards in too low number under natural conditions, being unable to keep the scale population in check. Soon after spraying a remarkable reduction in live scale population was observed, but because of natural enemies death, a quick recover of scale population was observed. This recover did not take place only if the sprayings were applied repeatedly at short time intervals. During most of the year, *S. articulatus* occurrence was higher than its economic damage level established in 10 scales/leaf. The parasitism was usually low, the maximum rate being 7,4%. *C. ficus* and *C. beckii* occurred in most of the orchards; *P. ziziphi* was found in only one orchard. In one of the orchard it was found only *S. articulatus*.
Index terms: *Selenaspidus articulatus,* parasitoids, predators

[2856] AN IPM APPROACH TO PREVENTION OF POTENTIAL PESTS THAT MIGHT BE IMPORTED TO THE UNITED STATES ON CHILEAN LOGS: PART I, EFFECTIVENESS OF METHYL BROMIDE ALTERNATIVES

B.R. White, R.I. Gara[1], D. Lanfranco, H. Peredo, P. Montes[2], G.K. Smith, and David Bridgwater[3], 1College of Forest Resources, University of Washington, Box 352100, Seattle, WA 98195-2100; 2Facultad de Ciencias Forestales, Universidad Austral de Chile, Valdivia, Chile; 3USDA Forest Service, Forest Pest Management, 1 Oak Plaza, 331 1st Ave., Portland OR 97208.

We studied the effectiveness of alternative pesticide treatments to methyl bromide fumigation in controlling high-risk Chilean forest pests that could be imported to the United States on logs. Various treatments have been proposed as alternatives to current regulations requiring methyl bromide fumigation. Little data, however, was available concerning the effectiveness of proposed treatments on Chilean insects or pathogens of risk to United States forest tree species. Scientists from Chile and the United States collaborated in evaluating the efficacy of biocides in Chile in order to identify promising alternatives to methyl bromide for treatment of whole logs destined for the United States. Initial studies were conducted using radiata pine bolts (28 cm X 0.75 m) from which the best treatments were identified. Further field studies were conducted to test these pytosanitary products on export-sized logs that were handled under industrial conditions. Results showed that a combination surface treatment of "Timber-Treat™" and "NP-1™" effectively protected debarked logs against hichhiking bark beetles and blue-stain fungi for three months. The addition of either methyl bromide or a "Vikane™" fumigation treatment following the surface treatment had no observable effect over the surface treatment alone.

[2857] INTEGRATED PEST MANAGEMENT (IPM) OF GRAPES IN OHIO

R. N. Williams[1] & D. S. Fickle[1], [1]Dept. of Entomology, Ohio State Univ., 1680 Madison, Wooster, OH, USA 44691

Many tools and techniques have been developed to deal with grape pests and are an important part of the IPM program. The goal is to provide a commercially acceptable level of pest control with minimal pesticide use. Research efforts are geared toward meeting this goal. Scouting techniques and insect thresholds have been developed for most of the major pests. Attractants have been developed for monitoring and in some cases controlling pest populations. Pest resistant cultivars are being utilized in some regions and others continue to be evaluated. Cultural practices have been established and continue to be refined and improved. Alternative control methods utilizing predators, parasites and disease vectors are currently being studied and evaluated for their efficacy, economics and practicality. A broad knowledge of all available options is necessary in IPM programs. Insect identification, biology, and behavior are critical in understanding viable options. Our research is geared toward improving IPM strategies by: (1). Testing new and experimental pesticides, particularly biorationals for efficacy to vineyard pests. We are evaluating new chemicals with a limited spectrum that are able to provide adequate control of specific pests. (2). We are studying the timing and number of applications of these control measures in hopes of improving efficacy. (3). We are evaluating rootstocks for vine vigor and insect resistance. The grape root borer is a potentially devastating pest of grapes in southern Ohio and we are currently evaluating several rootstocks for their resistance to this pest as well as their growth performance. Grape phylloxera continues to make its presence known in Ohio and we are currently surveying the roots of established vines throughout the state to determine the presence of the root form of this pest to better understanding the role they play in vine vigor. (4). Entomopathogenic nematodes are new biological weapons that are potentially lethal to many insect pests. New techniques for mass rearing of these biological weapons have been developed. We are currently evaluating nematodes for control of the grape root borer and the grape phylloxera. Preliminary results are encouraging. (5). Using insect attractants for monitoring and controlling pest populations is another part of our IPM research. We have developed an attractant for the adult rose chafer. This attractant may be used to monitor the emergence of this pest as well as reduce its numbers by mass trapping. It is currently available commercially. We are currently developing a lure that is childproof. Sex pheromones of the grape berry moth and grape root borer are being utilized to monitor adult activity and may be used to determine the optimal timing of pesticide applications. They may also be used in pheromone confusion and mass trapping strategies. (6). The transfer of information to the grower is fundamental to a sound IPM program.
Index terms: *Endopiza viteana, Vitacea polistiformis, Macrodactylus subspinosus.*

[2858] IPM AND EARLY PEST DAMAGE IN COTTON; HOW TO SUCCEED BY DOING NOTHING

L. J. Wilson[1], V. O. Sadras[2] & S. C. Heimoana[1], [1]CSIRO Cotton Research Unit, Locked Bag 59, Narrabri, Australia, 2390, E-mail lewisw@mv.pi.csiro.au; [2]Facultad de Ciencias Agrarias, Universidad Nacional de M

[2859] POTENTIAL OF MILLET AS A SWEET CORN COMPANION PLANT: EFFECT ON EUROPEAN CORN BORER AND BENEFICIAL INSECTS

M. G. Wright, J. Gardner & M. P. Hoffmann, Department of Entomology, Cornell University, Ithaca, NY 14853, USA, E-mail: mgw7@cornell.edu.

As a potential component of an integrated pest management program for the control of European corn borer (*Ostrinia nubilalis*) on sweet corn, we considered the potential that three types of millet have as trap crops for this insect. We also compared the diversity of beneficial insects among the three types of millet, and compared them to sweet corn. The experiments were conducted in central New York, USA. We evaluated *O. nubilalis* field preferences for different types of millet (pearl, proso and Siberian) and oviposition preferences in cage trials. Sweet corn was included in the cage trials. Beneficial insects were collected by vacuum sampling from millet and corn plots. Field results showed that *O. nubilalis* adults aggregated in Siberian millet, a suitable dense and humid habitat. Highest levels of *O. nubilalis* larval damage in the field trials were in proso millet, while Siberian millet incurred low damage, and pearl millet was almost free of damage. Cage trials showed little difference between the millets and sweet corn under hot dry conditions (with a non-significant majority of egg masses laid on corn). Under more optimal conditions, corn and pearl millet plants received the highest numbers of egg masses. Barriers of combinations of millet have the potential to provide a cultural control of *O. nubilalis*, using Siberian millet as an aggregation site, proso millet as a trap crop and pearl millet as a barrier crop, planted closest to the sweet corn. Millet plots harbored a greater diversity of beneficial insects than sweet corn, further increasing the potential value of barrier rows of millet around sweet corn patches.
Index terms: beneficial insects, millet, *Ostrinia nubilalis*, sweet corn, trap crops.

[2860] WEB-BASED AFRICA IPM FORUM FOR BETTER INFORMATION DISSEMINATION

Y. L. Xia & J. Baumgärtner, Dept. of Population Ecology and Ecosystem Science, International Centre of Insect Physiology and Ecology (ICIPE), P. O. Box 30772, Nairobi, Kenya, E-mail: yxia@icipe.org

An IPM Communications and Information Workshop for Eastern and Southern Africa (ICWESA) was held at International Centre of Insect Physiology and Ecology (ICIPE) from 1 to 6 March 1998. The 80 participants from sub-Saharan countries, international and development cooperation institutes recommended the establishment of an Africa IPM Forum for IPM information sharing and exchanging. Under the auspices of the IPM Information Partnership Consortium, an Africa IPM Forum (IPMAfrica) has been developed and integrated into ICIPE's Insect Informatics Initiative (Http://informatics.icipe.org). The forum is supported by the USAID/Africa Bureau and donors to ICIPE's core fund. IPMAfrica (http://informatics.icipe.org/IPMAfrica/) is a web-based discussion forum. It supports unlimited users, unlimited discussion fora/topics and unlimited messages/posts. Powered by Active Server Pages (ASP) and written in server side Java, IPMAfrica features many handy functions, like rich HTML message (supporting picture, sound, video and links), threaded or linear messages, file attachment, automatic-Cookie login, email integration (email alert of all responses to a post, linkage to email-only users via moderating), full search (all messages including file attachment are searchable), private messages, and open user profile management (to allow users to add specific properties). IPMAfrica has been developed as a supplementary and value-added product to the existing email discussion group Afrik-IPM.IPMAfrica publishes instantly all posted messages under different forum topics either threadedly or chronologically. At the moment, there are 25 forum topics: Agrobiodiversity, Armyworms, Biological Control, Bt, Crop Resistance, Fungal Diseases, GMO, Grasshoppers & Locusts, Horticulture IPM (DBM, Diseases and Fruitflies) ICT in IPM, Links with Other IPM Fora, Malaria & Mosquitoes, NGOs in IPM, Nematodes, Pesticides, Post-harvest Pests, Stemborers, Ticks, Tsetseflies, Virus Diseases, Weeds and Whiteflies. IPMAfrica must be accessed by a web browser, which supports frame (Internet Explorer or Netscape, above version 3.0).Index terms: IPMAfrica, ICWESA, ASP, ICIPE, Afrik-IPM

[2861] EFFICIENCY OF THIAMETHOXAM TO CONTROL *ONCOMETOPIA FACIALIS* (HEMIPTERA: CICADELLIDAE) IN CITRUS

P. T. Yamamoto[1], S. R. Roberto[1], W. Dalla Pria Jr[1], M. R. Felippe[1], A. C. Caetano[1] & A. L. Sanches[1], [1] Centro de Pesquisas Citrícolas, Fundecitrus, P. O. Box 391, Araraquara, SP, Brazil, 14.807-040, E-mail cient@fundecitrus.com.br.

The purpose of this study was to determine the efficiency of doses and formulation of thiamethoxam to control *Oncometopia facialis* (Signoret) (Hemiptera: Cicadellidae), vector of *Xylella fastidiosa* bacterium, which cause Citrus Variegated Chlorosis (CVC). The experiment was realized at the Niagara farm, located in Araraquara city, in 3-year-old 'Pera' sweet orange [*Citrus sinensis* (L.) Osbeck]. It was used a randomized design, with four replications, and one plant per plot. The following insecticides and doses (g i.a./plant) were tested: thiamethoxam 0.13, and 0.25 (CGA 293343GR, applied in soil), thiamethoxam 0.5 (Actara 250 WG, applied on citrus trunk); thiamethoxam 0.5 (Actara 250 WG, applied in soil); aldicarb 1.5 (Temik 150 G, applied in soil), imidacloprid (Winner 200 SL, applied on citrus trunk), and control. The insecticides were applied in February 5th, 1999. Imidacloprid and thiamethoxam (WG formulation) were applied with brush, around the citrus trunk 10 cm under the primary branches, the first one applied pure, and the second one diluted in 10 ml of water. The granulated insecticides were applied in grooves in both sides of the plant, under the canopy, incorporated with a rake. Thiamethoxam via soil was diluted in 20 litters of water and applied on the soil under the canopy. The tests were performed caging the insects on branches, using 10 adults of *O. facialis* per plant. The caging was realized in 7, 20 and 35 days after the insecticide application, and the mortality estimation was realized 1, 3 and 7 days after confinement. The thiamethoxam doses and formulation studied were little efficient to control *O. facialis*. The doses of thiamethoxam was not adequate for the plants tested. Aldicarb and imidacloprid were efficient until 35 days after application.
Index term: *Citrus sinensis*, *Xylella fastidiosa*, Citrus Variegated Chlorosis, CVC, Vector.

[2862] TOXICAL RESPONSES OF THE ASIAN LADYBIRDS, *HARMONIA AXYRIDIS* (COLEOPTERA: COCCINELLIDAE), AGAINST SEVERAL INSECTICIDES, ACARICIDES AND FUNGICIDES FOR INTEGRATED PEST MANAGEMENT OF APHIDS IN THE GREENHOUSES

Y. N. Youn[1], M. J. Seo[1], C. Jang[2], & Y. M. Yu[2], [1]Dept. of Agriculture Biology, Coll. of Agriculture, Chungnam National Univ., Taejon, 305-764, Korea, E-mail youngnam@hanbat.chungnam.ac.kr [2]Central Research Institute, Kyung-Nong Corporation, Kyungju, Kyungbuk, 780-110, Korea

For the integrated pest management of aphids in the greenhouse, the toxical resistance of natural enemies have to be examined as well as toxicity against aphids. In case of using predacious ladybirds for aphid control, it is no wonder that toxicology of ladybirds against pesticides should be tested. It was generally reported that pirimicarb as carbamates was widely applied with ladybirds for the control of aphid population, because it was low toxicity to eggs, larva, and adults of ladybirds. Profenofos and fenvalate were also comparatively safe to most of developmental stage of ladybirds. For the protection of plants, however, there were input many kinds of insecticides, acaricides and fungicides in the greenhouse. Therefore, we examined the toxical responses of different developmental stages of the Asian ladybirds against 5 insecticides (e.g., thiamethoxam, etofenprox, imidacloprid, acetamiprid, and abamectin), 4 fungicides (e.g., dichlofluanid, difenoconazole, procymidone, and pyrazophos), and 4 acaricides (e.g., abamectin, tebufenpyrad, ferazaquin, and chlorfenapyr). Etofenprox and acetamiprid were high toxicity to most of developmental stages including adult of the Asian ladybird at 200 µl/l and 40 µl/l of recommended dosages for aphid control, respectively. Thiamethoxam took knockdown response to 1st to 4th larva, pupa and adults; however, most of them were recovered within 24hrs after application. In case of imidacloprid with 50 µl/l of recommended dosage, LC_{50} were 30.3 and 190.2 µl/l to 3rd and 4th larva of ladybirds, respectively. And, abamectin for aphids and mites was high toxicity to even pupa and adults of ladybirds. On the other hand, pyrazophos took high toxical effects to eggs of ladybird at 39.5 µl/l comparative with 300 µl/l of recommended dosage. However, other 3 tested fungicides were not toxicity to any developmental stages of ladybirds at over 1,000 µl/l. For the most part, 1st and 2nd larva of ladybirds were very sensitive to most of tested insecticides and acaricides. It was supposed that application of insecticides and acaricides should be avoided at this time for young ladybirds, when aphid and mite population was suddenly outbroaken. On the other hand, ladybirds might be safely used for aphid control with some fungicides for plant diseases in the greenhouse.
Index terms: *Harmonia axyridis*, IPM, Insecticides, Acaricides, Fungicides

[2863] ARTHROPOD COMMUNITY STRUCTURE AND ITS CHANGING PATTERNS IN RICE ECOSYSTEMS IN KOREA

J.-C. Yun[1], J.-H. Lee[2], K.-B. Uhm[1] & J.-O Lee[3], [1]Div. Entomology, Dept. Plant Protection, NIAST, RDA, Suwon 441-707, Korea; [2]Entomology Program, School of Agricultural Biotechnology, Seoul National University, Suwon 441-744, Korea, E-mail jh7lee@plaza.snu.ac.kr.; [3]National Horticultural Research Institute, RDA, Suwon 440-310, Korea.

The arthropod community in rice paddy fields was analyzed using guild concept during 1993-1995. To investigate the arthropod community structure changes with development of rice phenology under different environmental disturbance (pesticide treatments), arthropods were sampled weekly from 8 sites located throughout Korea. Total 85 families and 216 species of arthropods were collected and identified. Among the families, Chironomidae (28.7%), Cicadellidae (22.3%), Delphacidae (20.0%), Lycosidae (9.3%), Veliidae (2.8%), Ephydridae (2.4%), Aphididae (2.2%), Tetragnathidae (1.3%), and Erigonidae (1.3%) consisted of 90.5% in total arthropod densities. The phytophagous species were mostly from Homoptera including *Laodelphax striatellus, Sogatella furcifera,* and *Nephotettix cinticeps.* In natural enemies, spiders such as *Pirata subpiraticus* (59% of the total natural enemies), and *Pachygnatha clercki* were the most abundant. Very few parasitoids were collected from all study locations. In early rice growing season, Chironomidae complexes were the most abundant. Among natural enemies, *P. subpiraticus* and *Pa. Clercki* were the most abundant. *L. striatellus* and *S. furcifera* were the dominant phytophagous species in the early growing season. In mid and late rice growing seasons, *L. striatellus, S. furcifera* and *N. cinticeps* were the most abundant phytophagous species. The rice arthropod community patterns changed with different rice plant phenology. Also, pesticide treatment influenced the arthropod community structures in the rice ecosystem.

[2864] CITRUS WHITEFLY, *DIALEURODES CITRI* (HOMOPTERA: ALEYRODIDAE) IN ADRIATIC REGION OF CROATIA

K. Zanic [1], S. Kacic[1] & J. Igrc-Barcic[2], [1] Inst. for Adriatic Crops and Karst Reclamation, Put Duilova 11, Split 21000, Croatia, E-mail: katja@stijena.krs.hr, [2] Faculty of Agriculture, Svetosimunska 25, Zagreb 10000, Croatia

Dialeurodes citri first invaded citrus orchards of South Adriatic during 1977, near Dubrovnik. Because this pest characteristics have not been studied in Croatia, this paper reviews its morphology, distribution, host plant range, biology and ecology. Leaf samples, collected all over Croatian coast and islands, were observed in the laboratory to create the map with citrus whitefly location spots and the list of host plants. Pest biological cycle, life cycle and overwintering were investigated in Split region (May 1996 – May 1998). For these purposes, samples of 30 leaves (10 leaves of each lemon, mandarine and persimmon) were collected weekly from the selected site, during the warm period of the year. During the winter, lemon and mandarine leaf samples were collected once per month. Preimaginal stages numbers per leaf and their presence were recorded. Adult stage presence was observed few times a week in the field, in period May- November. The presence of citrus whitefly was confirmed in all citrus growing areas of Croatia. The number of noted host plants was somewhat lower than in Mediterranean countries. Other than citrus it colonized and harmed: laurustinus (*Viburnum tinus*), persimmon (*Diospyros kaki*) and several plants of Oleaceae. There were three pest generations on citrus per year in Split region. However the part of larval population that belonged to second generation did not finish postembrionic development and it remained on the summer flush leaves and waited the hibernation. Pest took 43 to 72 days to develop from egg to adult stage in the field conditions, during the vegetation period. It overwintered mainly as fourth instar larva. There were two pest generations on decidous persimmon tree in a year.
In distinction from other Mediterranean countries *Dialeurodes citri* is the only aleyrodid species on citrus in Croatia presently.

[2865] EFFICIENCY OF MIREX-S MAX (SULFLURAMID 0.3%) BAIT AGAINST *ATTA SEXDENS RUBROPILOSA* AND *ACROMYRMEX OCTOSPINOSUS* (HYMENOPTERA: FORMICIDAE)

J. C. Zanuncio[1], R. Zanetti[2], J. M. M. Pereira[1] & A. P. da Cruz[3], [1]Dep. de Biologia Animal, Univ. Federal de Viçosa, 36.571-000 Viçosa, MG, BRAZIL, E-mail: zanuncio@mail.ufv.br; [2]Dept. de Entomologia, Univ. Federal Lavras, Caixa Postal 37, 37.200-000, Lavras, MG, BRAZIL.

Leaf cutting ants represents the principal problem in ireforestation areas in Brazil and control of this pest was made mainly with baits with dodecachlor up to the last decade. Due to environmental problems this compound was proibit and many products were tried aiming to substuit the dodecachlor. The efficiency of Mirex-S Max (sulfluramid 0.3%) bait in the dosages of 6, 8 and 10 grams per square meter of ant nest was evaluated against *Atta sexdens rubropilosa* and *Acromyrmex octospinosus* (Hymenoptera: Formicidae) compared to a dodecaclor bait at 10 grams per square meter of ant nest. Activity of ant nests was evaluated after 1, 7, 15, 30, 54, 90, 120 and 150 days after aplication of these baits. All ant movement on the surface of ant nests finished between up to 30 to 54 days but no cutting activity of ants was recorded after seven days of aplication of either baits. Mirex-S Max can replace the dodecachlor bait against *A. sexdens rubropilosa* and *A. octospinosus*, since an efficiency of 88.89, 77.77 and 77.77% was obtained with 6, 8 and 10 grams of Mirex-S Max per square meter of *A. sexdens rubropilosa* nest and 77.78, 100.00 and 100.00% control of *A. octospinosus* were recorded, respectivelly, while 10 grams of the dodecachlor bait per square of ant nest reached 77.77% and 100.00% against these two ant species respectivelly, with no significative differences between baits and dosages for the same ant species. Besides these two species, the Mirex-S Max was proved to be highly efficient against many other leaf cutting ant species such as *Atta laevigata, Atta cephalotes, Atta bisphaerica, Acromyrmex subterraneus, Acromyrmex octospinosus* (Hymenoptera: Formicidae). For this reason the Mirex-S Max bait replaced dodecachlor baits in Brazil with environmental and eficiency advantages against leaf cutting.
Index terms: Leaf-cutting ants, granulated baits, methodology of aplication

[2866] AN OVERVIEW OF OCCURRENCE, DEVELOPMENT AND DAMAGE OF BAMBOO MITES AND THEIR INTEGRATED MANAGEMENT IN FUJIAN, CHINA

Y. X. Zhang[1], Z. Q. Zhang[2], Q.Y. LIU[3], J.Z. Lin[1] & J. Ji[1], [1]Institute of Plant Protection, Fujian Academy of Agriculture Science, Fuzhou 350013, China, E-mail: zyxlj@pub3.fz.fj.cn; [2]Landcare Research, Private Bag 92-170, Auckland, New Zealand; [3]Laboratory of Forest Protection, Fujian Forestry Bureau, Fuzhou 350002, China.

This paper gives an overview of the occurrence of mite pests (*Schizotetranychus nanjingensis* Ma & Yuan, *Aponychus corpuzae* Rimando and *Aculus bambusae* Kuang) and their damage to the moso bamboo (*Phyllostachys pubescens*) in Fujian province, China. The effects of mites on the physiology of the plants and their yield are discussed. Possible causes of their outbreaks in bamboo forests are outlined. A schematic model for the integrated management of bamboo mites is proposed.
Index terms: Bamboo (*Phyllostachy pubescens*), mites, outbreak, integrated management

[2867] UTILIZATION OF HOST-SEEKING ATTRACTANTS CONTAINER BREEDING AND FLOODWATER *AEDES* CONTROL

D. L. Kline, USDA, ARS, CMAVE, P.O. Box 14565, Gainesville, FL, 32604, USA, E-mail: dkline@gainesville.usda.ufl.edu.

The traditional approach to vector control, where large geographic areas are treated with chemical insecticides, has several problems associated with it. These include development of insecticide resistance by the target species, negative impact on nontarget species, high cost of insecticides, and potential environmental contamination. These problems have led to the development and evaluation of non-pesticidal (i.e, alternative) control technology. One alternative is the use of attractant-baited targets and traps. Several investigations into the potential use of attractant-baited targets and traps have recently been initiated in Florida against container breeding, fresh and brackish water breeding *Aedes* mosquitoes. The major species that have been targeted are *Aedes albopictus*, *Ae. canadensis*, *Ae. infirmatus*, and *Ae. taeniorhynchus*. Various combinations of attractants (e.g. 1-octen-3-ol, carbon dioxide and several patent-pending human volatile candidate attractants) were tested under field conditions with several trap types. When targets were used instead of traps, they were impregnated with lambdacyhalothrin (0.2g AI/m^2). These targets remained effective, i.e., bioassays of field collected adult female *Aedes taeniorhynchus*, resulted in > 90% mortality, 30 minute post-exposure, for three weeks. Data will be presented that show the importance of species-specific attractant blends, trap type, and trap spacing in obtaining meaningful population reduction. The future prospects of removal trapping for control of nuisance and vector mosquito species will also be discussed.
Index terms: Mosquitoes, human emanations, kairomones, traps, targets, lambdacyhalothrin

[2868] MASS SPECTROMETRIC ANALYSIS OF HUMAN SKIN EMANATIONS TO IDENTIFY COMPOUNDS THAT INFLUENCE THE HOST-SEEKING BEHAVIOR OF MOSQUITOES

U. R. Bernier, United States Department of Agriculture-Agricultural Research Service, Center for Medical, Agricultural, and Veterinary Entomology, 1600 SW 23rd Drive, Gainesville, FL 32608, USA, E-mail ubernier@gainesville.usda.ufl.edu

Kairomones produced by a host, and specifically human hosts, play a major role in the host-seeking behavior of anthropophilic female mosquitoes Because of the disease vectoring capability of mosquitoes that feed upon human hosts, efforts are being made to discover the identity of the chemical compounds that are used in host-location. Multiple sampling techniques for collecting and characterizing human odors have been developed and used to compile a thorough understanding of the volatile chemicals given off by human skin. The sampling techniques mainly comprise collection of chemical emanations in the gas phase with detection by mass spectrometry. One means of allowing for sample identification of highly polar compounds is the use of small glass beads to collect residue from human skin. Although this method does discriminate against highly volatile compounds, it allows for solvent-free loading of the sample and minimizes water deposition from perspiration. Use of this technique has led to the isolation and identification of over 270 compounds present in analyses of human emanations. To adequately characterize the most volatile compounds given off from the skin, purge and trap mass spectrometry was employed to analyze headspace collections of air above a human arm. This technique discriminates against polar compounds, but combined with the glass bead technique, provides a more exact compilation of human produced compounds. Information obtained from these complementary analyses has resulted in the discovery of attractant blends for *Aedes aegypti*, *Anopheles albimanus*, and *Ae. albopictus*. Effective blends do not involve the use of carbon dioxide, except in the case of *Ae. albopictus*, where a suitable substitute for carbon dioxide has not yet been discovered. The best blends are either as efficient, or more efficient than the human arm at attracting laboratory mosquitoes when tested in a triple cage dual port olfactometer. The blends are comprised of as little as two compounds, but become more effective as the number of attractant compounds is increased. Currently, the best blends comprise three components. These are being tested in the field as a way to enhance the efficiency of surveillance traps. Some human-produced emanations have been found to inhibit the attraction of mosquitoes to blends and to the human arm; the potential for use of these in attraction-antagonist technologies is being explored.
Index terms: *Aedes aegypti*, *Anopheles albimanus*, kairomones, attractants, GC/MS

[2869] THEMATING BEHAVIOUR OF ANOPHELES GAMBIAE THROUGHTS ON SPECIATION

D. Charlwood.

ABSTRACT NOT RECEIVED

[2870] OLFACTORY RECEPTORS OF THE MALARIA MOSQUITO ARE SENSITIVE TO HUMAN SWEAT COMPONENTS

J. Meijerink[1, 2] & J. J. van Loon[1], [1]Dept. of Entomology, Wageningen Univ. P. O. Box 8031, Wageningen, NL-6700 EH, The Netherlands, E-mail joop.vanloon@users.ento.wau.nl; [2]Present adress, Dept. of Ecology, Lund Univ., Sölvagatan 37, Lund, SE-22362, Sweden, E-mail jocelijn.meijerink@ekol.lu.se.

Female mosquitoes of the species *Anopheles gambiae* Giles *s.s.* are one of the most important vectors of human malaria in Africa. It is generally assumed that they locate their human host by odours. These odours are detected by olfactory receptor neurons situated on the antenna. Potential kairomones for female *An. gambiae* were identified from human sweat and tested for their sensory activity by means of electrophysiological techniques. Sweat freshly collected from the human forehead did not elicit electroantennogram (EAG) activity. However, sweat which was incubated at body temperature, evoked reproducible EAG responses and attracted female *An. gambiae* in a windtunnel bioassay. GC-MS analysis of the headspace composition of the incubated sweat revealed indole, 1-dodecanol and 3-methyl-1-butanol as most abundant compounds. These were present in only minor or trace amounts in the headspace collections from fresh sweat. Geranyl acetone and 6-methyl-5-hepten-2-one were present in both the headspaces of the fresh and incubated sweat samples. Additional studies revealed that the incubated sweat contains large amounts of ammonia. In order to reveal olfactory receptor neurons responsive to the identified sweat-borne components, studies were conducted at the single cell level. For other mosquito species the grooved peg sensillum is considered to house receptor neurons sensitive to host-odours. Indeed, incubated sweat elicited excitation of a receptor neuron innervating a subpopulation of the grooved peg sensilla. The same receptor neuron was excited by ammonia, implying that ammonia is causing a part of the attractiveness of the incubated sweat. However, most of the tested identified sweat-borne components did not elicit responses of grooved peg receptor neurons but evoked excitation of receptor neurons associated with the sensilla trichodea. Two different subpopulations of sensilla trichodea were found. Neurons innervating one of the subpopulations were sensitive to indole, while the other subpopulation housed receptor neurons sensitive to geranyl acetone. These data suggest that not only the grooved peg receptor neurons encode host-odours but that the sensilla trichodea might fulfil a function in host-seeking behaviour of female *An. gambiae* as well. The function of the different olfactory receptor neurons will be discussed.
Index terms: *Anopheles gambiae*, single sensillum, identification, ammonia

[2871] UNDERSTANDING OF MOSQUITO ATTRACTION THROUGH IDENTIFICATION OF VOLATILE COMPOUNDS EMANATING FROM HUMANS

Willem Takken[1] and Teun Dekker[2], [1]Laboratory of Entomology, Wageningen University, P.O. Box 8031, 6700 EH Wageningen, The Netherlands. E-mail: willem.takken@users.ento.wau.nl; [2] Dept. of Entomology, University of Riverside, California 92521, USA. E-mail: tdekker@ucracl.ucr.edu

In recent years new evidence has shown that host-seeking mosquitoes are attracted to blood hosts by semiochemicals emanating from these hosts. Most mosquito species are opportunistic in this process, having no specific host preference. Exceptions to this rule are *Anopheles gambiae s.s.*, *Aedes aegypti* and *Culex quinquefasciatus*, which all prefer humans above other vertebrates. Compared to other mosquitoes, the latter three species are less dependent on carbon dioxide and respond more strongly to other host volatiles. The question is whether these volatiles are human-specific or not. Humans emit > 500 volatile chemicals, and it seems impossible to test these all individually on their role in the host-seeking behaviour of mosquitoes. Moreover, it is likely that synergism between two or more volatiles occurs that enhances the behavioural response of the mosquitoes. Thus, it is possible that one compound may have a behavioural effect, which is expressed only in the presence of another compound. In recent years, methods have been developed that focus on the identification of the human-specific chemicals that these mosquitoes are expected to use. The paper will discuss these methods and present some recent findings on human kairomones that are attractive for these mosquito species.
Index: mosquitoes, host seeking behaviour, kairomones, human odours

[2872] HOW THE FINE-SCALE PLUME STRUCTURE OF HOST-ODOURS AFFECT THE FLIGHT BEHAVIOUR OF MOSQUITOES

M. Geier, H. Franz, A.M. Rose & J. Boeckh, Institut für Zoologie, Universität Regensburg, Universitätsstr. 31, 93053 Regensburg, Germany, E-mail martin.geier@biologie.uni-regensburg.de.

Odour-modulated optomotor anemotaxis is the primary orientation mechanism guiding insects towards an odour source. The spatial/temporal distribution of the emitted odourants depends mainly on the source's size and the release mode of the odour. In the case of pheromone guided orientation of male moths flying towards a calling female, the plume's typical intermittent fine scale structure is typical for such small objects. This plume structure has been shown essential for the plume following flight manoeuvres of males. Their orientation behaviour and sensory equipment is well adapted to such situations. We investigated whether the odour guided flight orientation of mosquitoes towards their hosts is also adapted to the distribution of kairomones around or downwind from their hosts. We can assume that in this case the emitted odours will initially form a large and probably less disrupted plume. Other characteristic features of the distribution of odours around or downwind of larger animals are due to the fact that attractive odours are emitted in two different ways: (1) with the breath, which is exhaled periodically, and (2) from the skin, which gives off volatile substances continuously by convection currents. To study the flight behaviour of female yellow fever mosquitoes *Aedes aegypti,* we video recorded the plume-following manoeuvres in a Plexiglas wind tunnel with 0.5 by 0.5 cross section and a length of 2m. Using two video cameras and a computer digitising system (WINANALYZE®) we were able to reconstruct the flight paths in 3D. Without any odour stimulation mosquitoes flew predominantly downwind or cross-wind with wide loops (casting flights). Similar flight manoeuvres resulted under constant stimulation with CO2. Sustained upwind flights were rarely observed. In turbulent CO2 plumes, however, 50% of the mosquitoes locked on the plume and flew upwind in a zigzag course. Skin odour also elicited upwind flights towards the odour source, but the flight manoeuvres depend on the plume structure: in turbulent plumes about 50 percent of the mosquitoes reached the odour source and their flight paths were convoluted or zigzag with frequent turns and loops, whereas in broad homogeneous plumes about 90% of the mosquitoes reached the source in fast and straight upwind flights with less turns. We interpret this flight behaviour as an adaptation to the natural situation near the host where the mosquitoes encounter more homogeneous clouds of body odour and more turbulent or disrupted plumes of breath with high fluctuations of CO2.
Index terms: *Aedes aegypti,* mosquitoes, host finding, orientation, odour plume

[2873] RESPONSE OF MOSQUITOES TO NECTAR-RELATED INFOCHEMICALS OF PLANTS

W. A. Foster, Dept. of Entomology, Ohio State Univ., 1735 Neil Ave., Columbus, OH 43210-1220, USA, E-mail: foster.13@osu.edu.

Sugar is a natural component of the diet of adult mosquitoes, both female and male, and is derived from plants, mainly in the form of nectar or honeydew. In the males of practically all species, and among the females of many or most, plant sugar is essential for optimum fitness. It is utilized for all energy-demanding activities, including survival, flight, and reproduction. The energy derived from vertebrate blood is often either insufficient to meet a female mosquito's needs, or prevents the blood meal's full use to meet the female's reproductive potential. Thus, sugar feeding is usually an integral part of adult behaviour. The ability of mosquitoes to find sources of sugar is not well understood. It appears that both the visual and chemical properties of flowers act as orientation cues to mosquitoes for locating floral nectar, just as they do for pollinators. The volatile chemical components of flowers serve as synomones for pollinators and as kairomones to the mosquitoes that steal nectar. Floral volatiles are typically a mixture of compounds, principally terpenes, phenylpropanoids and benzoids, and fatty acid derivatives. It is possible that some of them may serve as attractants in traps, providing an economical alternative to the use of carbon dioxide as a bait in traps used to monitor mosquito populations. Some of these compounds and their mixtures have been tested in the laboratory or field, and their ability to attract mosquitoes has been measured. Results of floral-baited trap catches indicate that mixtures are important, that attraction can be high, and that the sex and species attracted differs from catches in traps using other types of attractants.
Index terms: mosquito, sugar, nectar, floral, attractant.

[2874] SEMIOCHEMICAL STRATEGIES IN MOSQUITOES AND MIDGES

A.J. Mordue (Luntz), Dept. of Zoology, Univ. of Aberdeen, Tillydrone Ave, Aberdeen AB24 2TZ, U.K. E-mail: a.j.mordue@abdn.ac.uk.

A complex array of semiochemicals is involved in the elicitation of behaviours in haematophagous insects with several similar chemicals being required across species for host recognition. Superimposed on this basic pattern are ubiquitous cues such as the alkyl phenols which may enhance overall responsiveness and much more specific host related cues that may play an increasingly important role as host specificity increases in different species. The responses of generalist feeders such as the Scottish biting midge, *Culicoides impunctatus* to host kairomones reveal a wide spectrum of sensitivities to many well known host kairomones e.g. activation by CO_2 attraction to 1-octen-3-ol, acetone, a variety of alkyl phenols and lactic acid. Human kairomones such as specific axillary components may elicit attraction or have no effect in ways that may be different from more anthropophilic species, such as anopheline mosquitoes. Indeed mosquitoes may show exquisite sensitivity to specific human odours. This has been demonstrated in our laboratory with host-seeking female *Aedes aegypti* which find ethanol extracts of axillary swabs taken during ovulation (day 12-14 of menstrual cycle) to be significantly more attractive than swabs taken at other times in the cycle. In oviposition behaviour gravid females may be specifically attuned to habitat related cues that signal their own environment, as seen for example in *C. impunctatus* where females are induced to lay in habitats infused with odours of Juncus spp., an indicator of larval habitat. A great deal of research has been carried out on *Culex quinquefasciatus* oviposition behaviour where ubiquitous background cues (alkyl phenols, indoles) combined with a specific habitat-related cue (3-methyl indole) (skatole) and a female derived oviposition pheromone on the egg rafts, combine to bring about a marked aggregation of oviposition. We have shown in the laboratory that the synthetic pheromone and 3-methyl indole together give synergistic oviposition responses. This fact together with the possibility of cheap pheromone production through the use of plant-derived precursors provides an excellent basis for the practical deployment of ovitraps in surveillance and trapping out methodologies. In both these examples (host and oviposition site-location) ubiquitous cues such as alkyl phenols occur and are used by the insect. The idea of parsimony in environmental semiochemicals, together with the up or down regulation of specific receptors in different physiological states, will be discussed. The role of semiochemical concentration in the elicitation of behaviour and practical aspects of vector control will also be explored.
Index terms: *Culex quinquefasciatus, Aedes aegypti, Culicoides* spp., chemical ecology

[2875] CLIMATE CHANGE, ECOLOGY AND HUMAN DISEASE

Willem Takken[1] and Rudi Slooff[2], [1]Laboratory of Entomology, Wageningen University, P.O. Box 8031, 6700 EH Wageningen, The Netherlands. E-mail: willem.takken@users.ento.wau.nl; [2] 3085 route du Chateau de Pile, F-24520 Cours-de-Pile, France

The anticipated effects of climate change, as predicted by the Intergovernmental Panel of Climate Change (IPCC), will influence many aspects of human health such as nutrition, heart disease, heat stress, skin cancer and infectious diseases. The latter are expected to be most profoundly affected because a large part of the world population is living in countries where basic health care is lacking. As a consequence, people living in poor countries will not be able to profit from measures that can counteract the changes resulting from climate change. Examples of diseases that are likely to increase in prevalence are malaria, leishmaniasis, dengue and cholera. Malaria will spread into highland areas where it is presently absent because of temperature limitations. Also, increased rainfall will favour this disease. Leishmaniasis is expected to spread into semi-desert areas due to the creation of favourable habitats for the phlebotomine vectors. Dengue will profit from a rapid expansion of vector mosquitoes into new areas and from increased episodes of intense rainfall, favouring the creation of breeding sites for the vectors. Cholera is already increasing in incidence and geographic distribution due to the increased frequency of the El Niño events. The expected rise in temperature and increase in frequency of intense rainfall caused by climate change will create ecological conditions where vectors of many parasitic diseases can thrive. It will be difficult to counteract these changes, and we must be prepared to spend more efforts and resources on the prevention of these diseases, in order to avoid epidemics of catastrophic size or enhanced frequencies.
Index: climate change, health, infectious diseases, malaria, leishmaniasis, dengue, cholera

[2876] VULNERABILITY OF LIVESTOCK TO ARTHROPOD PARASITES AND VECTOR-BORNE DISEASES UNDER GLOBAL CHANGE

R. W. Sutherst, N. White & G.F. Maywald, CSIRO Entomology, Long Pocket Laboratories, 120 Meiers Rd, Indooroopilly, Queensland, Australia 4068. Email R.Sutherst@ento.csiro.au

Most of the major parasite and vector-borne disease problems of livestock are caused by tropical species, particularly ticks, myiasis flies and biting flies. As such they are more severe in regions with high temperatures and high rainfalls. At present, these parasite problems usually occur in extensively managed systems that are under increasing pressure to intensify, particularly in developing countries. As low temperatures or dryness limit the ranges of tropical species, their geographical distributions are expected to expand towards the poles and into higher altitudes under global warming. This is likely to bring them into contact with more intensively farmed areas. Increasing human populations and consumption is putting more pressure on the land and leading to a net transfer of pastoral land to cropping. There is increasing pressure on existing grazing, with nutritional deficiencies of livestock making them more vulnerable to parasite attack. Demographic changes in human populations are occurring with ageing populations in developed countries and gross distortions of age structures and gender balances in sub-Saharan Africa due to HIV. Both trends are leading to increased difficulties in the management of livestock and their parasites. While some parasites like screw-worm flies are widely distributed, other less widespread species, such as horn fly, have shown in recent years that they are capable of jumping barriers to colonise new continents. The invasion of S. America by horn-fly provides an insight into future risks under global change, with increasing incidence of invasions by exotic species as a result of accelerating international trade and tourism. Given that several of the most costly species such as horn-fly and the tropical cattle tick are resistant to many of the available chemical pesticides, their spread to new habitats has the potential to force major changes in practices of livestock protection. The Intergovernmental Panel on Climate Change (IPCC) has developed the concept of 'vulnerability' to measure the risk to different industries and regions under climate change. Its application to the cattle industry in Australia under climate change is illustrated. Examples are used to illustrate the effect of a number of different drivers of global change on livestock parasite problems and to highlight some likely interactions between them. Management will need to be aware of interactions between different drivers of change, different parasites and different livestock management systems when designing management options to respond to the changes. An integrated approach to global change risk assessments is essential if holistic solutions are to replace *ad hoc* and uncoordinated responses aimed at individual species.
Index words: Integration, models, interactive effects,

[2877] CLIMATE CHANGE, ECOLOGY AND HUMAN DISEASE

W. Takken & R. Slooff.

ABSTRACT NOT RECEIVED

[2878] THE IMPACT OF DEFORESTATION ON MALARIA: A CASE STUDY FROM THE PERUVIAN AMAZON

A.Y. Vittor[1], J.A. Patz[2], R.H. Gilman[1], J.E. Conn[3], J. Tielsch[1] & G.G. Glass, [1]Dept. of International Health; [2]Dept. of Occupational and Environmental Health; Dept. of Molecular Microbiology and Immunology, Johns Hopkins Univ. School of Public Health, 615 N. Wolfe St., Baltimore, MD 21205, USA, E-mail amy_vittor@hotmail.com. [3]Dept. of Biology, Univ. of Vermont, Burlington, VT 05405, USA.

The Northern region of the Peruvian Amazon has been subjected to deforestation caused in large part by road construction, which opens up previously inaccessible areas to farming, logging, and cattle ranching. Simultaneously, the area has seen a sharp rise in malaria incidence, increasing ten-fold from 1987 to 1997, and an invasion by South America's major malaria vector, *Anopheles darlingi*. We are currently collecting Anopheline adults and larvae in order to better understand the environmental determinants that favor *A. darlingi* breeding and proliferation. We have collected adult Anophelines in 10 sites along the Iquitos-Nauta road and in 20 sites along the nearby Nanay River from December 1998 to June 1999 in deforested and forested areas from 18.00 to 06.00 hours using human landing catches. Preliminary analysis indicates that there is a positive correlation between *A. darlingi* abundance and deforestation, controlling for seasonality and distance from the river. The presence of a forest barrier and livestock did not prove significant. The presence of humans was positively correlated with *A. darlingi* abundance when considered as a binary variable (presence/absence), but the size of the human population when considered as a continuous variable (when > 1) was negatively correlated. *A. triannulatus* and *A. mediopunctatus* abundances were associated with forested areas. We are also examining the *A. darlingi* specimen collected in varied habitats for genetic differences using three techniques including random amplified polymorphic DNA-polymerase chain reaction (RAPD-PCR), restriction fragment length polymorphism (RFLP), and microsatellite analyses. The data from the RAPDs and RFLPs indicate that the specimen from forested sites are genetically more heterogeneous and different from those collected in villages. The microsatellite data suggest that the samples from select forest sites are significantly different from samples from villages with relatively large areas of clearing and pasture land.
Index terms: *Anopheles darlingi*, environmental determinants, RAPDs, RFLPs.

[2879] HIGHLAND FRINGE MALARIA IN AFRICA AND CLIMATE CHANGE

A. K. Githeko[1] & W. Takken[2], [1]Kenya Medical Research Institute, Centre for vector Biology and Control Research, Climate and Human health Research Unite. [2]University of Wageningen, The Netherlands

Highland malaria within latitudes 10S and 10N occurs between altitudes 1500m and 2000 while below latitude 10S epidemics occur at 1000-1200 m. Since 1988, there have been numerous reports of malaria epidemics in East and Southern Africa. For example malaria epidemics have spread from 3 to 15 districts in western Kenya and have also become an annual event. During this period, there has been an increase of about 2°C in the mean monthly maximum temperature in the region 2N-2S, 30E-40E (Kenya, Uganda, and Tanzania). Further climate linked malaria epidemics have been reported in Tanzania and Rwanda. Climate change will have short and long-term impacts on disease transmission. For example, short-term increase in temperature and rainfall as was seen in the 1997/98 El Niño caused *Plasmodium falciparum* malaria epidemics in the East African highlands Research in Kenya has demonstrated that the highlands are complex ecosystems comprising of valleys and plateaus. Malaria in these ecosystems may be either rainfall- driven or rainfall and temperature driven. Deforestation of the highlands may have opened up new breeding sites for *An. gambiae* and *An. funestus* mosquitoes due to the removal of the canopy and an increase in local warming. Vector breeding is a function of hydrology and topography and immunity is inversely related to the distance from the transmission foci. Theoretically, further warming should affect areas above 2000m in East Africa Faced with the loss of efficacy of chloroquine in many parts of Africa, highland malaria is now a serious threat to large populations and it could get worse..

[2880] TICKS AND GLOBAL CHANGE - A HOT TOPIC IN NORTHERN EUROPE!

M. Renstrom & E. Lindgren, Dept. of Natural Resource Management, Stockholm University, SE-106 91 Stockholm, Sweden. E-mail peltis@swipnet.se.

Tick-borne diseases are a growing concern in temperate zones of the Northern Hemisphere. There has been an increase in geographical distribution and density of the disease-transmitting tick, *Ixodes ricinus*, in northern Europe during the 1980s and 1990s. During the same time period the serious human tick-borne infectious diseases Lyme borreliosis and the viral tick-borne encephalitis (TBE) have also increased in distribution range as well as in incidence. There are indications that this increase is related to the milder climate that has been prevalent during the last 2 decades. The projected global warming is therefore likely to cause further increases in tick-borne diseases in the region. Lyme borreliosis is difficult to study due to the scarcity of reliable epidemiological data. On the other hand, long-term analyses of TBE incidence are possible in many European countries and in Sweden in particular. Studies of TBE endemic areas in Sweden during four decades have shown that climatic variations strongly influence disease incidence, and that a combination of milder winters and extended periods during the spring and autumn seasons with temperatures favourable for tick activity is related to the recent increase in TBE incidence. New results show that it would be possible to predict high-risk years for TBE incidence by using seasonal temperature variables. This could be a useful tool for public health authorities for appropriate timing of information campaigns and vaccination programmes against TBE, thus reducing public expenses as well as individual suffering.

[2881] THE INFLUENCE OF URBANIZATION ON VECTOR-BORNE DISEASES

D. J. Gubler, Division of Vector-Borne Infectious Diseases, Centers for Disease Control and Prevention, PO Box 2087, Fort Collins CO USA, E-mail djg2@cdc.gov.

There has been a dramatic global resurgence/emergence of vector-borne diseases in the past 30 years. Of the demographic and societal factors responsible for this resurgence/emergence, unplanned and uncontrolled urbanization are among the most important. Selected diseases will be used to illustrate the impact of urbanization on disease transmission, and challenges to reverse the trend will be discussed.
Index terms: urbanization, vector-borne disease, mosquitoes.

[2882] THE INFLUENCE OF DEFORESTATION ON VECTOR-BORNE DISEASES

D. R. Roberts[1] & P. Masuoka[1], [1]Center for Applications of Remote Sensing and GIS to Public Health, Department of Preventive Medicine, Uniformed Services University of the Health Sciences, 4301 Jones Bridge Rd, Bethesda, MD 20814 U.S.A. E-mail: droberts@usuhs.mil

Forest ecology is variable, as are the arthropod-borne diseases and transmission cycles within forest ecosystems. Human activities bring about various levels of change in forest ecosytems. "Slash and burn" agriculture entails small clearings of forest. Major crop or cattle ranching projects bring about clearcutting of large tracts of forest. The most commercially valuable trees may be selectively cut or all trees may be cut (clearcut) in the process of commercial logging. Additionally, trees may be selectively cut for perennial shade agriculture. The type and purpose of deforestation will influence the time required for forest regeneration. In total, all acts of deforestation, all levels of human interactions with forest ecosystems, and all successional changes associated with forest regeneration will influence potentials for transmission of arthropod-borne diseases, to include both zoonoses and anthroponoses. In some cases deforestation may exacerbate problems of disease transmission and in other cases it may actually reduce disease threat. The threat may change dynamically with forest regeneration. Additionally, the degree of human association and interaction with the forest, forest edge and deforested areas will influence overall risk of disease transmission. These relationships will be illustrated with data on specific arthropod-borne diseases (e.g., malaria and arboviruses), with emphasis on tropical rain forests and diseases of the Americas. Statistics on rates of deforestation and maps showing distributions of tropical rain forests will be presented.
Key words: deforestation, disease ecology, vectors

[2883] THE INFLUENCE OF WATER PROJECTS ON VECTOR-BORNE DISEASES

A. Spielman

ABSTRACT NOT RECEIVED

[2884] THE INFLUENCE OF WAR AND CONFLICT ON VECTOR-BORNE DISEASES

D. H. Molyneux.

ABSTRACT NOT RECEIVED

[2885] CLIMATE CHANGE AND VECTOR-BORNE DISEASES

P. Reiter, Dengue Branch, Division of Vector-Borne Infectious Diseases, National Center for Infectious Diseases, Centers for Disease Control and Prevention (CDC), U.S. Department of Health and Human Services, 2 Calle Casia, San Juan, Puerto Rico 00921-3200, Tel: 1 787 766 5181, Fax: 1 787 766 596, e-mail:preiter@cdc.gov

Global atmospheric temperatures are presently in a warming phase that began 250-300 years ago. Speculations on the potential impact of continued warming often focus on the vector-borne diseases. Elementary models, based on the concept of vectorial capacity, suggest that higher global temperatures will enhance their transmission rates and extend their geographic ranges. However, the history of three such diseases—malaria, yellow fever and dengue—reveals that climate has rarely been the principal determinant of their prevalence or incidence. In cohort with local ecology, human activities were by far the most significant factor, and remain so today. It is therefore inappropriate to use such models to predict future prevalence.

[2886] *CULEX NIGRIPALPUS*--AVIAN INTERACTION AND THE TRANSMISSION OF ST. LOUIS ENCEPHALITIS

J. F. Day, Florida Medical Entomology Laboratory, Institute of Food and Agricultural Sciences, University of Florida, 200 9th Street SE, Vero Beach, FL 32962.

Blood and serum from 3,915 wild and domestic birds (2,590 resident, 139 migrant, and 1,186 captive), representing 56 species collected in central Florida from 1989 through 1997, were analyzed for evidence of St. Louis encephalitis (SLE) virus transmission. All sera were tested for SLE hemagglutination inhibition (HI) antibody. Selected sera and bloods were tested for SLE neutralizing (NT) antibody and virus. The reproductive success of resident birds was highest from 1990-1992 and lowest from 1994-1997. Transmission of SLE to resident birds, especially Mourning Doves (MODO), peaked during the summer of 1990, a year during which a widespread SLE epidemic was recorded in central Florida. The SLE antibody-positive resident birds first appeared during September of the epidemic year. Some SLE, HI antibody-positive birds were captured throughout 1991, but only 5% were yearlings, compared with 36% in 1990. By 1993, wild resident birds expressing HI and NT antibodies to SLE had nearly disappeared. None of the migrant birds tested were SLE-positive. Sentinel chickens maintained in Indian River County during the epidemic year seroconverted to SLE starting in early July with peak seroconversion rates in August, September, and October. High (≥50%) SLE seroconversion rates in sentinel chickens preceded those in wild birds by 10 wk and preceded peak human SLE transmission by at least 8 wk. Major SLE epidemics in south Florida depend on abundant wild bird populations, especially during the amplification phase of the transmission cycle. We propose that hard winter freezes along the temperate-subtropical climatic zone interface in central Florida, at approximately 27°30' North Latitude, opens foraging and nesting habitats for ground-feeding birds, resulting in high reproductive success and an abundance of seronegative individuals that rapidly amplify the SLE virus later in the year.
Index terms: avian amplification hosts, encephalitis, St. Louis encephalitis, arboviral transmission

[2887] FEEDING BEHAVIOR OF *AEDES AEGYPTI* AND DENGUE VIRUS TRANSMISSION

T. W. Scott[1], [1]Dept. Entomology, Univ. of California, Davis, CA 95616, USA. E-mail twscott@ucdavis.edu

Aedes aegypti is among the most important arthropod vectors of microbial pathogens to humans. It is the principal vector of dengue virus worldwide, a disease that causes more human morbidity and mortality than any other arboviral infection. In this presentation I will review a decade of research on patterns and processes of *Ae. aegypti* feeding behavior that favor efficient transmission of dengue virus and constitute a significant challenge to the prevention of disease. Longitudinal data from dengue endemic areas in Thailand and Puerto Rico indicate that *Ae. aegypti* feeds almost exclusively and frequently on human blood. Almost all (≥ 95%) engorged females examined by ELISA contained human blood. Histological examination of engorged specimens revealed that overall 34 to 47% of the mosquitoes imbibed > 1 blood meal in a single gonotrophic cycle. On average females took ~0.6 to 0.8 human blood meals per day. However, the frequency and time interval between multiple meals varied within and between study areas. In Thailand 65% of the mosquitoes fed twice on the same day, whereas in Puerto Rico 57% took multiple meals separated by ≥1 day. Rates of multiple feeding were associated positively with temperature and negatively with mosquito size in Thailand, but not in Puerto Rico. Ongoing DNA fingerprinting analyses using hypervariable genetic markers indicate that mosquitoes often feed on more than one person within a short time period. Moreover, field collected females rarely contained detectable fructose (2 to 21%). Results from lab and field studies indicate that female *Ae. aegypti* with a diet restricted to human blood have a significant selective advantage (e.g., net replacement rate and intrinsic rate of growth) over those fed blood and sugar. Deviation by *Ae. aegypti* from the feeding duality (blood and plant carbohydrates) that has been reported for females of most other mosquito species results in such frequent contact with human hosts that entomological thresholds for dengue transmission are expected to be low. Although the nature of the relationship between *Ae. aegypti* population density and risk of human dengue virus infection remains undefined, frequent contact by this species with its human hosts will make vector control, short of vector eradication, a formidable challenge for the prevention of disease.

Index terms: mosquito, vector, blood feeding, fitness.

[2888] FITNESS ADVANTAGE FOR YELLOW FEVER MOSQUITOES (*AEDES AEGYPTI*) THAT FEED ON HUMAN BLOOD

J. D. Edman[1] & L. C. Harrington[1], [1]Dept. of Entomology, Univ. of California, P. O. Box 2324, Davis, CA 12345-3456, USA, E-mail jdedman@ucdavis.edu

Aedes aegypti, the urban vector of dengue and yellow fever viruses, feed almost exclusively on humans. This seems paradoxical since egg production by this and other species, is lowest when fed on human blood. Human hemoglobin contains almost no isoleucine (ILE), and human plasma contains low to moderate titers of free ILE compared with other available hosts. The sub-optimal amount of this essential amino acid for egg development was therefore thought to be responsible for limiting egg production with human blood. We recently discovered in Thailand and Puerto Rico that wild female *Ae. aegypti* seldom feed on plant sugar, an important nutritional input in all previous laboratory experiments with this species. Instead, they fed frequently and almost exclusively on human blood. In light of these findings, we reinvestigated the effect of high and low concentrations of ILE in blood on the accumulated energy reserves, survival and reproduction of this important vector. By tracking individual females over time, we determined effects with greater accuracy and accounted for differences in the volume of blood ingested. We utilized a method that allows for analysis of the glycogen, sugar and lipid content of individual mosquitoes and we simulated nature by providing daily blood meals but no sugar except in two comparative experiments. Initial results failed to confirm previous reports of greater egg production among females fed ILE-supplemented blood artificially but demonstrated the accumulation of greater energy reserves when mosquitoes were daily offered normal, low-ILE human blood. A subsequent experiment supported these findings and suggested that *Ae. aegypti* take smaller but more frequent blood meals when offered a human host daily compared with a high-ILE rodent. We then confirmed that egg production could be enhanced by feeding females on high-ILE blood if they had previously fed on sugar. This explained the discrepancy with previous reports and the apparent fitness paradox involving species that selectively feed on humans. In a final life table study, we documented the long-term fitness advantages of human blood feeding for this mosquito. In addition to 42% longer age specific survival (l_x) when fed on human blood, reproductive output (m_x) and the cumulative net replacement rates (R_0) also were greater than for rodent-fed mosquitoes. These results demonstrate both an energetic and reproductive advantage for *Ae. aegypti* that feed on humans. Their propensity for frequently feeding on human blood, concomitant with enhanced survival, dramatically increases the capacity of *Ae. aegypi* to efficiently disseminate viral pathogens among humans.

Index terms: mosquito, *Aedes aegypti*, host-blood type, nutrition, fitness

[2889] BIODEMOGRAPHIC AND EPIDEMIOLOGIC CONSEQUENCES OF MORTALITY IN THE YELLOW FEVER MOSQUITO

L. M. Styer[1], T. W. Scott[1] & J. R. Carey[1], [1]Dept. of Entomology, Univ. of California, One Shields Ave, Davis, CA 95616-8584, USA, E-mail: lmstyer@ucdavis.edu.

The yellow fever mosquito, *Aedes aegypti*, affects the health of billions of people each year by transmitting viruses that cause dengue and yellow fever, two of the most important arthropod-borne viral diseases worldwide. While yellow fever has been effectively controlled by vaccination, the only reliable method to limit the spread of dengue is through control of the mosquito vector. Since the 1950's, medical entomologists have recognized the importance of adult mosquito survival in determining the extent of pathogen transmission and this insight led to the extensive use of adulticides to reduce the daily survival of adult mosquitoes. Models of vector borne disease spread, such as vectorial capacity, use entomological factors of mosquito density, biting rate, vector competence, and mosquito daily survival to predict the number of new human infections resulting from a single infected person entering a fully susceptible population. Mosquito survival rate is the most sensitive component of these pathogen transmission models because of the extended incubation period of pathogens in their mosquito hosts, in some cases lasting as long as two weeks. A key assumption of a majority of these models, however, is that mosquitoes experience a constant mortality rate at all ages. We tested this assumption of age-independent mortality by examining the mortality patterns of a large population of >100,000 *Ae. aegypti*. The resulting daily mortality curves refuted the hypothesis that mortality is age-independent and revealed distinct age and sex-specific mortality patterns. To determine the effects of dynamic mortality patterns on values of vectorial capacity, we modified the vectorial capacity equation to account for age-dependent mosquito mortality. When compared to a model that assumed constant mortality, the age-dependent modification resulted in increased values of vectorial capacity for young mosquitoes and was most sensitive to changes in early mortality rates. Not accounting for dynamic mortality when assessing different vector-borne disease control strategies could result in an overestimation of entomological thresholds, resulting in vector population levels that are sufficient for pathogen transmission, even after "presumed suitable" control measures have been implemented. Concepts associated with the study of vector mortality patterns in pathogen transmission are broadly applicable to a variety of vector-borne diseases. A better understanding of the mortality patterns of Ae. aegypti will contribute to improved control measures of this and other important vectors of arthropod-borne pathogens.

Index terms: *Aedes aegypti*, mortality, vectorial capacity, entomological threshold.

[2890] INTERACTIONS BETWEEN MALARIA PARASITES AND THE MOSQUITO VECTOR

P. Billingsley, R. Wilson, C. C. & D. Gare, Department of Zoology, University of Aberdeen, Tillydrone Avenue, Aberdeen AB24 2TZ, Scotland, U.K. E-mail: p.billingsley@abdn.ac.uk

The mosquito midgut is the site of profound changes in the development of malaria parasites. This talk will focus on two aspects of this development -the recognition of the midgut wall by the ookinete and the responses of the epithelium to the developing oocyst. Ookinetes of *Plasmodium berghei* will recognise GlcNAc-rich synthetic substrates *in vitro* and the same sugar can be targeted *in vivo* to inhibit parasite infectivity to the mosquito. In a reciprocal interaction, the mosquito midgut responds to infection by production of a mannan-binding lectin which further modulates infectivity. At the base of the midgut epithelium, the basal lamina is an extracellular matrix rich in collagen IV and laminin. We have characterised the collagen IV gene expressed in the mosquito midgut, and its expression during larval and adult development and parasite infection. These results will be reviewed in the context of vector-parasite studies elsewhere and their significance to future malaria control strategies outlined.

Index terms: mosquito, midgut, carbohydrate, lectin, extracellular matrix

[2891] DYNAMIC CHANGES IN LYME DISEASE SPIROCHETE POPULATIONS DURING TRANSMISSION BY NYMPHAL TICKS

J. Piesman[1], [1]Div. Vector-Borne Infectious Diseases, CDC, P.O. Box 2087, Ft. Collins, CO 80522, USA. E-mail jfp2@cdc.gov.

Nymphal *Ixodes scapularis* ticks are the principal vectors of Lyme disease spirochetes (*Borrelia burgdorferi* sensu stricto) in North America. Human risk of acquiring Lyme disease is closely related to the duration of attachment of these nymphal ticks. There is virtually no risk of transmission during the first 24 hrs of nymphal attachment, little risk during the second 24 hrs, and dramatically increasing risk after 48 hrs of tick feeding. Thus, human risk of acquiring Lyme disease can be dramatically reduced through prompt tick removal. The factors regulating the dispersal and transmission of these spirochetes during tick feeding are quite complex. Before infected nymphs start to feed, spirochetes are restricted mainly to the midgut. During feeding, rapid multiplication of the spirochete population takes place, followed by subsequent dispersal to the hemolymph and salivary glands, and eventual transmission to the host. Along with this dispersal is a shift in the Outer Surface Protein (OSP) of these spirochetes from OSPA to OSPC. OSPC may be a host adapted surface protein. Regulation of the expression of these outer surface proteins has been related to both temperature and spirochete abundance. In addition, the presence of host factors such as plasminogen may influence spirochete dispersal. Current studies in the Lyme Disease Vector Section focus on defining changes in spirochete populations during tick feeding. The OSPA human Lyme disease vaccine acts to decrease spirochete populations in the tick midgut, thus preventing spirochete multiplication, expression of OSPC, spirochete dispersal to the salivary glands and transmission to the host. This is a unique mode of action for a human vaccine. The dynamics of transmission risk of the agent of human granulocytic ehrlichiosis is quite different from that of Lyme disease spirochetes.

Index terms: *Ixodes scapularis*, *Borrelia burgdorferi*, salivary glands

[2892] INTERACTION AMONG MULTIPLE *IXODES SCAPULARIS*-BORNE PATHOGENS AND THEIR HOSTS

D. Fish[1], M.L. Levin[2] & F. DesVignes[3], [1]Dept. of Epidemiology and Public Health, Yale School of Medicine, 60 College Street, P.O. Box 208034, New Haven, CT USA 06520-8034 [2]CDC, Viral and Rickettsial Zoonoses Branch, 1600 Clifton Road, MS - G13, Atlanta, GA USA 30333 [3]Massachusetts State Dept. of Health, Bureau of Communicable Disease Control, 305 South St., Jamaica Plains, MA USA 02130.

Ixodes scapularis, the most wide spread Nearctic representative of the Holarctic *Ixodes persulcatus* tick species complex, vectors a diverse fauna of pathogens that infect humans, domestic animals, and wildlife. The dominant pathogens, *Borrelia burgdorferi*, causative agent of Lyme disease and *Ehrlichia phagocytophila*, causative agent of human granulocytic ehrlichiosis, coexist over much of the range of *I. scapularis* and appear to be independently maintained through different reservoir-host cycles. Coinfection prevalence in host seeking ticks consistently approximates the product of single infection prevalence. Experimental transmission from vector to vertebrate host is independent of coinfection, although *E. phagocytophila* is more rapidly transmitted than is *B. burgdorferi*. Acquisition of pathogens by ticks feeding upon experimentally infected individual reservoir hosts is not independent when hosts are previously infected with either pathogen. Previous infection appears to reduce reservoir capacity for a second pathogen as determined by xenodiagnosis. Also, host immunity differentially affects host reservoir capacity. Hosts infected with *E. phagocytophila* are infectious to ticks for a shorter time period compared to *B. burgdorferi*. These results demonstrate greater complexity in the natural maintenance cycles of tick-borne pathogens than has been previously recognized.

Index terms: Tick, pathogens, Lyme disease, ehrlichiosis

[2893] TICK-HOST INTERACTIONS IN THE CO-FEEDING TRANSMISSION OF TICK-BORNE ENCEPHALITIS VIRUS: CELL INVOLVEMENT

M. Labuda[1], M. Kazimírová[1], E. Ele ková[2], M. Slovák[1], N. Fuchsberger[2] & P.A. Nuttall[3], [1]Inst. Zoology, Slovak Acad. Sci., 842 06 Bratislava, Slovakia, E-mail uzaelabu@savba.sk; [2]Inst. Virology, Slovak Acad. Sci., 842 45 Bratislava, Slovakia; [3]CEH Institute of Virology and Environmental Microbiology, Oxford OX1 3SR, United Kingdom.

Studies on the non-viraemic co-feeding transmission of tick-borne viruses indicate a complex interaction between viruses, ticks and hosts at the tick – vertebrate host interface. Cellular involvement at the site of tick feeding has been clearly demonstrated when tick-borne encephalitis (TBE) virus and selected natural rodent hosts were used in the experiments. Very efficient virus transmission during co-feeding of infected and uninfected ticks on the same host, irrespective of the levels of viraemia was accompanied by virus infection in the skin feeding sites of both infected and uninfected ticks. Viraemia did not induce generalized infection of the skin. The results indicate that the local skin tick feeding site is an important location for primary virus replication in the host. Virus susceptibility of host skin-associated cells seems to be a prerequisite for subsequent transmission between co-feeding ticks. Titration of virus in skin homogenates and of virus produced by skin explants was used to assess the ability of the host to support transmission of TBE virus. Results showed the most efficient amplifying host among the tested species was *Apodemus flavicollis*. A host species susceptible to generalized infection and developing high viraemia was not necessarily very efficient in supporting TBE virus transmission, as observed with *Pitymys subterraneus*. The possible explanation is that the tick associated skin infection of the given host species does not favour virus transmission between co-feeding ticks. Among the cells recruited into the tick feeding site in the skin are Langerhans cells, very potent antigen presenting cells, and these were infected with TBE virus. It is reasonable to assume they carry the infection into the draining lymph nodes. This hypothesis is being tested experimentally by co-culture of uninfected lymph nodes with infected skin explants. Immunomodulatory activities in tick saliva, like the observed suppression of IFNα and NK cells can also be host specific and may be important in supporting non-viraemic transmission.

Index terms: tick, non-viraemic transmission, skin infection, Langerhans cells.

[2894] CO-FEEDING: EPIDEMIOLOGICAL SIGNIFICANCE FOR TICK-BORNE PATHOGEN TRANSMISSION

S.E. Randolph, Dept. of Zoology, Univ. of Oxford, South Parks Road, Oxford OX1 3PS, UK. e-mail: sarah.randolph@zoology.ox.ac.uk

The transmission of a non-systemic infection from an infected tick to uninfected ticks co-feeding on the same host individual has a number of quantitative and qualitative consequences for the distribution of tick-borne pathogens. First, vertebrates that are unable to develop systemic infections may nevertheless contribute to enzootic cycles. For example, sheep on high moorland grazings in UK support cycles of Lyme borreliosis in the absence of other hosts, thereby expanding the range of Lyme spirochaetes. This may subject them to new forces of evolutionary change. Secondly, non-systemic infections are less virulent, permitting better survival of infected hosts. Thirdly, this transmission route exploits the markedly aggregated distribution of ticks amongst their hosts; when such distributions of both immature tick stages are coincident rather than independent, the number of infectible larvae co-feeding with any one infected nymph is significantly increased. For tick-borne encephalitis virus (TBEv), for example, these latter two factors raise the transmission potential to a level that permits persistent enzootic cycles, but only under certain climatic conditions. This accounts for the limited, focal distribution of TBEv within parts of Europe. Co-feeding, non-systemic transmission has now been recognized for tick-borne viruses and bacteria, and also for insect-borne viruses. It may well prove to be a wide-spread phenomenon accounting both for the ecological diversity of some vector-borne infections, and; in contrast, for the ecological specificity of others.

Index terms: *Ixodes ricinus*, tick-borne encephalitis, Lyme borreliosis, enzootic cycles

[2895] BACTERIAL SYMBIONTS AND THE CONTROL OF CHAGAS DISEASE

P. M. Pennington[1], E.M. Dotson[1], R.V. Durvasula[2] & C.B. Beard[1], [1]Centers for Disease Control and Prevention, Dept. of Parasitic Diseases, 4770 Beuford Hgwy., Chamblee, GA 30341, USA; [2]Yale Univ. School of Medicine, Dept. of Internal Medicine, 333 Cedar St., New Haven, CT 06510.

Chagas disease is caused by *Trypanosoma cruzi* and is transmitted by a number of triatomine species belonging to the family Reduviidae. Control is achieved primarily by reducing or eliminating domiciliary vector populations through insecticide spraying. The efficacy of these programs is dependent on long-term sustainability, and a major obstacle to success is reinfestation of homes after spraying. For this reason, we are developing a potential control method to be used in conjunction with insecticide spraying. This strategy consists of genetically modifying the vector's symbiotic bacteria to express anti-parasitic agents in the insect's gut. Introducing these recombinant bacteria into reinfesting bug populations would make them refractory to *T. cruzi* infection, decreasing their vectorial capacity. The major vectors of Chagas disease in Central America are *Rhodnius prolixus* and *Triatoma dimidiata*. We are currently developing genetic systems for endosymbionts of these two species. We have transformed *Rhodococcus rhodnii*, the symbiotic bacteria of *R. prolixus*, using a DNA integration vector containing the L1 phage integrase and a marker gene. The integrated marker genes were inserted only once into the genome. Further analysis revealed at least six different insertion sites in individual clones. Resulting transformants were stable over 100 generations. A construct is also being tested that contains the cecropin A propeptide, thus allowing secretion of an inactive peptide into the gut lumen where it will be activated upon blood ingestion. We are currently assessing the site of release of this cecropin A peptide in 27 bacterial clones that contain this construct. The symbiotic bacteria of *T. dimidiata* have not been previously identified. Because each triatomine species harbors different bacteria, finding the appropriate symbiont-vector relationship is pivotal to this control strategy. The gut microbial flora of field-caught specimens was isolated, characterized, and preliminary identifications made by sequencing the 16S rRNA gene. The symbiotic potential of selected isolates was assessed. Preliminary data suggest that one isolate, *Gordona terrae*, which is related to *R. rhodnii*, provides a symbiotic function. Transformation of this bacterium is currently being evaluated using both DNA integration vectors and homologous recombination.

Index terms: Reduviidae, endosymbiont, recombinant, cecropin

[2896] EXPRESSION OF SINGLE CHAIN ANTIBODIES BY INSECT SYMBIONTS

R. V. Durvasula.

ABSTRACT NOT RECEIVED

[2897] WOLBACHIA AS AGENT FOR CONTROLLING INSECT-BORNE DISEASES IN HUMANS

S. O'Neill.

ABSTRACT NOT RECEIVED

[2898] WOLBACHIA AND GENETIC MANIPULATION OF PREDATORY MITES

M. A. Hoy.

ABSTRACT NOT RECEIVED

[2899] BACTERIAL SYMBIONTS AND THE CONTROL OF AFRICAN TRYPANOSOMES

S. Askov.

ABSTRACT NOT RECEIVED

[2900] SYMBIONT-MEDIATED MALE-KILLING AND THE POTENCIAL BIOTECHNOLOGICAL APPLICATIONS

G. Hurst.

ABSTRACT NOT RECEIVED

[2901] RANGE EXTENSION OF *IXODES SCAPULARIS* AND LYME DISEASE IN NORTH AMERICA

U. Kitron[1] & M. Wilson[2], [1]Dept. of Veterinary Pathobiology, Univ. of Illinois, 2001 S. Lincoln Ave., Urbana, IL 61802, U.S.A. E-mail: u-kitron@uiuc.edu; [2]Dept. of Biology, Univ. of Michigan, Ann Arbor, MI 48109, U.S.A. E-mail: wilsonml@umich.ed

The distribution of *Ixodes scapularis* and the risk of Lyme disease have been expanding over the past couple of decades as this tick vector invades new sites. Possible determinants include increased host abundance, transport by hosts, changes in landcover/land use, and human activity. Increased awareness of Lyme disease risk and availability of new tools for control and prevention impact on risk in complex ways. In the North-Central U.S., a slow and gradual expansion of the main focus in western Wisconsin/eastern Minnesota has taken place, and several new smaller foci have become established in surrounding states. Successful invasion and establishment in a new site depends on frequency of introductions, nature of the habitat, and suitability/availability of hosts. Migratory birds and dispersing deer, particularly along riparian corridors, seem to provide ample opportunity for repeated introductions of *I. scapularis* ticks. Much habitat appears highly suitable. Apparently, however, most such introductions rarely result in successful establishment and development of new foci, suggesting that microclimatic conditions may not be suitable. Recent mild winters of the late 1990's may have permitted establishment of several new enzootic sites, particularly along the Illinois River. Micro and macro-scale analysis of environmental determinants and their association with tick abundance in over 100 sites in the upper Midwest, allowed for the development of a habitat risk profile for ticks and Lyme disease transmission. Based on bedrock geology, quaternary deposit, soil order, elevation, vegetation and climatic variables, probability of establishment and possible limits on tick abundance in new and potential sites can be evaluated. Geographic information systems and spatial statistics were used for data association and analysis. Satellite data are evaluated for use as surrogates for environmental determinants of tick distribution

Index terms: tick, invasion, risk, GIS, spatial statistics

[2902] SAME VECTOR, SIMILAR HOSTS, DIFFERENT PATHOGENS: CONTRASTING RISK MAPS OF LYME BORRELIOSIS AND TICK-BORNE ENCEPHALITIS ACROSS EURASIA

S.E. Randolph, Dept. of Zoology, Univ. of Oxford, South Parks Road, Oxford OX1 3PS, UK. e-mail: sarah.randolph@zoology.ox.ac.uk

In Europe, the bacterial spirochaetes *Borrelia burgdorferi s.l.* that cause Lyme disease and the virus that causes tick-borne encephalitis (TBEv) are transmitted by the same tick (*Ixodes ricinus*) and share the same ubiquitous hosts (mice of the genus *Apodemus*). Yet they show very different patterns of spatial distribution. Whereas Lyme spirochaetes circulate more or less wherever there are ticks, TBEv occurs only in well-defined foci within central Europe and the Baltic States. In contrast, across the Russian Federation, the distribution of both Lyme spirochaetes and TBEv coincide with that of its vector tick, *I. persulcatus*. Explanations for these contrasting epidemiologies lie in the biological features of the tick-pathogen-host interactions, specifically the duration of infectivity in the vertebrate, the routes of transmission from tick to tick *via* the vertebrate, and the range of hosts competent to support these transmission routes. From theoretical considerations and analyses of field data it is clear that enzootic cycles of TBEv only exist where particular climatic conditions promote a specific pattern of tick seasonal dynamics. Thus TBEv is limited by abiotic factors, which can be identified from satellite imagery, allowing continental-scale risk maps to be drawn. This understanding permits us to make predictions about future risk under changing environmental conditions. Lyme borreliosis, by contrast, is limited by biotic factors operating against a generally permissive abiotic background. In particular, the interaction of diverse *Borrelia* genotypes with an even more diverse array of vertebrate host species determines the variable infection prevalence in ticks, and therefore risk to humans. Although these biotic factors will certainly have environmental correlates that may be remotely sensed by satellites, the specific relationships have not yet been established to allow them to be incorporated into risk maps.

Index terms: *Ixodes ricinus*, satellite imagery, landscape epidemiology

[2903] SPATIAL AND TEMPORAL HETEROGENEITY IN DENGUE VIRUS TRANSMISSION AND *AEDES AEGYPTI* POPULATION DENSITIES IN IQUITOS, PERU

A. C. Morrison[1], K. Russell[2], A. Getis[3], D. Watts[2], D. Focks[4], C. Calampa[5], K. Gray[3], H. Astete[1], K. Block[2], C. Oman[4], Zyzak, M[2] & T. Scott[1], [1]Dept. Entomology, 1 Shields Ave., UC Davis, Davis, CA 95616; [2]NMRCD, Unit 3800, APO AA 34031 Lima, Peru; [3]Dept. Geography, SDSU, 5500 Campanile Dr., San Diego, CA, 92182, USA; [4]Ctr Med. Agr. Veterin. Entomol., USDA, 1600/1700 SW 23rd Dr., P.O. 14565, Gainesville, FL 32604, USA; [5] Dirección de Salud de Loreto, Av. 28 de Julio, Punchana, Iquitos, Peru.

We report data from a longitudinal cohort study designed to determine the quantitative relationship between *Aedes aegypti* (L.) population density and risk of dengue virus transmission. Entomological surveys for larvae, pupae, and adult Ae. aegypti were initiated in January 1999 in neighborhoods where blood samples were also obtained from school children for dengue serological testing. We geo-referenced all surveyed houses, including those of the school children, and managed these data in a GIS developed for the Amazonia city of Iquitos. Between January and September 1999, we surveyed 6,600 houses located in 8 geographic regions (range 358-1356 houses/region) in Iquitos. Pearson correlations were calculated for measures of entomological risk and dengue sero-prevalence rates at 3 geographic scales: 8 zones, 33 subzones, for individual households. Sero-prevalence rates for dengue 1, dengue 2, or both in the 8 zones ranged from 48% to 76%. At the zone-level, the house (HI; 16-37%), container (CI; 4-11%) and Breteau (BI; 27-76%) indices were significantly correlated to each other (r=0.8-0.9; $P < 0.05$), but only the BI was significantly correlated with the number pupae/ha (range; 56-287; $r = 0.8$, $P < 0.05$). No correlation of larval indices was observed with adult mosquito collections at this geographic scale. At a finer geographic scale, however, there was significant correlation between larval indices, pupal indices, and adult collections (r = 0.4-0.8, $P < 0.05$). Dengue-seroprevalence rates were significantly correlated with the BI and pupae/ha at the zone level and with pupae/ha and pupae/person at the subzone level. The Northern part of the city had the highest sero-prevalence rates and *Ae. aegypti* indices. Preliminary sero-incidence rates from the same areas are consistent with the sero-prevalence rates observed in the baseline blood samples. In addition, temporal variation in *Ae. aegypti* population densities was observed. We conclude that the differences in *Ae. aegypti* population densities were consistent with observed spatial differences in dengue virus transmission, but that the predictive value of different measures of entomological risk varies with the geographic scale at which the analysis is carried out.
Index terms: vector, spatial statistics, serology

[2904] DISPERSAL OF HAEMATOPHAGOUS DIPTERA IN NORTH AMERICA: METEOROLOGY AND FLY BIOLOGY

C.J. Jones[1], University of Illinois College of Veterinary Medicine. Parasitology Division, Department of Veterinary Pathobiology, Basic Sciences Building, 2001 S. Lincoln Avenue, Urbana, Illinois, 61802, U.S.A. carljone@uiuc.edu.

Haematophagous diptera utilize a variety of methods when dispersing. Significant rates and distances of transportation of larval stages is most likely to be accomplished as an infestation of a vertebrate host or in moving water. Eggs may be transported as on inanimate objects, plants or paratenic animal hosts. Although immature dispersal may at times be of interest in disease transmission, normally it is the movement of adults about which we are most concerned. Both the distance moved and the chronological and physiological age of dispersing flies can be of paramount importance in determining not only the probability of disease transmission by competent vectors, but the potential for control at the origin. Both the source and the time spent in travel by allochthonous flies can determine both the timing and technology for control procedures as well as leading to a better understanding of the factors surrounding the development of new disease foci. Physiological age-grading was developed for most important vector species by the middle of the twentieth century and extended to most synanthropic haematophagous arthropods by the mid 1980s. Chronological age, which plays such an important part in the development of viral and parasitic diseases transmitted by flies, has been more recalcitrant to analyses. Not only can chronological age be of epidemiological importance, but it can be used in determining the distance and direction of fly dispersal, especially when combined with meteorological data. Currently, the most effective accepted way of chronological age-grading for diptera is the measurement of pteridine accumulation from the eyes. When combined with physiological age-grading, temperature data and prevailing wind or frontal movement information, chronological age can be used to develop reliable estimates of both the direction and distance traveled by synanthropic flies. In some cases, genetic technology can provide additional evidence of dispersal, but many common vector species have high genetic homogeneity. The relevance of these techniques and that of emerging technology such as near infra-red imaging, drone aircraft for insect monitoring, insect monitoring radars, and doppler weather radars will be discussed.

[2905] MICROEPIDEMIOLOGY OF MALARIA IN WESTERN KENYA

W.A. Hawley[1,2], M. Ombok[2], L. Kamau[2], J. Gimnig[1,2], A. Hightower[2], [1]Division of Parasitic Diseases, Centers for Disease Control and Prevention, Atlanta, GA 30333 USA, email byh0@cdc.gov; [2]Kenya Medical Research Institute, PO Box 1578, Kisumu, Kenya.

Spatial and temporal variability in malaria transmission patterns is described in a 70km^2 of western Kenya where malaria is holoendemic. Mosquito abundance was determined in over 800 individual houses over a 3 year period. Over the same period, malaria morbidity and mortality was measured for children less than 5 years old living in each house. Houses and appropriate geographic features were mapped using differential GPS. Marked variability in abundance of both major vectors—*Anopheles gambiae* and *An. funestus*--is partly explained by rainfall patterns and topography. Though the spatial pattern of variation in transmission shows some stability over time, much of the observed variation in abundance of these vectors is associated with seasonal variation in rainfall. We relate temporal and spatial variation in transmission of malaria to incidence of *Plasmodium falciparum* infection in young children living in this area. We also correlate variation in abundance of vectors to outcome measures directly related to malaria infection in children: fever combined with high parasitemia, anemia of different levels of severity, and mortality. Results show that spatial variation in these outcomes is only partly explained by spatial variability in transmission intensity. Reasons for this observation are discussed in the context of malaria control in Africa.
Index terms: *Anopheles gambiae*, *Anopheles funestus*, malaria, spatial variation

[2906] INTEGRATING REMOTELY-SENSED DATA INTO BIOLOGICAL MODELS OF TRYPANOSOME TRANSMISSION IN AFRICA

D.J. Rogers & S.E. Randolph, Dept. of Zoology, Univ. of Oxford, South Parks Road, Oxford OX1 3PS, UK. e-mail: david.rogers@zoology.ox.ac.uk.

Hitherto, dynamical models for vectors and vector-borne disease transmission, where they exist, are driven by climatic factors, principally those that determine the rates of density-independent mortality of the various life-history stages of the vector. Density-dependent mortality rates are also an essential component. Based on the strong relationships between satellite data and the environmental conditions relevant to arthropod vectors, and between satellite-derived environmental variables and vector mortality rates directly, the original model for tsetse flies in Africa has now been modified to be driven solely by satellite data. The model explains 93% of the variance in fly catches from a region of The Gambia, West Africa. This tsetse population model has been coupled with trypanosome transmission equations to predict the seasonally changing levels of trypanosome infections in local herds of N'Dama cattle in The Gambia. The model explains 57% of the observed variance in the mean level of infections and captures the seasonal variations in these levels reasonably well. This is the first satellite-driven model of both a vector and the pathogen it transmits.
Index terms: *Glossina morsitans*, trypanosomes, satellite imagery, dynamical models

[2907] MONITORING VECTOR-BORNE DISEASES OVER THE BRAZILIAN AMAZON, PROJECT SIVAM

G. Bretas

ABSTRACT NOT RECEIVED

[2908] THE ROLE OF HOUSEFLIES IN THE SPREAD OF HUMAN DISEASE - CONTROL IMPLICATIONS

M. Anderson

ABSTRACT NOT RECEIVED

[2909] NEW REGULATORY PROCEDURES FOR FILTH AND EXTRANEOUS MATERIALS IN FOOD

J. R. Bryce[1], [1]U.S. Food and Drug Administration, 200 C Street, S.W., Washington, DC 20204, E-mail: jbryce1@smtpgate.ora.fda.gov.

The Food and Drug Administration is revising its strategy for regulating filth and extraneous materials in food. The goal is to replace, to the extent possible, the existing case-by-case process for reviewing legal actions with a new process, or strategy, that is transparent and places appropriate emphasis on food safety issues. Transparency means that the standards and reasoning for regulatory decisions will be made available publicly by publishing objective, scientific criteria. The first goal was to develop a scientific basis for the new strategy. The science base has been developed and will be published in *Regulatory Toxicology and Pharmacology*. Three articles appeared in the December, 1998 issue of this peer-review journal. These three articles define scientific criteria for the objective evaluation of physical, biological and chemical hazards associated with filth and extraneous materials in food. Two additional articles are planned for later publication. The next objective was to organize the scientific criteria into a transparent process for reviewing legal actions. The criteria are organized into three prioritized categories: 1) Health hazards associated with filth and extraneous materials; 2) violations of Good Manufacturing Practices (GMPs) involving filth and extraneous materials; 3) Aesthetically based filth and extraneous materials. The science base was then used to classify contaminants into one of the three action criteria categories and to develop specific action criteria for the most common types of contaminants. The result will place greater regulatory emphasis on category 1 health hazards and less on harmless, aesthetically based category 3 contaminants. Health hazards are comprised of physical hazards, chemical hazards, and biological hazards. Physical hazards include sharp contaminants that pose a swallowing hazard. The strategy recognizes the emerging science of chemical hazards caused by IgE-mediated allergens from food-contaminating pests including insects and mites. Biological hazards are mainly food borne bacterial pathogens. The strategy identifies the scientifically established insects and vertebrates that act as contributing factors for the spread of food borne disease, as well as identifying the universal behavioral attributes or profiles that would place any pest in this category. The profile for disease carrying pests includes synanthropy, endophily, communicative behavior, attraction to filth and human food, and pathogens isolated from wild populations.

Index terms: strategy, hazards, contaminants, pests

[2910] TRANSMISSION OF E. COLI 0157:H7 BY FLIES TO PRODUCE

W. Janisiewicz.

ABSTRACT NOT RECEIVE

[2911] THE ROLE OF FLIES AS VECTORS OF *SALMONELLA* IN EGG FARM LAYER HOUSES

A. R. Olsen[1], T. S. Hammack[1], & J. R. Bryce[1], [1]U.S. Food and Drug Administration, 200 C Street, S.W., Washington, DC 20204, E-mail: jbryce1@smtpgate.ora.fda.gov.

Flies, especially house flies, *Musca domestica,* are widely recognized as potential reservoirs and vectors of foodborne *Salmonella* pathogens. In this study, flies were collected at poultry caged-layer facilities that had produced eggs that were implicated as the food vehicle in two recent outbreaks of *Salmonella* serotype Enteritidis (S.E.) infections. The flies were separated by species into pools for microbiological testing. A total of fifteen species-pools of house flies and seven species-pools of bronze dump flies, *Hydrotaea aenescens* were analyzed. S.E. was isolated from two of the fifteen pools of houseflies. Other species of *Salmonella* were isolated from three pools of flies including *S.* serotype Infantis from house flies and from dump flies and *S.* serotype Heidelberg from house flies. *S.* serotype Mbandaka was isolated from a lesser mealworm, *Alphitobius diaperinus.*
Index terms: *Musca domestica*, *Hydrotaea aenescens*, poultry

[2912] ASSESSING RISKS ASSOCIATED WITH FOOD-CONTAMINATING INSECTS AND MITES

K. Wildey

ABSTRACT NOT RECEIVED

[2913] ALLERGENIC MITES: AN EMERGING FOOD SAFETY ISSUE

G.C. Ziobro[1] & A.O. Olsen[1], [1]Microanalytical Branch, Food and Drug Administration, Washington, DC 20204, USA.

Mite concentrations of over 100 live allergenic mites per 100g packaged food product have been found in various consumer products. Among the species found are *Dermatophagoides farinae* in bakery products including boxed mixes (cake mix, pancake mix, biscuit mix, etc); *Dermatophagoides microceras* in pancake mix; and *Tyrophagus putrescentiae*, the most commonly encountered contaminating species in packaged food products. *Acarus siro*, *D. pteronyssinus*, *Euroglyphus maynei*, *Suidasia pontifica*, *Threophagus entomophagus*, and *Tyrophagus putrescentiae* have been isolated from dried, canned, frozen, and pickled seafoods. The United States Food and Drug Administration is placing greater emphasis on regulating those filth elements which may pose a threat to public health. The initial step is to identify the potential threat and to evaluate the published scientific literature concerning the threat. If the literature supports the idea that the filth element may pose a threat to public health, then the Agency tests various methodologies to measure the threat evaluating them for reliability, accuracy, and ruggedness. Part of this testing is to do a limited survey of consumer products as well as purposefully adulterated samples. If the limited survey of consumer products holds that there may be a problem then a national survey is undertaken. The results of the national survey are used to measure the risk to the consumer and are the scientific basis for regulatory actions by the Agency. This talk will concentrate on the review of the Agency's review of the literature concerning the threat posed by the presence of allergenic mites in foods and the preliminary results from the comparison of guanine, ELISA, and PCR techniques to measure mite contamination in foods.
Index term: mites, allergens, *Dermatophagoides, Tyrophagus putrescentiae*

[2914] MOSQUITO – PARASITE INTERACTIONS: MOLECULAR DISSECTION OF INNATE IMMUNE RESPONSES TO MALARIA INFECTION

G. Dimopoulos & F. C. Kafatos, European Molecular Biology Laboratory, Meyerhofstrasse 1, 69117 Heidelberg, Germany, E-mail Dimopoulos@embl-heidelberg.de

A fine tuned equilibrium between the hosts and vectors immune responses and the parasites immune evasiveness seems to have developed through coevolution allowing the malaria parasite to propagate at transmittable levels without killing the host and vector. The components and mechanisms involved in the mosquito's defense against malaria infection and the parasite's capacity to evade them is a crucial part of the interactions between these two organisms and may potentially be used for modulating transmission of the disease. Several *Anopheles gambiae* genes encoding proteins homologues known to operate in defense mechanisms have been isolated and used to characterize the innate immune responses to microbial elicitors and malaria. The mosquito's tissue specific and systemic innate immune responses to *Plasmodium berghei* infection coincide spatially and temporally with midgut invasion and translocation of parasites to the salivary glands. Interestingly, significant parasite losses have been documented during these two transition stages. Whether these infection responsive genes are implicated in restricting the infection remains to be shown through their functional characterization. Innate immune responses are believed to be triggered through recognition of non-self by pattern recognition receptors. Several mosquito immune responsive genes encoding such candidate receptors have been discovered and include 3 GNBP (gram-negative bacteria-binding protein) and betaGRP (beta-1,3-glucan recognition protein) homologues, a likely PGRP (peptidoglycan recognition protein) homologue; two putative gal lectins , a chitin binding domain containing mucin and six fibrinogen-like domain lectins. GNBP and PGRP are involved in triggering phenoloxidase cascades in other insects. Lectins are involved in opsonization and fibrinogen-like domain containing proteins are implicated response to schistosoma infection in snails and agglutination of bacteria in horse shoe crab. Functional analysis of these mosquito proteins has been initiated with the aim of detecting interactions with the malaria parasite and other microorganisms. Mass-expression profiling of *Anopheles gambiae* ESTs using cDNA microarrays is being applied for the detection of additional immune responsive genes with specific induction or repression patterns to infection. Screening EST clones with probes from cell lines and refractory and susceptible mosquito strains challenged with microbial elicitors and/or malaria may allow detection of immunity components involved in refractoriness and anti-malaria specific defence. Candidate genes are being pursued for further analysis.

[2915] MALARIA PARASITE ENCAPSULATION GENES IN *ANOPHELES GAMBIAE*

F. H. Collins, [1] **X. Wang,** [1] **L. Q. Ton,** [1] **J. R. Hogan,** [1] **K. A. Dymbrowski,** [1] **D. Borkova** [2] **& F. C. Kafatos** [2], [1] Dept. of Biological Sciences, Univ. of Notre Dame, Notre Dame, IN 46556-0369, USA; [2] European Molecular Biology Laboratory, Meyerhofstrasse 1, D-69117 Heldelberg, Germany.

A strain of the African malaria vector *Anopheles gambiae* has been selected that is refractory to a wide range of malaria parasites, killing them as they complete penetration of the midgut epithelial cells and come to rest between the cells and the surrounding basement membrane. Genetic mapping has implicated three genes in this *Plasmodium* encapsulation response, known as *Pen1*, *Pen2*, and *Pen3*. Efforts are currently underway to clone these genes by a positional cloning strategy. At present, *Pen1* has been mapped to an approximately 600 kb interval of the genome, the DNA of which has been cloned in set of overlapping Bacterial Artificial Chromosome vectors. Progress in the sequencing of this interval and identification of the *Pen1* gene will be described.

Index terms: *Plasmodium*, positional cloning, mosquito, genomics

[2916] GENETICALLY-ENGINEERED MOSQUITOES RESISTANT TO THE TRANSMISSION OF MALARIA

M. de L. Capurro[1], **J. Coleman**[1], **K.E. Olson**[2], **B.T. Beerntsen**[1], **E. Rocha**[3], **A.U. Krettli**[4] **and A.A. James** [1], [1]Dept. of Mol. Biol. and Biochem., Univ. of California, Irvine, CA 92697 USA, E-mail mcapurro@uci.edu, [2]Dept. of Microbiology, Colorado State Univ., Fort Collins, CO, USA. [3]Depto de Patologia, Univ. Federal de Alagoas, Maceio-AL-BR [4]Centro de Pesquisas, Rene Rachou, FIOCRUZ, Belo Horizonte, M.G, BR.

We are developing transgenic mosquitoes that are resistant to malaria parasites to test the hypothesis that genetically-engineered vectors can be used to block transmission of the disease. We are using *Aedes aegypti* and the avian malaria parasite, *Plasmodium gallinaceum*, as a model because we can develop and test many of the basic approaches with this system in anticipation of working with the human malaria parasite, *P. falciparum*, and its major African vector, *Anopheles gambiae*. In previous work, we characterized mosquito genes whose promoter sequences are candidates for controlling the expression of an antiparasite coding region, and developed stable transformation technology that will allow the integration of antiparasite genes into the vector germline. We show here that we have developed an effector portion of an antiparasite gene that can be used to interfere with the transmission of the parasites. Mouse monoclonal antibodies (MAbs) that recognize the circumsporozoite protein (CSP) of *P. gallinaceum* can block sporozoite (SPZ) invasion of mosquito salivary glands. The corresponding heavy- and light-chain variable regions encoding the anti-CSP Mab, N2H6D5, were engineered to produce a single-chain antibody construct, N2scFv. The N2scFv gene was cloned into a Sindbis virus expression plasmid, infectious virus produced, and this was used to inoculate adult mosquitoes. Control and virus-infected mosquitoes were allowed to feed on *P. gallinaceum*-infected chickens. Salivary glands were dissected from experimental mosquitoes and SPZs counted using phase microscopy. In our initial experiments, mosquitoes from cohorts that showed heavy oocyst infections in their midguts were used and this resulted in high numbers of SPZs in glands derived from untreated animals. With these heavy infections, prevalence was not affected, however, mean intensities in mosquitoes expressing N2scFv were reduced by as much as 99.6% and 99.2% when compared to untreated controls or controls treated with a Sindbis virus expressing a non-specific protein (GFP), respectively. Hemolymph SPZs were recovered from N2scFv-expressing mosquitoes and the recombinant protein was detected on the surface of the parasite by immunolocalization. Thus, we have engineered the first effective anti-*Plasmodium* gene and this represents the next step in testing the overall strategy of the genetic control of transmission.

Index terms: *Aedes aegypti*, malaria, transformation, vector, single-chain antibody

[2917] ENGINEERING BLOOD MEAL-ACTIVATED SYSTEMIC IMMUNITY USING FAT BODY-SPECIFIC GENES IN THE MOSQUITO VECTOR

A. S. Raikhel[1], **V. A. Kokoza**[1], **A. Ahmed**[1], **D. Martin**[1], **M. Mienaltowski**[1], **G. Attardo**[1] **& W. L. Cho**[2]. [1]Entomology Dept. and Program in Genetics, Michigan State Univ., East Lansing, MI, USA, E-mail: araikhel@pilot.msu.edu; [2]Parasitology Dept., National Yang-Ming Univ., Taipei, Taiwan.

Progress in molecular genetics makes possible the development of novel disease control strategies that target the competence of mosquitoes to transmit pathogens. To elucidate the regulatory cascade that controls high-level blood meal dependent expression of yolk protein genes *vitellogenin* (*Vg*) and *vitellogenic carboxypeptidase* (*VCP*) in the mosquito fat body, we identified ecdysone response elements for the ecdysteroid receptor as well as binding sites for early genes mediating ecdysone response, E75 and E74. Several binding sites for transcription factors determining tissue-specific transactivation, including GATA, are present in the promoters of both genes. Transformed into *Drosophila*, the promoter regions of both *VCP* and *Vg* containing these tissue-specific and hormone response elements confer fat body-specific expression of a reporter gene. Mosquito transformation, utilizing the *Hermes* transposable element, has been utilized to further delineate the regions of *Vg* and *VCP* promoters required for blood-meal activated, fat body-specific expression of these genes. Next, we tested the regulatory region of the *Vg* gene for its ability to express potential anti-pathogen factors in transgenic mosquitoes. *Hermes*-mediated transformation was used to integrate a 2.1-kb *Vg* promoter fragment driving the expression of the *Defensin A* (*DefA*) coding region. Stability of *Vg-DefA* transgene insertions through the seventh generation (G_7) was demonstrated by amplification of genomic DNA and Southern blot analyses. The *Vg-DefA* transgene was activated strongly in the fat body by a blood meal. The mRNA levels reached a maximum at 24 hours post-blood meal (hPBM), corresponding to the peak expression time of the endogenous *Vg* gene. Transgenic defensin (tDefA) accumulated in the hemolymph at high levels and persisted for 20-22 days after a single blood feeding. Purified tDefA showed antibacterial activity comparable with that of defensin isolated from bacterially challenged control mosquitoes. Thus, we are now able to engineer genetically stable transgenic mosquitoes with an element of systemic immunity, which is activated through the blood-meal-triggered cascade rather than by infection. This work represents a significant step towards utilization of molecular genetic approach in controlling vector's competence in pathogen transmission.

Index terms: *Aedes aegypti*, vitellogenin, defensin, pathogen transmission.

[2918] STABLE TRANSFORMATION OF ANOPHELINE MOSQUITOES WITH THE *MINOS* TRANSPOSABLE ELEMENT FROM *DROSOPHILA HYDEI*

F. Catteruccia[1], **T. Nolan**[1], **T. Loukeris**[2], **F. Kafatos**[2] **& A. Crisanti**[1], [1] Imperial College of Science, Technology and Medicine, Imperial College Road, London SW7 2AZ, UK; [2] EMBL, Meyerhofstrasse 1, 69117 Heidelberg, Germany.

Anopheline mosquitoes function as vector for human malaria, thus representing one of the major health threats for hundreds of millions of individuals living in third world countries. The lack of a suitable gene transfer technology for anopheline mosquitoes has hampered so far progress in understanding at the molecular level the interactions between these vector species and the malaria parasite. Attempts to modify the DNA of anopheline mosquitoes have severely been hampered by three major problems: 1) the development of a DNA delivery vector capable of transposing in anopheline mosquitoes; 2) the lack of a suitable selectable marker to detect positive transformants; 3) the establishment of a new technology to overcome the technical difficulty of injecting DNA into mosquito embryos. We provide here evidence that the transposable element *Minos* from *D. hydei* marked with an enhanced form of the green fluorescent protein GFP is able to integrate by active transposition into the germ line of *Anopheles stephensi* mosquitoes at high frequencies. We have developed a vector, pMinEGFP, in which the enhanced GFP (EGFP) was placed under the control of the Actin promoter from *D. melanogaster* within the inverted repeats of *Minos*. A total of 885 *A. stephensi* embryos were injected with a mixture of pMinEGF and the helper plasmid pHSS6hsILMi20, which provided the enzymatic activity for *Minos* transposition. Five independent integration events were obtained among the 91 Go adults which survived injections, with an estimated transformation frequency of 5.5%. Positive G1 larvae were easily recognisable by their fluorescent phenotype (see picture). Fluorescence was mainly localised in the gut, but different patterns were also observed. Southern blot analyses of transformed lines showed that in all cases a single integration event had occurred. Sequencing of the junctions between the inserted element and the *A. stephensi* genome confirmed that integration had occurred by precise *Minos* mediated events. The availability of the gene transfer technology developed in this study offers a powerful tool to investigate the role of mosquito molecules involved in parasite-host cell interactions and opens a wide range of applications to explore the genome of these important disease vectors.

Index terms: *Anopheles stephensi*, vector, malaria.

[2919] SELECTION OF PEPTIDES FROM A PHAGE-DISPLAY LIBRARY WHICH BIND TO THE MOSQUITO MIDGUT AND TO SALIVARY GLANDS

A. Ghosh, P. E. M. Ribolla & M. Jacobs-Lorena, Case Western Reserve University, Dept. of Genetics, 10900 Euclid Ave., Cleveland, OH 44106-4955, USA, Email: mxj3@po.cwru.edu.

Mosquitoes are obligatory vectors for the transmission of malaria, a disease that kills about 2 million people every year. The life cycle of *Plasmodium* (the causative agent of malaria) in the mosquito is complex. The parasite must cross two different epithelia: ookinetes traverse the midgut and sporozoites traverse the salivary gland. While ample evidence is available that these events require specific *Plasmodium*-epithelium recognition, little information is available about the molecular basis of these interactions. To identify protein sequences that interact specifically with the gut epithelium, we used a library of phage that display random peptides on their surface. The peptides contain 8 random amino acids flanked by 2 cysteines and 2 more random amino acids [XC(X)$_8$CX] inserted at the amino-terminus of the *fd* phage protein VIII. About $2x10^{11}$ phages per mosquito were fed to adult *Anopheles gambiae* females. After 30 min or 24 h, midguts were dissected, washed, and the bound phages were eluted by lowering the pH. The recovered phage were amplified and used for further rounds of selection. To isolate phage that bind to salivary glands a similar selection procedure was used, except that phage was administered by injection into the hemocoel rather than by feeding. In one experiment (dissection after 30 min), 39 random phages recovered from the gut after the 4th round of selection were isolated and sequenced. From these, one sequence (PCQRAIFQSICN) appeared 19 times (49%), one (PCSIYLTQVGCG) 14 times (36%), one 3 times (8%), one 2 times (5%) and one only once. None of the sequences show significant similarity with known *Plasmodium* surface proteins. In another experiment (dissection after 24 h), the same major sequence (PCQRAIFQSICN) was recovered exclusively after the 4th round of selection. Interestingly, the same sequence was recovered from phage selected for salivary gland binding. A synthetic peptide tagged with biotin preferentially binds to salivary gland distal lateral lobes. Experiments to measure interference of these phages with *Plasmodium* invasion are in progress.

Index terms: *Anopheles gambiae*, surface ligands, disease vectors, malaria

[2920] STUDIES OF *WOLBACHIA* IN *CULEX PIPIENS* COMPLEX IN CHINA

T. Zhao, S. Song, Y. Dong , F. Song & B. Lu, The Institute of Microbiology and Epidemiology, Beijing, P. R. China, 100071, zty@public.bta.net.cn

The proteobacterium *Wolbachia* is a kind of endosymbiont of insects and some other invertebrates; Crossing incompatibility is common effect of *Wolbachia* on insects. It was found that there was crossing incompatibility in *Culex pipiens* complex in China. There are four subspecies of *Cx. pipiens* complex, i.e. *Cx. pipiens pipiens*, *Cx. pipiens quinquefasciatus*, *Cx. pipiens pallens* and *Cx. pipiens molestus*, all of them were recorded in China, in order to know whether mosquitoes of *Cx. pipiens* complex which we used for crossing experiments were infected with *Wolbachia*, 4 strains of four subspecies were used to detect with PCR, including *Cx. pipiens pipiens* Wulumuqi strain, *Cx. pipiens pallens* Beijing strain, *Cx. pipiens quinquefasciatus* Guangzhou strain and *Cx. pipiens molestus* Beijing strain. It was shown that 4 strains of subspecies were infected with *Wolbachia* by detection of PCR with 16SrDNA primers and *wsp* gene primers, and it was found that *Wolbachia* of *Cx. pipiens* complex of China is *Wolbachia pipientis* with DNA sequence analysis of *wsp* gene.

Index terms: *Wolbachia pipientis, Culex pipiens,* PCR

[2921] STUDIES ON THE POSSIBILITY OF TRANSMISSION OF DENGUE VIRUS BY *CULEX PIPIENS QUINQUEFASCIATUS* IN LABORATORY

T. Zhao, Y. Dong, C. Xie, F. Song, F. Yang, L.Lu & B. Lu, The Institute of Microbiology and Epidemiology, 20 Dongdajie , Fengtai, Beijing, P. R. China, 100071, zty@public.bta.net.cn

Dengue and Dengue haemorrhagic fever is one of important mosquito-borne disease in China, there are some cases in Guangdong, Hainan and Guangxi of China from 1978. *Aedes albopictus* and *Ae. aegypti* are vectors of dengue in China, but there have been some research work reporting that *Culex pipiens quinquefasciatus* is a vector species of dengue of China, Because *Cx. pipiens quinquefasciatus* is a widespread species in south part of China, it is necessary to study whether this species can transmit dengue virus. The present paper is the results of study on experimental infection and transmission of *Cx. pipiens quinquefasciatus* with dengue virus type 2 in laboratory. *Cx. pipiens quinquefasciatus* and *Ae. albopictus* were fed with artificial blood containing of dengue virus (10^{-9}-10^{-10} TCID50). Dengue virus could not be isolated from *Cx. pipiens quinquefasciatus* and it was negative in the detection of RT-PCR with universal primers of dengue virus after 48 hours of feeding, Dengue virus could not be found in midgut cell of *Cx. pipiens quinquefasciatus* with electron microscope after feeding, on the other hand, dengue virus could be isolated from *Ae. albopictus* and it was positive in the detection of RT-PCR at 1-13 days after feeding, Dengue virus could be found in the midgut cell of *Ae. albopictus* with electron micoscope after 2 hours of feeding. The female mosquitoes of the two species were fed with baby mice, after they had fed the artificial blood for 7 days. The serum of mice which were fed by *Cx. pipiens quinquefasciatus* were negative with method of IFA after two weeks of feeding, and those of *Ae.albopictus* were positive, it was shown that dengue virus could not replicate in the body of *Cx. pipiens quinquefasciatus*, and *Cx. pipiens quinquefasciatus* should not be considered as a vector of dengue in China.

Index terms: *Culex pipiens quinquefasciatus*, dengue, experimental infection

[2922] THE INTERACTION BETWEEN CLIMATIC FACTORS AND BLUETONGUE OUTBREAKS IN ISRAEL, THE EASTERN MEDITERRANEAN AND THE FEASIBILITY OF ESTABLISHING BLUETONGUE-FREE ZONES

Y. Braverman[1], F. Chechik[2], B. Mullens[3], [1]The Kimron Veterinary Institute, Bet Dagan, Israel; [2]The Meteorological Services, Bet Dagan, Israel; [3]Department of Entomology, University of California, CA, USA

Israel has more than 30 years of extensive information on bluetongue (BT) occurrence in sheep flocks and sentinel cattle in different regions of the country. Meteorological parameters were not independently correlated with occurrence of BT over the entire period. Meteorological parameters preceding years with high prevalence of bluetongue (1975, 1987, 1988 and 1994)(average of 43 affected sheep flocks) were compared with parameters for years with little or no BT transmission (1980, 1981, 1983 and 1992). Winters preceding high BT seasons were significantly warmer; average maximum temperature of the coldest month was 2 to 3^{0}C higher, and average maximum and minimum temperatures were 1-2^{0}C higher. Rainfall in BT outbreak years was approximately normal, while winters preceding low BT seasons were wetter (40% more rainfall in the coldest month and 17% more winter rainfall overall). BT outbreak years had significantly more winter days with maximum temperatures higher than 13 or 18^{0}C, and more nights with minimum temperatures > 5^{0}C. Average maximum temperatures for the coldest winter month, below 16.5^{0}C were associated with low BT seasons, while more then 18 days with winter temperatures above 18^{0}C were followed by high BT transmission. In most parts of Israel except mountains >700 m above sea level, the average maximum temperature of the coldest winter month is >12.5^{0}C, which is thought to enable the survival of BT viruses. Mountain areas also have fewer animals/km2, and more of these are BT-resistant ruminants such as goats. Two "safe zones" with regard to export of ruminants and their products are proposed: the Arava Desert Valley and mountains above 700 m. Bluetongue outbreaks are not known from these regions. The Arava is regarded as a particularly low-risk region due to smaller numbers and presumed lower survivorship of the principal vector, *Culicoides imicola*. The Arava Desert Valley also is out of the Persian Trough air stream, which seems to be connected with introduction of BT into Israel. These safe zones might be exploited for export of animals and germplasm.

Index terms: Bluetongue, climate, *Culicoides imicola*

[2923] APPLICATION OF THE FORENSIC ENTOMOLOGY TO ESTIMATE OF *POST MORTEM* INTERVAL, IN INVESTIGATIONS OF HOMICIDE, BY THE DEPARTMENT OF POLICE OF RIO DE JANEIRO - BRAZIL

J. Oliveira-Costa, Dept. of Technician-Scientific Police, I.C.C.E., Ailton da Costa St., s/n - 25 de agosto - Duque de Caxias-RJ- Brazil, CA 25071-160/ Trainee in the Dept. of Entomology of National Museum. E-mail janyra@gbl.com.br

In the last decades, the Forensic Entomology began to integrate the investigation procedures, in cases of homicide, mainly, in the determination of the chronology of the death (*post mortem* interval - PMI). International Scientific Institutions already have specific laboratories to aid law officer at the death scene concerning to that problematic one. Besides, in Brazil, lamentably, there aren't associations between entomologist and law officers, as well as, there are just a few law officers that have entomology knowledge. Consequently, the application of this technique is unusual. The Department of Technician and Scientific Police, in a pioneer action, as part of a project of reorganization of this section, tries to transform in routine the association of law officers with entomologists of the National Museum. This work presents three cases of studies, where the methodology used for collection of the Diptera, transportation and rearing of the collected specimens were described, as well as, calculation of the estimate of *post mortem* interval based on the concept of the accumulated degree-hours (ADH). From the presented cases, in two examples, the estimate based on the biology of the species of *Chrysomya megacephala* and *Cochliomyia macellaria*, approached of that obtained by another investigation means. In the third case, the estimate was on this side of the real interval, because there was a delay in the arrival of the insects for laying of eggs that have been happened by the fact of the cadaver to be in place of difficult access to sarcophagous insects.
Index terms: Forensic Entomology, Diptera, PMI, and law officer.

[2924] PREVENTION OF SPOROGONY OF *PLASMODIUM VIVAX* IN *ANOPHELES DIRUS* MOSQUITOES BY TRANSMISSION-BLOCKING ANTIMALARIALS

R. E. Coleman[1], N. Polsa[1], N. Eikerat[1], J. Sattabongkok[1], R. Brueckner[2] & T. M. Kollars, Jr.[1], [1]Dept. of Entomology, U.S. Army Medical Component, Armed Forces Research Institute of Research, 315/6 Rajvithi Road, Bangkok 10400, Thailand, E-mail: rcoleman@thai.amedd.army.mil; [2]Division of Experimental Therapeutics, Walter Reed Army Institute of Research, Walter Reed Army Medical Center, 503 Robert Grant Road, Forest Glen Annex, Silver Spring MD 20910.

The sporontocidal activity of four dihydroacridine-diones (WR-233602, WR-243251, WR-250547, and WR-250548) and three fluoroquinolone (WR-279135, WR-279298, and WR-279288) was determined against naturally circulating isolates of *Plasmodium vivax*. Laboratory-reared *Anopheles dirus* mosquitoes were infected with *P. vivax* by feeding them on gametocytemic volunteers reporting to local malaria clinics in Kanchanaburi and Tak provinces, Thailand. Four days after the infectious feed, mosquitoes were refed on uninfected mice treated 90 minutes previously with a given drug. Sporontocidal activity was determined by assessing both oocyst and sporozoite development. None of the fluoroquinolones exhibited sporontocidal activity against *P. vivax* at a dose of 100 mg base drug/kg mouse body weight, whereas all 4 dihydroacridine-diones affected sporogonic development to some degree. WR-233602 affected oocyst development, but had no impact on sporozoite production, WR-250548 affected oocyst development and had a limited effect on sporozoite production, and WR-243251 and WR-250547 had a marked impact on all phases of sporogony. These data clearly demonstrate that experimental dihydroacridine-diones are capable of interrupting the sporogonic development of *P. vivax*.
Index terms: Malaria, sporontocidal drugs.

[2925] A LONGITUDINAL PAIRED TRIAL OF TWO SENSING DEVICES FOR DETECTING PERIDOMESTIC POPULATIONS OF *TRIATOMA INFESTANS* (HEMIPTERA: REDUVIIDAE) IN RURAL NORTHWESTERN ARGENTINA

R. E. Gürtler[1,2], G. M. Vazquez Prokopec[1], L. A. Ceballos[1], C. Lund Petersen[1] & O. D. Salomon[3], [1] Lab. of General Ecology, Dept. of Biological Sciences, University of Buenos Aires, Ciudad Universitaria, 1428 Buenos Aires, Argentina, E-mail gurtler@bg.fcen.uba.ar. [2]Administración Nacional de Laboratorios e Institutos de Salud (A.N.L.I.S.) "Dr. Carlos G. Malbrán", [3] Centro Nacional de Docencia e Investigación en Enfermedades Endémicas-A.N.L.I.S., Paseo Colón 568, 1063 Buenos Aires, Argentina.

The regional elimination of *Triatoma infestans* (Klug) requires a sensitive, simple and widely applicable tool for detecting infested peridomestic sites that can be handled by the affected communities. A prototype of sensing device for detecting peridomestic populations of *T. infestans* was tested in a longitudinal paired trial with bamboo canes in Amamá and nearby rural villages (Santiago del Estero, Argentina) from February to December 1999. The bamboo device consisted of 12 cm long fragments of bamboo cane, *Guadua trinii*, with pleated filter paper inside. The prototype was a commercially available black plastic cylinder 19 cm high and 10 cm diameter, with a screw cap at the top and 2 openings at the bottom, and a removable cardboard-made central structure. Of 23-29 *T. infestans*-positive peridomestic ecotopes detected by timed manual capture assisted with a flushing-out spray in April 1999 that were inspected at least once, the percentage of prototypes with any sign of infestation slightly varied from 78% in April to 60% in September and 69% in December. The paired bamboo canes only detected 15%, 19%, and 25% of the infested ecotopes, respectively. Of 18-35 ecotopes negative for *T. infestans* in April 1999, the prototypes increasingly detected any sign of infestation, from 17% of the ecotopes in April to 49% in December, whereas the bamboo canes rarely detected any infestation. The prototypes collected 616 *T. infestans* bugs, 333 exuviae, 933 eggs, and 1172 triatomine dejecta, whereas the bamboo canes collected only 65 *T. infestans*, 28 exuviae, 2 eggs, and 84 triatomine dejecta. Overall, the prototypes detected more *T. infestans* bugs or signs than the bamboo canes by a factor of 17.1, thus giving conclusive evidence of its acceptability as a resting, molting, and oviposition site. The prototypes were significantly more sensitive than the matched bamboo canes in each of the 3 surveys of *T. infestans*-positive ecotopes, and in 1 survey of the negative ecotopes. This study provides conclusive evidence of the superiority of a prototype of sensing device for detecting peridomestic *T. infestans* populations in reference to the bamboo canes. This study was supported by UNDP/World Bank/WHO (TDR) from the Special Program for Research and Training in Tropical Diseases, and the University of Buenos Aires.
Index terms: Chagas disease, surveillance, sampling, vector control.

[2926] PHLEBOTOMINE SANDFLIES TRANSMITTING *LEISHMANIA* IN CHANGING ENVIRONMENTS IN BRAZIL

P. D. Ready[1], S. B. Filho[2], E. F. Rangel[3] & A. A. de Souza[4], [1]Molecular Systematics Laboratory, Department of Entomology, The Natural History Museum, London SW7 5BD, U.K. e-mail: P.Ready@nhm.ac.uk; [2]Centro de Pesquisas Aggeu Magalhães/FIOCRUZ, Recife, PE, Brazil; [3]Departamento de Entomologia, Instituto Oswaldo Cruz, Rio de Janeiro, RJ, Brazil; [4]Seção de Parasitologia, Instituto Evandro Chagas, Belém, PA, Brazil.

About 400 species of phlebotomine sandflies are classified in the New World genus *Lutzomyia* (Diptera: Psychodidae), which contains all the American vectors of *Leishmania* species (Protozoa: Trypanosomatidae). There is a noticeable association in the New World between taxonomic groups of the vectors and the endemic parasites causing human leishmaniasis. In Brazil, members of the *Lutzomyia (Nyssomyia) flaviscutellata* complex usually transmit *Leishmania (Leishmania) amazonensis* and related species, and sandflies of other species complexes in the subgenera *Nyssomyia*, *Psychodopygus* and *Trichophoromyia* transmit *Leishmania (Viannia) braziliensis* and its related species. Molecular phylogenies have clarified the relationships between the vectors and parasites and, therefore, it is now easier to distinguish between the evolutionary and ecological components of the vector-parasite specificity associated with particular zoonotic transmission cycles in Brazil. Encounters between vectors and reservoir hosts in the same ecotopes are as necessary as vector-parasite compatibility for transmission in changing environments. Some vectors of *Le. amazonensis* and *Le. braziliensis* are abundant in secondary forests (both man-made and naturally occurring) or peri-domestically in deforested regions, where the continuing importance of human leishmaniasis is best explained in terms of the rapid selection for pre-adapted vector genotypes as well as the presence of mammalian reservoir hosts (including humans). Leishmaniasis transmission in secondary forests and man-made environments has not been associated with the presence of cryptic species of vectors. The evidence for this comes from recent phylogenetic and population genetics studies, using molecular markers from mitochondrial and nuclear genes as well as microsatellites. *Leishmania (Leishmania) infantum chagasi* has been introduced from the Old World and, in contrast to the endemic parasites, it is transmitted by two phylogenetically divergent vectors that frequently encounter the principal reservoir host (the domestic dog) in settled areas, which are often within more arid regions.
Index terms: *Lutzomyia*, Phlebotominae, leishmaniasis, changing environments, co-evolution.

[2927] STRUCTURE AND EXPRESSION OF THE LARVAL AND ADULT HEXAMERIN GENES, MdH1.1 AND MdH2.1, IN *MUSCA DOMESTICA*

C. K. Moreira-Ferro[1], M. de L. Capurro[2], A. G. de Bianchi[1], M. F. Walter[3], H. Biessmann[3], A. A. James[2] & O. Marinotti[1], [1]Departamento de Parasitologia, Instituto de Ciências Biomédicas, Universidade de São Paulo, P.O.Box 66208, CEP 05508-900, São Paulo, SP, Brasil, [2] Department of Molecular Biology and Biochemistry, University of California, Irvine, CA 92697, USA. [3]Developmental Biology Center, University of California, Irvine, CA 92697, USA. E-mail: crikampf@usp.br. Financial support: FAPESP

Hexamerins are high molecular weight proteins found mostly in the haemolymph of insects and whose function has been proposed as storage proteins. We previously isolated and characterized the two hexamerins from the housefly, *Musca domestica*. Hex-L is present during the larval and pupal stages and has been implicated as a source of amino acids and energy during metamorphosis. Hex-F is found only in adults, is induced by a protein meal, and it has been suggested that in females, it may be a storage protein for amino acids used during the final stages of egg formation. The gene MdH1.1, that encodes one subunit of the *Musca domestica* larval hexamerin, Hex-L, was characterized. The complete nucleotide sequence, including the 5'-end region, was determined. This gene is composed of two exons (209 and 2133 bp), separated by one small intron (61 bp), and encodes a mature RNA of 2.6 Kb. The cap site was identified by primer extension analysis, situated 25 to the3'-end of the TATA box. A polyadenylation signal was localized in the 3'-end region of the gene. Southern blot analysis demonstrated that this gene is a member of a multigene family. In situ hybridization with digoxigenin-labeled cDNAs that encode the subunits of Hex-L to polytene chromosomes from larval salivary glands, gave several signals in more than one chromosome, demonstrating that the genes that encode the larval hexamerin are located in different chromosomes. The gene MdH2.1, that encodes one subunit of the *M. domestica* adult hexamerin, Hex-F, is being characterized. The complete 5' non-coding nucleotide sequence was already determined. Southern blot analysis suggests that this gene is member of a multigene family, and that the genes are located in tandem. A 0.9 kb DNA fragment containing the putative promoter of MdH1.1 and a 0.8 kb DNA fragment containing the putative promoter of MdH2.1 were cloned so as to drive the expression of the firefly luciferase coding region. Insect cells in culture were transfected with the above constructs and the luciferase activity was measured to quantify the promoter activities.

Index terms: hexamerin, *Musca domestica*, storage protein

[2928] UNDERSTANDING OF MOSQUITO ATTRACTION THROUGH IDENTIFICATION OF VOLATILE COMPOUNDS EMANATING FROM HUMANS

Willem Takken[1] and Teun Dekker[2], [1]Laboratory of Entomology, Wageningen University, P.O. Box 8031, 6700 EH Wageningen, The Netherlands. E-mail: willem.takken@users.ento.wau.nl; [2] Dept. of Entomology, University of Riverside, California 92521, USA. E-mail: tdekker@ucracl.ucr.edu

In recent years new evidence has shown that host-seeking mosquitoes are attracted to blood hosts by semiochemicals emanating from these hosts. Most mosquito species are opportunistic in this process, having no specific host preference. Exceptions to this rule are *Anopheles gambiae s.s.*, *Aedes aegypti* and *Culex quinquefasciatus*, which all prefer humans above other vertebrates. Compared to other mosquitoes, the latter three species are less dependent on carbon dioxide and respond more strongly to other host volatiles. The question is whether these volatiles are human-specific or not. Humans emit > 500 volatile chemicals, and it seems impossible to test these all individually on their role in the host-seeking behaviour of mosquitoes. Moreover, it is likely that synergism between two or more volatiles occurs that enhances the behavioural response of the mosquitoes. Thus, it is possible that one compound may have a behavioural effect, which is expressed only in the presence of another compound. In recent years, methods have been developed that focus on the identification of the human-specific chemicals that these mosquitoes are expected to use. The paper will discuss these methods and present some recent findings on human kairomones that are attractive for these mosquito species.

Index: mosquitoes, host seeking behaviour, kairomones, human odours

[2929] ATTRACTION OF FEMALE *AEDES AEGYPTI* TO IDENTIFIED COMPOUNDS ON HUMAN SKIN

O. J. Bosch[1], M. Geier[1] & J. Boeckh[1], [1]Inst. für Zoologie, Univ. Regensburg, Universitätsstr. 31, D-93040 Regensburg, Germany, E-mail oliver.bosch@biologie.uni-regensburg.de.

In previous studies, a number of compounds from host odors were described to be attractive for mosquitoes. However, the role of single substances in combination with other odors has not yet been studied. In order to do so, we created a synthetic blend by combining attractive volatiles step by step. We tested the behavioral responses of female yellow fever mosquito *Aedes aegypti* (L.) (Diptera: Culicidae) to ammonia and n-aliphatic carboxylic acids with chain length from C_1 to C_{18} in a modified Y-tube olfactometer. Each single compound was presented over a wide range of concentrations in combination with L-(+)-lactic acid, a major component on human skin. We observed a significant increase of attractiveness for certain concentrations of ammonia and the aliphatic fatty acids with chain length from C_1 - C_3, C_5 - C_8 and C_{13} - C_{18}. When these stimuli were tested alone, no behavioral effects were observed. The other fatty acids did not cause any attractive effect, neither in combination with lactic acid nor alone; the addition of fatty acids C_9 or C_{11} even reduced the responses to lactic acid. Some of the attractive fatty acids were also tested in combination with carbon dioxide, but these stimulus constellations had no effect on the behavioral responses. This indicates that the essential role of lactic acid as a synergist can not be compensated by carbon dioxide. A step-wise increase of attractiveness was found when distinct combinations of fatty acids were mixed to lactic acid. The most attractive odor blend consisted of a mixture of two fatty acids, ammonia, and lactic acid and was almost as attractive as an extract of human body odor. The results demonstrate that the attractive host odor for the yellow fever mosquito consists not only of a single substance, but rather of a blend of odors which are not or only slightly attractive by themselves.

Index terms: Mosquito, host odor, attractant; ammonia, fatty acid

[2930] THE UNIDET STATES FOOD QUALITY AND PROTECTION ACT; PUBLIC HEALTH PESTICIDE ACT

G. Wichteman

ABSTRACT NOT RECEIVED

[2931] THE WORLD HEALTH ORGANIZATION'S PESTICIDE EVALUATION PROGRAM: GLOBAL MOSQUITO CONTROL

N. Gratz.

ABSTRACT NOT RECEIVED

[2932] MICROBIAL PESTICIDES: CURRENT AND FUTURE USES FOR INTEGRATED MOSQUITO CONTROL

M. Mulla.

ABSTRACT NOT RECEIVED

[2933] *BACILLUS SPHAERICUS*: LONG-TERM EFFICACY AND ROLE IN RESISTANCE MANAGEMENT

S. C. Krause, Valent BioSciences Corporation, 870 Technology Way, Libertyville, IL USA

Bacillus sphaericus was first recognized with mosquito insecticidal properties in the 1960s; however, commercial formulations remained essentially absent from the market for almost 30 years. Renewed interest in this microbe for larval control will continue to increase globally as program directors search to expand their limited portfolio of effective insecticides. Field applications of VectoLex® (strain 2362) can provide effective larval control of 30+ days across a variety habitats and species. Although the persistence of *B. sphaericus* in treated populations may contribute to the development of resistance, it offers a biological alternative to conventional chemical products with similar residual profiles. Suggested methods to integrate *B.sphaericus* as an effective primary or secondary larvicide and the current gaps in our research will be discussed.

[2934] MALARIA CONTROL: SIMPLE - ENVIRONMENTALLY SOUND-EFFICACIOUS AND SUSTAINABLE

M. J. Perich, Dept. of Entomology, Walter Reed Army Institute of Research, Washington, DC, 20307-5100, USA, E-mail mjperich@gateway.net

Malaria vector control due to increasing resistance to conventional synthetic insecticides by the anophleine mosquito vectors and detrimental effects to the environment by such compounds has increased the need for new, simple, environmentally sound, efficacious and sustainable (S.E.E.S.) vector control methodology. Integrated and varied approaches are necessary for global malaria vector control because of the diverse ecology and behavior o fthe many anopheline species, which are primary and secondary vector species. Malaria vector control strategies such as barrier spraying for Neotropical exohhilic vectors or insectiicde treated bednets for endophagic malaria vectors are designed on ht is premise. Such strategies and selected others will be discussed on a SEES bases.
Index terms: Anohelines, Integrated Pest Management, Vector Control

[2935] MICROBIAL PESTICIDES FOR MOSQUITO CONTROL IN CHINA: CURRENT AND FUTURE CONSIDERATIONS

Z. M. Yuan[1, 2], Y. M. Zhang[1], E. Y. Liu, Q. X. Cai[1] & Y. Pang[2], [1]Wuhan Inst. Of Virology, Chinese Academy of Sciences, Wuhan 430071, China, E-mail yzm@pentium.whiov.ac.cn; [2]State Key Lab. For Biocontrol, Zhongshan Univ. Guangzhou 510275, China.

Mosquitoes transmit some of the world's most serious diseases in China, like malaria, Dengue, yellow fever, encephalitis and filariasis etc. Besides, they remain of considerable nuisance value in many regions. Attack against the mosquito is recognized as the only hope for eradication of these diseases and this nuisance. Because of their high specific toxicities, long-term effects in field and the safety to mankind and environment, the two entomopathogenic bacteria, *Bacillus sphaericus* and *B. thuringiensis* subsp. *israelensis*, have attracted more attention of local governments in China in mosquito control management. Using the low-cost medium primarily composed of agriculture by-product and employing deep-tank and semi-solid fermentation techniques, several mosquito-larvicidal formulations have been developed based on the local *B. s* isolates Ts-1, Bs-10 and C3-41 as well as *B.t.i* isolate 1897 in Tianjing, Jiangsu and Hubei Province, China respectively. Among them, *B.s* C3-41 Mosquito-Larvicidal Formulation is most widely used microbial agent. For the last decades, *B.s* and *B.t.i* formulations were mainly utilized for *Culex* sp. control in cities and towns. In more than 60 cities and towns throughout China, different mosquito breeding-site, including sewage ditches, ponds, puddles, cesspits, marshes, small tanks and a large number of temporary habitats in construction areas after rainfall, were routinly treated with these microbial pesticides. At the application retes of 1-3mg /M^2 for *B.s* and 5-10mg/M^2 for *B.t.i*, over 90% larval reduction could be obtained within 48hs, and the mosquito population was reduced in a tolerable level during the application period. These pesticides were also used for *Anopheles* sp. and *Aedes* sp. control in some parts with high malaria incidence. Approximately 150-ton liquid *B.s* formulations with potency of 50-200ITU/mg have been produced and 12,000 hectares of different mosquito breeding sites were periodically treated yearly. In certain southern cities in China, *B. s* formulation has been intensively used as a sole larvicide for controlling mosquito for more than ten years and a desirable efficacy has been acquired. So *B.s* and *B.t.i* are considered as the most promising agents for mosquito control in China, especially for Culex control in cities. Recently, the appearance of resistance mosquito colony to *B.s* has hindered the further application of this pesticide in integrated mosquito control management. New microbial pesticides based on new specific isolates or genetically modified strains are to be developed and evaluated.

Index terms: *Bacillus sphaericus*, *Bacillus thuringiensis* subsp. *israelensis*, vector, mosquito control.

[2936] BITING FLY REPELLENTS, PAST, PRESENT AND FUTURE

E. J. Gerberg & N. G. Gratz, E-mail: gene@GNV.IFAS.UFL.EDU

A review of repellents, from smoke by prehistoric man, to early used natural repellents such as Oil of Citronella, to synthetics such as dimethyl phthalate, ethyl hexandiol and dimethyl carbate. Present used repellents include diethyl toluamide (DEET), and new phytochemicals. Future repellents may be systemics, masking compounds or perhaps a vaccine

[2937] CURRENT AND FUTURE APPLICATION TACHNOLOGY FOR MOSQUITO CONTROL

M. Meisch & J. Brown.

ABSTRACT NOT RECEIVED

[2938] INTEGRATED MOSQUITO MANAGEMENT PHILOSOPHY AND IMPLEMENTATION

R. J. Novak, Univ. Illinois, 607 E. Peabody, City, State: Champaign, IL 61820, United States

All insect pests of man and animals fall into two major categories; those that cause nuisances and those that transmit pathogens. A distinction is drawn between the two groups because for vector-borne diseases, pest management has the requisites of urgency in dealing with epidemics, flexibility for deployment under a wide variety of ecological and cultural situations, efficacy in achieving a very high degree of management to suppress the disease and simplicity and economy in tune with resource availability. Pest -management programs for mosquito vectors of human disease are more intricate than those found in agriculture mainly due to habitat variability, whether urban or feral, and the economics associated with human morbidity and mortality. The objective of this presentation is to present the definition of Integrated Pest Management as it relates to mosquito control for both nuisance and vector management and how pesticides play a important role in achieving this goal.

[2939] GENETIC RELATIONSHIPS BETWEEN CALLIPHORIDAE OF FORENSIC IMPORTANCE

J.R. Stevens[1] & R.L. Wall[2], [1]School of Biology, Univ. of Exeter, Prince of Wales Rd, Exeter, UK EX4 4PS, [2]School of Biology, Univ. of Bristol, Woodland Rd, Bristol, UK BS8 1UG, Email: j.r.stevens@exeter.ac.uk.

Phylogenetic relationships among Calliphoridae species of forensic importance are explored using DNA sequence data from ribosomal RNA and cytochrome genes. The relationships described can help to define classes of molecular marker, including the identification of intra-sequence features, which may be of use in forensic entomology, while at the same time providing new insights to the evolution of the parasitic habit within the family.
Index terms: *Lucilia*, *Calliphora*, ribosomal RNA, phylogeny

[2940] ESTABLISHING A COUNTRYWIDE DATABASE OF INSECT SUCCESSION ON CARRION IN CANADA

G. S. Anderson, School of Criminology, Simon Fraser Univ. 8888 University Dr., Burnaby, B.C. V5A 1S6 CANADA, E-mail ganderso@sfu.ca.

Insects colonize remains in a predictable sequence so their presence, species and diversity on a body can be used to determine time since death. However, the species of insect and sequence of colonization is impacted greatly by many parameters including season, habitat, exposure to sunlight, burial vs. exposed etc., but one the most important factors is geographical region, or biogeoclimatic zone. Biogeoclimatic zone includes the geographic region, meteorological conditions and soil type, which all have a strong influence over flora and fauna of a region. Therefore, different biogeoclimatic zones will have differing insect succession on carrion. As so many factors effect insect succession on carrion, it is very important to know the species and time of arrival of insects that colonize remains for any given area or situation before they can be used to determine time since death. As forensic entomology is being required more and more in different regions of Canada, it is important to understand the differences between insect colonization of carrion across the country. The eventual objective of this work is to develop databases of insect succession on carrion in all biogeoclimatic zones of Canada. I began this project in 1992, in British Columbia (Western-most Province of Canada) and am now working in collaboration with other scientists and students in 5 Provinces across Canada (B.C., Alberta, Saskatchewan, Manitoba and Nova Scotia), covering 7 biogeoclimatic zones, and we are conducting research in each zone which includes carrion in direct sunlight, in shade, in different seasons and in different habitats. It is intended to continue this work into further zones and micro-zones. When complete, this country-wide database will be unique in covering such a massive area. Information from these ongoing databases has already been of value in homicide analysis and in court. This talk will describe the collaborations, funding and organization of this work, together with a comparison of the insect succession rates in different regions.
Index terms: Succession, biogeoclimatic zone, time since death

[2941] PIGS AND FLIES: A FORENSIC ENTOMOLOGY PERSPECTIVE IN SOUTHWESTERN AUSTRALIA

I. R. Dadour[1] & D. F. Cook[2], [1]Zoology Dept., University of Western Australia, Nedlands, 6009, E-mail idadour@cyllene.uwa.edu.au; [2]Entomology Section, Agriculture Western Australia, South Perth, 6151, Western Australia.

Cadavers undergo a series of predictable changes during decomposition, and are "visited" by a succession of flies and other insects. One way to simulate fly succession in a specified locality is to use non- human corpses. Although human corpses are used in some specific studies in the USA, current debate suggests that decomposing pigs are the next most reliable model. Pigs are similar to humans in that they have little body hair. In Australia only two studies on pig decomposition have been published. The current work being conducted in WA has now decomposed 90 pigs, buried and on the surface, both clothed and unclothed and killed in different themes i.e. gunshot, stabbing and throat cutting. The value of this work has allowed entomologists, forensic police and pathologists to view corpses in a forensic perspective with replication. As well as homicides, new work is focusing on simulated suicides in cars, filming pigs decomposing using infrared cameras. The entomological information accumulated from these studies will be discussed in this presentation , including the succession of blowfly species that are attracted to the corpse, the fly species attracted to buried corpses, the thermal properties of maggot masses and some information on the "context" of corpse decompostion.
Index terms: larvae, Diptera, decomposition, succession

[2942] IDENTIFICATION OF FORENSICALLY-IMPORTANT AUSTRALIAN BLOWFLIES

J. F. Wallman[1], M. Adams[2] & S. C. Donnellan[2]. [1]Dept. of Environmental Biology, The Univ. of Adelaide, SA 5005. Aust. E-mail: james.wallman@adelaide.edu.au; [2]Evolutionary Biology Unit, South Australian Museum, North Terrace, Adelaide, SA 5000. Aust.

In southern Australia most of the blowfly species (Diptera: Calliphoridae) found in carrion are of the genus *Calliphora*. All have applied importance as forensic indicators of time since death, as well as being vital constituents of ecosystems because of their role in the decomposition of carcasses. It is therefore important to have the means of identifying these blowflies with certainty. The research presented here was directed at developing methods for the reliable identification of the adults and third instar larvae of these flies. This was done using three techniques: 1) morphological taxonomy, 2) allozyme electrophoresis and 3) mtDNA sequencing. Adults and third instar larvae of the following native species of *Calliphora* were examined using all three techniques: *C. stygia*, *C. albifrontalis*, *C. dubia*, *C. augur*, *C. hilli hilli* and *C. maritima*. Together, the three techniques enable certain identification of all six species. 1. Morphological taxonomy. The species are similar as adults, but even more so as immatures; larvae of sister species, such as *C. stygia* and *C. albifrontalis*, are almost indistinguishable. Nonetheless, keys have been developed that separate all of the above species as adults and third instar larvae. Morphological features that are central to the identification of the adults are: i) colour of the dusting on the head; ii) minimum width of the frons in males; iii) number of pairs of presutural acrostichal setae; iv) colour of the integument of the legs; and v) colour of the abdomen. In the third instar larvae, the structure and distribution of the cuticular spines were shown to be of primary diagnostic value; other stuctures upon which reliance has been placed previously, such as the posterior spiracles, were found to be too unreliable for identification. 2. Allozyme electrophoresis. Analysis of adults using this technique revealed clear differences between all species. The further applicability of allozymes for the diagnosis of larvae was confirmed by the great similarity of their electrophoretic profiles to those of the corresponding adults (93% of loci were expressed by both life history stages). 3. mtDNA sequencing. Nucleotide sequences of portions of the mitochondrial *COI* and *COII* genes were obtained from the *Calliphora* species. Species were readily differentiated only at the species-group level; some species were inseparable.
Index terms: Calliphoridae, *Calliphora*, morphology, allozymes, mtDNA

[2943] TESTING RELIABILITY OF ANIMAL MODELS IN FORENSIC ENTOMOLOGY WITH 50-200 LB. PIGS VS. HUMANS IN TENNESSEE

N. H. Haskell, Dept. of Biology, St. Joseph's College, Rensselaer, IN 47978, USA
e-mail:
blowfly@technologist.com

A national focus on scientific evidence, both in the popular and scientific press, has resulted from the well-covered Simpson trials in California. As an extension, the reliability of entomological evidence has recently been challenged in several cases, including U.S. Federal District Court, First Judicial Circuit Court (Escambia County, Fla.), and York Regional Court (Newmarket, Ontario, Canada). Common areas of alleged concern involve data generated at the Anthropological Research Facility (ARF) in Knoxville, Tennessee. These challenges arise by unproven assertion that such data are unreliable because repeated, historical use of the area for scientific studies has fostered a "richness" of individual decomposition organisms that makes the area unsuitable as a model site for forensic field research. State and federal law has heretofore dictated that field research on decomposition of human remains be conducted at the ARF and in accordance with these dictates, National Institute of Justice study , "Testing the Reliability of Animal Models in Research and Training Programs in Forensic Entomology," was founded on a field trial conducted at the ARF in 1989. Therefore, additional comparative studies were initiated with support from the National Institute of Justice to expand comparisons to include pigs with weights including 50lbs., 100lbs and 200lbs., all of which were replicated. In addition, it became possible to have replication of the human subjects with two human remains being placed along with the six pigs. Daily collections were made during mid afternoon for a period of 34 days. Initiation of the study was on July 1, 1998 and continued through August 3, 1998. Methods of arthropod sampling included aerial net collection, hand collection with larval rearing, pitfall traps, and using a control site located 70 yards outside the ARF compound to monitor background insect populations and dispersion of carrion fauna. Statistical analysis of insect fauna, in addition to analysis of climatological data, is approached from a community metrics for both forensically important and non important taxa. Tests include paired similarity between the replicates, total species richness, and the rank abundance of arthropod taxa.

[2944] FORENSIC ENTOMOLOGY IN NEW YORK CITY: LIFE IN THE BOROUGHS

J. Clery.

ABSTRACT NOT RECEIVED

[2945] INSECTS OF FORENSIC SIGNIFICANCE IN ARGENTINA

A. Oliva, Museo arg. Cs nat., Av. A. Gallardo 470, Buenos Aires, Argentina, 1405

At Buenos Aires (34°36'S), species of blowflies (Diptera: Calliphoridae) alternate along the year. Against what might be expected, oviposition does not correspond with ranges of absolute temperatures. A fall in the minimal temperature just before oviposition of *Calliphora vicina* is observed at the beginning of the fall season; it is suspected that a similar stimulus accounts for activation of adults after aestivation. On the other hand, *Phaenicia sericata* appears to be stimulated out of hibernation by a slight rise in the minimal temperatures. Since these responses vary seasonally, it is proposed that the photoperiod influences them. At a locality north of 32°S, the common species of *Ophyra* develops outdoors (summer). However, at Buenos Aires this is a species associated with buried or indoors corpses. This shows plainly that for the purpose of Forensic Entomology studies, Argentina must be divided into several climatic areas. A provisional division has been based on latitude and on geographic altitude. The latter is associated with arid climate, the wider circadian fluctuation of which appears to delay development of blowfly larvae. Cosmopolitan species of blowfy change their behaviour according to the latitude, and this may be due to the different photoperiod stimuli that they receive. The divisions proposed for Argentina are: 1) south of 42°S (cold temperate); 2) between 42°S and 32°S (warm temperate); 3) between 32°S and Tropic of Capricorn (subtropical); 4) north of Tropic (tropical). Each one should be subdivided into humid and arid, which correspond roughly to plains and highlands. 1) is an exception as the climate is arid in nearly the whole division. This corresponds roughly to 1) difference in length of summer and winter days more than 3 h 2) difference about 2 h and a half; 3) difference about 2 h; difference about one and a half h. At latitudes below 20 degrees, difference is negligible, while above than 60 degrees the length of winter day becomes negligible. (This hardly matters in Argentina, where the mainland ends at a lower latitude, while Antarctica is covered in ice the year round.) As zoogeographical divisions are not quite satisfactory for insects of forensic interest (most important species are cosmopolitan and synanthropic), this method might be considered for the whole world, after modification according to the pattern of arid or humid climates.
Index terms: *Calliphora*, *Phaenicia*, *Ophyra*, photoperiod variation

[2946] FIELD INVESTIGATION IN FORENSIC ENTOMOLOGY: TRAINING FORENSIC INVESTIGATORS

K. C. Kim, Department of Entomology, The Pennsylvania State University, University Park, PA 16802 USA; E-mail kck@psu.edu.

Forensic entomology, the application of entomological knowledge to help solve civil and criminal litigation, provides definitive tools for determining " who done it," and makes invaluable contributions to solving the mystery of many homicide cases. In the United States forensic investigation in homicide cases often involves entomological expertise in determining the time of death. In most of forensic investigations however, forensic entomologists are not directly involved in scene investigations. After scene investigation forensic investigators usually seek entomological expertise when insects and related arthropods are found associated with the victim's body at the scene or medical examiner's autopsy. In most cases the samples submitted for entomological analysis are often inadequate and without necessary field data surrounding the victim's body such as site and body temperatures and the pattern of arthropod infestation on the body. Thus, the samples do not represent realistic faunal and developmental profiles. As a result, entomological analysis is often constrained in making the correct estimation of postmortem interval (PMI). To improve the current practice I have conducted an annual training program, Penn State Forensic Entomology Workshop, for forensic investigators since 1993. This course is a 3-day program with hands-on laboratory and field studies using pig models. The course covers an introductory entomology, principles of forensic entomology, taxonomy of the sarcosaprophagous insects and related arthropods, and PMI calculation. Participants of the course include forensic investigators, namely detectives and crime lab scientists, coroner or medical examiner, and fellow entomologists. Forensic investigators who participated in the course develop a better understanding of forensic entomology and submit adequate entomological samples with necessary environmental data at the scene for entomological service. The details of the course instruction will be discussed.
Index terms: Forensic entomology, Workshop, PMI, training, forensic investigators

[2947] THE ROLE OF AQUATIC INSECTS IN FORENSIC INVESTIGATIONS

J.R Wallace[1] & R.W. Merritt[2].[1] Dept. of Biology, Millersville Univ., Millersville, PA 17551, USA;[2] Dept. of Entomology,
Contact author: R. W. Merritt, Dept. of Entomology, Michigan State University, East Lansing, MI 48824, USA.

Medicocriminal forensic entomology deals with arthropod involvement in events surrounding felonies, usually violent crimes such as murder, suicide and rape. Key elements in these investigations is determining the time between death and corpse discovery, which is generally referred to as the postmortem interval or PMI. Decomposition of a body submerged in an aquatic environment occurs at a rate roughly half that of decomposition in air, due to cooler temperatures and the inhibition of insect activity. Although most PMI's involve the use of terrestrial insects that colonize the body, such as Diptera and Coleoptera (e.g., blow flies, flesh flies, histerid and carrion beetles), aquatic cases may involve different groups of invertebrates, such as midges, caddisflies, crayfish, amphipods, and isopods. Generally aquatic insects are not known to be necrophagous (specifically finding and then feeding on dead tissue), as are terrestrial species. However, some aquatic insects will use submerged or floating corpses as a solid surface for attachment to facilitate feeding, whether it be filtering, feeding on periphyton, or hiding from predators. Other aquatic arthropods (e.g., crayfish) will feed extensively on human tissue. We present several case histories in which aquatic invertebrates have been used to help determine the postmortem submersion interval or PMSI.
Index terms: decomposition, aquatic, mdges, caddisflies, PMSI

[2948] FLIES AND DRUGS IN SOUTHEASTERN BRAZIL

L. M. L. Carvalho[1] & A. X. Linhares[1], [1] Departamento de Parasitologia-IB, Unicamp, Caixa Postal 6109, Campinas, SP, CEP 13083-970, Brasil, E-mail luma@obelix.unicamp.br; This study was supported by FAPESP.

Necrophagous insects have been used as an alternative to estimate the death time. In addition, the study of insects, specially larvae found in cadavers can also contribute to the qualitative identification of substances or abuse drugs present in the corpse. Drug related deaths have increased in many countries of the world, including Brazil. Usually, victims are not found for several days to months and because of it, entomological techniques are useful in forensic analysis. Therefore, it is important to determine if these substances can affect the development of flies and as a consequence, causing errors in estimating the death time. The purpose of this study was determine the effect of abuse drugs on the development and growth of Diptera larvae, as well as to verify the time of emergence of adults; factors that can influence and affect the estimate of postmortem interval (PMI). Rabbits weighting 3.2 to 4.0 Kg were used as test animals for the administration of drugs (cocaine, diazepam, amphetamine and THC). Twice the lethal concentration for each drug was administered by intra cardiac injection. The control rabbit received only saline solution. The rabbits were killed mechanically, and a sample of liver was exposed to newly emerged larvae of *Chrysomya putoria* and *Chrysomya albiceps*. At 6h intervals up to 54h, total weighs were recorded for groups of ten larvae for each liver sample and for each species. The larvae were placed in an artificial diet and kept in the laboratory at 27°C, in order to complete their development. The time required for pupariation, emergence and longevity were also recorded in hours. The SAS Package was the statistical program used to analyse the data. It was observed that regardless of the drug used, both species of flies were influenced by the presence of the drug (F=264,9 P<0,0001) and showed differences in their cycle life: pupariation time (F=3,58 P<0,0003), emergence time (F=40,2 P<0,0001) and longevity (F=4,86 P<0,0029), when compared to the control ones.
Index terms: *Chrysomya putoria*, *Chrysomya albiceps*, drugs, forensic entomology, PMI

[2949] DNA-BASED DIAGNOSTIC TESTS FOR FORENSIC ENTOMOLOGISTS

J.D. Wells, Dept. Justice Sciences, Univ. of Alabama at Birmingham, 901 S. 15th Street, Birmingham, AL 35294, USA, E-mail: jwells@uab.edu.

Recent advances in molecular biology have had a profound influence on forensic science, and several applications of DNA techniques have been proposed for forensic entomologists. The methods that have been experimentally demonstrated, but which have yet to be widely practiced, fall into two general categories; the identification of insect gut contents and the identification of insect specimens. Gut contents are identified in order to associate an insect with an individual person. Pubic lice may be transferred from assailant to victim during a sexual assault, and it is now possible to compare human mitochondrial and satellite DNA from louse gut contents with DNA from a suspected assailant. In a similar manner human DNA from a fed mosquito resting on an interior wall may strongly suggest that a particular person was recently present in the room. Analysis of maggot gut contents can allow investigators to associate maggot and victim when larvae but no corpse are found at a scene, or if both are discovered but there is a plausible alternate food source for the maggots. If the larvae developed on the other food source then their age is irrelevant to estimating time of death. DNA-based identification of insect specimens circumvents the difficulty that now exists in identifying the immature stages, and in some cases even the adults, of many forensically important insects based on anatomy. For example, the larvae of Sarcophagidae in carrion cannot be distinguished based on anatomy even to the level of genus, and in many species it is only the adult males that can be identified with certainty. In contrast we have found that all sarcophagids likely to be collected from a corpse at an urban location in the USA or Canada can be easily distinguished based on mitochondrial DNA sequence data. Similar results have been achieved with the Calliphoridae. We have also begun to examine more variable loci in an effort to describe the population genetic structure of carrion flies. In this presentation I will briefly review the general principles of forensic DNA typing, summarize the research in our laboratory and that which has been published by others on DNA-based diagnostic tests for forensic entomologists, and discuss what I think will be the impact of these technological developments on the discipline of forensic entomology.
Index terms: Sarcophagidae, Calliphoridae, identification, microsatellites, mtDNA

[2950] FORENSIC ENTOMOLOGY CASEWORK BEYOND DETERMINATION OF POST MORTEM INTERVAL: FAKE BLOOD SPATTER, MAGGOT SPECTERS, AND RED BACTERIA

M. Benecke, Univ. of Cologne, Forensic Biology Research Unit, Inst. f. Zoology, 50923 Köln, Germany, E-mail benecke@uni-koeln.de, http://www.uni-koeln.de/~akr05/

In our daily forensic routine we frequently stumble across cases that are a multidisciplinary challenge for the forensic entomologist. Here we present three cases dealing with entomological evidence from crime scenes in Germany, and the United States. In two of the cases, the material was provided, and analyzed several month after the actual point of death (in one case several month after the corpse was removed). The first case deals with an appartment that was completely empty and cleaned out but was found to be the source of a severe infestion with blowfly maggots in seven other appartments located nearby. The reason was found to be a corpse in decay from which maggots had been crawling away after an unexpected drop in outside temperature the day before the corpse war removed. During the following month, the larvae rested in diapause, hidden in cracks. In the following spring, the maggots spread out in search for places to hide and pupate. The second case deals with a bacteria infection that was thought to be the main reason for the death of a person in a closed appartment. The only evidence for the infection was a single *M. stabulans* pupa on a decomposing corpse. The pupa was found to contain high levels of the so-called "blood drop bacterium" *S. marcescens*. The third case deals with artifacts at a crime scene caused by blowflies (research performed in cooperation with L. Barksdale, Lincoln Police Dept., Nebraska, USA). Some blood spatter-like patterns on a wall were analyzed by DNA typing ("genetic fingerprint"), and a quick test for blood was applied. The stains were found to consist of blood of the victim; however, we could prove by experiments, and by extensive statistical testing that adult flies had produced the alledged blood stain pattern, and that blood spatter had not occured.
Index Terms: Blowflies, Blood Spatter, Artifacts, Bacteria, DNA Typing

[2951] THE PRESENT OF OPHYRA SPP. (DIPTERA: MUSCIDAE) AS IMPORTANT CLUES IN THE STIMULATION OF POST-MORTEM INTERVAL OF HIGHLY DECOMPOSED BODIES FOUND IN MALASYA

B. Omar & A. M. Marwi.

ABSTRACT NOT RECEIVED

[2952] EFFECTS OF HANGING AND BURNING ON DECOMPOSITION PATTERNS AND ARTHROPOD INVASION OF REMAINS

M. L. Goff [1] & W. D. Lord [2], [1] Dept. of Entomology, Univ. of Hawaii at Manoa, 3050 Maile Way, Honolulu, HI 96822, USA. [2] Critical Incident Response Group, FBI Academy, Quantico, VA 22135, USA.

Patterns and rates of decomposition and arthropod invasion of a decomposing body are dependent on a number of factors. Studies were conducted on the Island of Oahu, Hawaii, and at the FBI Academy, Quantico, Virginia to investigate the effects of hanging and burning of a body on rates and patterns of arthropod mediated decomposition. The animal model for these studies was the domestic pig. The hanging study was conducted in a xerophytic habitat on the island of Oahu and in a mesophytic habitat at the FBI Academy. In both habitats, the process of decomposition was prolonged when compared with control carcasses and the number of arthropod taxa encountered physically on the hanging carcass was lower. In the hanging, a secondary center of arthropod activity was observed in the drip area immediately below the hanging carcass. Taxa normally encountered on a decomposing carcass were observed in this area, but not on the carcass itself. In the burning studies, carcasses were burnt to approximate a level #2 burn on the CGS. Both studies were conducted on the island of Oahu, Hawaii, one in a xerophytic habitat and the other in a rainforest habitat. No marked differences were observed in the arthropod fauna associated with burnt or control carcasses at either site. Alternate sites for oviposition resulting from cracking of the skin allowed for earlier major ovipositions on the burnt carcasses and decomposition was accelerated by from 1 to 4 days when compared to the control carcasses.
Index terms: Forensic Entomology, postmortem interval, succession

[2953] PARASITOIDS IN FORENSIC ENTOMOLOGY

J. Amendt & R. Krettek, Forschungsinstitut und Naturmuseum Senckenberg, Senckenberganlage 25, 60325 Frankfurt, Germany.

The estimation of the PMI (post mortem interval) is one of the most important features in forensic entomology. Most exact results are obtained 2-3 weeks after death by using the first colonization-wave of necrophagous insects, mainly blowflies. If there are longer periods of death, the methods for calculating the PMI are much weaker, e.g. using the successional stage of the fauna of the corpse. A specific group of insects is hardly used hitherto, despite the fact of their potential use for a exact estimation of longer PMI's: parasitoids. Parasitoids, in contrary to real parasites, always kill their hosts. The main species belong to the Hymenoptera and Diptera, but the Coleoptera are also an important taxa. The parasitic habit is restrict to the immature stages, and the parasitoid female attack egg, larva or pupa of their hosts. The development is endo- and/or ectoparasitic. According to the parasitoid species there are many intermediate stages regarding the strategy of the parasitoid, e.g. the parasitoid can attack the egg of the host, but the parasitic larva starts its development just during the larval development of the host. In europe the larvae and pupa of synanthropic flies are attacked by about 80 parasitoid species. Especially pupal parasitoids of blowflies could play a major role for the estimation of a PMI of about a period of several weeks. The time of parasitation is very often restricted to a small, very well defined window of time at the beginning of the pupal development. Moreover, the development times of many parasitoids are well examined due to the fact that they are important biological agent against syanthropic house-flies. After identifying the host and the parasitoid it's possible to add their development times. Using these specialised guild of insects could prolongue the period, where we can determine a exact PMI. The different parasitoid guilds of blowflies will be present. A case-history and the results of different field- and laboratory studies illustrate the potential use of parasitoids in forensic entomology. Beside that positive aspects we highlight some potential sources of error for the estimation of the PMI, which could be produced by parasitized blowflies, e.g. the prolongued development of a blowfly due to parasitation.
Index terms: Post-mortem interval, blowflies

[2954] THE FORENSIC ENTOMOLOGIST IN THE CONTEXT OF THE FORENSIC PATHOLOGIST'S ROLE

C. P. Campobasso[1] & F. Introna[1], [1]Section of Legal Medicine (DI.M.I.M.P.), Univ. of Bari, Piazza Giulio Cesare, Policlinico, Bari 70100, ITALY, E-mail cpcarlo@yahoo.com

An adequate death investigation requires the combined efforts and cooperation of experts in different disciplines: crime scene technicians, medical examiners/coroners, forensic anthropologists, forensic entomologists, forensic pathologists, other medical and non-medical professionals. These front-line experts play a crucial role in the death investigation process. The forensic pathologist normally has the legal authority to take charge of the dead body at a death scene and his primary functions are the examination of the cadaver by analyzing the extent of injuries and the post-mortem changes of forensic importance and the recovery of physical evidence. He is responsible for determining the time, cause and manner of any death which is the result of violence, suspicious or unexplained circumstances or a death which is sudden or unattended. The forensic entomologist can provide invaluable aid in death cases where cadavers (especially badly decomposed corpses or skeletal remains) are colonized by insects. His principal role is to identify the arthropods associated with such cases and to analyze entomological data for interpreting insect evidence. The major goal of medico-criminal entomology is to contribute to the determination of the time, cause, manner and place of the investigated death with the support of all the elements which can be inferred from the study of insects found on the cadaver or nearby. The application of techniques devised recently in forensic entomology can allow experts in the field to collect strong entomological evidence and provide useful information not only in a death investigation but in a wide range of forensic questions, even in the identification of suspects. As the work of forensic entomologists at the death scene, at the autopsy and in the laboratory is defined and well known, this paper focuses on the difficulties that could arise if forensic pathologists and entomologists are uncertain about the procedures that they have to followed, do not realize the value of objective findings or fail to evaluate them (for instance misinterpreting post-mortem artifcats). Every forensic case presents a slightly different set of circumstances and has to be tackled individually, however forensic pathologists should work with the forensic entomologists on death investigation cases from the visual observations of the cadaver on the scene, through the collection of arthropods and temperature data at the death scene and at the autopsy, till the final report with the evaluation of entomological and other biological findings.
Index terms: forensic science, forensic entomology, forensic pathology.

[2955] LEGAL MEDICINE X FORENSIC ENTOMOLOGY IN BRAZIL

L. M. L. Carvalho[1] & F. A. B. Palhares[2], [1] Departamento de Parasitologia-IB, Unicamp, Caixa Postal 6109, Campinas, Sp, Brasil, cep 13083-970, E-mail luma@obelix.unicamp.br; [2] Departamento de Medicina Legal-FCM, Unicamp, Sp, Brasil. This study was supported by FAPESP.

The modern legal medicine has to bring to our doctors, lawyers and experts the dynamic concepts of daily work, but at the same time, keeping in mind the classical concepts. The legal medicine has a multi and interdisciplinary character and therefore, it cannot be done only by forensic doctors. A case must be studied by researchers of different fields, such as the physician, the biologist, the engineer, the odontologist, the entomologist, etc. Although the potential for contributions of entomology to legal investigations has been known for at least 700 years, only within the last years the forensic entomology has been studied in Brazil and defined as a field of forensic science. It is wide field but it is very little explored by brazilian researchers, specially because in general, the death scene investigator considers that maggots are disgusting elements present in decomposing bodies. The basic reason for using insects in investigations resides in the fact that insects are the first ones to detect a cadaver and are present in all stages of decomposition. The law does not consider the forensic entomology as an official tool used in forensic science and it is not used in the court of law, a common practice in the USA and other countries. Several studies dealing with insect succession and pig decomposition in different regions and altitudes have been done in Southeastern Brazil in order to acquire the database, needed for this kind of study. The next step is to participate in case histories and then, to document the utility of medicocriminal entomology and point out the unique contributions of this field of science, specially to estimate the postmortem interval (PMI).
Index terms: forensic science, forensic entomology, PMI, insects

[2956] SCIENTIFIC UNCERTAINTY VERSUS SPECULATION: FREQUENTLY ATTACKED WEAKNESSES OF FORENSIC ENTOMOLOGY EVIDENCE

R. D. Hall, Dept. of Entomology, University of Missouri, 1-87 Agriculture Building, Columbia, MO 65211, USA, E-mail HallR@missouri.edu.

Scientists deal with probabilities, not certainties. Scientific "truth" is continually revisited and revised. In contrast, legal disputes must be settled with finality, often by juries whose members may be more impressed with assurances of certainty than explanations of relative likelihood. To be admissible in U.S. state or federal courts, the opinions of scientific experts must conform to general "good science" standards. Often misunderstood by judges, juries and scientific experts alike is the gradation between certainty, variability and speculation. Opinions based on speculation or guesswork do not reflect good science and should therefore be excluded from the courtroom or disregarded by the trier of fact. The adversarial battle between experts can become heated during pretrial motions or at trial. Intense pressure to prevail may result in opinions containing more speculation than verifiable science. Whereas forensic entomology in the broad sense has enjoyed judicial acceptance for more than a century, its application to the facts of any particular case can be problematic. The use of remote historical temperature data to infer thermal conditions at a decomposition scene can be either good science or speculation, depending on the circumstances involved. Similarly, insect access to dead bodies is best understood in exposed terrestrial situations, where necrophilous flies can appear within minutes during appropriate seasons and time of day. In these cases, insect development can be analogous to postmortem interval. Burial, immersion in water, wrapping in fabric or plastic, or location of a body inside a structure can fatally complicate the analysis. Preservation of the insect specimens used in a forensic entomology investigation is straightforward when proper techniques are employed, but failures in this regard can result in unwarranted speculation.
Index terms: forensic entomology, scientific evidence, admissibility.

[2957] A PROBABILITY MODEL OF VECTOR BEHAVIOR: EFFECTS OF DDT AND DELTAMETHRIN REPELLENCY, IRRITANCY, AND TOXICITY IN MALARIA CONTROL

D. R. Roberts[1] & J.P. Grieco[1], [1]Center for Applications of Remote Sensing and GIS to Public Health, Department of Preventive Medicine, Uniformed Services University of the Health Sciences, 4301 Jones Bridge Rd, Bethesda, MD 20814 U.S.A. E-mail: droberts@usuhs.mil

A probability model of how DDT residues and potentially other insecticides function within a malaria control program is described. A step-wise organization of endophagic behaviors culminates in a vector acquiring a human blood meal inside the house. Different vector behaviors are described, epidemiologically defined, temporally sequenced, and quantified with field data. Components of vector behavior and the repellent, irritant, and toxic actions of insecticide residues are then assembled into a probability model. The sequence of host-seeking behaviors is used to partition the total impact of sprayed walls according to the three chemical actions. Quantitatively, the combined effect of repellency and irritancy exert the dominant actions of DDT residues in reducing man-vector contact inside houses. This is illustrated by adjusting the repellent, irritant and toxic actions to a common base of 50% effect. The result, based on functions of conditional probabilities, shows that combined effects of repellency and irritancy account for 75% and toxicity accounts for less than 13% of the overall reduction in indoor biting and survival of vector mosquitoes. We tested these vector-insecticide interactions in experimental hut studies; comparing actions of DDT and deltamethrin against host-seeking populations of *Anopheles vestitipennis* in southern Belize, C.A. We found that DDT residues provided 97% protection from indoor biting through chemical repellency. Deltamethrin was much less effective in preventing mosquitoes from entering and biting indoors. Fortunately, most indoor biting after midnight was eliminated by residues of deltamethrin. The relationships defined in the probability model are also illustrated with published and unpublished data for two separate populations of *Anopheles darlingi*, *Anopheles gambiae* and *Anopheles funestus* in Tanzania, and *Anopheles punctulatus* in New Guinea.
Key words: DDT, *Anopheles vestitipennis*, *Anopheles darlingi*

[2958] A THREE-YEAR FIELD EVALUATION OF THE IMPACT OF ROTATIONS AND MOSAIC AS RESISTANCE MANAGEMENT STRATEGIES IN *ANOPHELES ALBIMANUS* IN SOUTHERN MEXICO

A. D. Rodríguez[1,2], P. Penilla[1,2], J. Hemingway[2], A. Trejo[1] & M. H. Rodríguez[1], [1]Infectious Diseases Research Centre/Malaria Research Centre, National Inst. of Public Health, P. O. Box 537, Tapachula 30700, Chiapas, México. [2]School of Biosciences, Univ. of Wales. P. O. Box 915, Cardiff CF10 3TL, Wales UK.

Since 1995, we have undertaken annual rotations of unrelated insecticides (ROT), spatial mosaic spraying (MOS) of two unrelated insecticides in the same area, and traditional spraying of a single insecticide to compare the efficacies of these strategies. The ROT scheme included an organophosphorus (OP) during the first year, a pyrethroid (PYR) during the second and a carbamate (CAR) during the third year. The MOS included the application of an OP and a PYR in the same locations during the three years. Two forms of traditional spraying with DDT or a PYR were tested. Susceptibility tests (WHO) and biochemical assays, were used to monitor the susceptibility status of the *An. albimanus* populations and the resistance mechanisms involved, respectively. High level of DDT resistance and low levels to OP, CAR, and PYR insecticides were detected by WHO discriminating dosage bioassays before the intervention. Resistance to DDT was caused by elevated levels of GST, and AChE was responsible for the OP and CAR. High DDT resistance was detected during the whole intervention in all treatments. Resistance to the PYR increased in all treatments, but after the third year was significantly higher in the PYR control. OP resistance increased in all treatments after two years, but regressed after the third year in PYR and ROT treatments. Changes in CA susceptibility were detected by WHO bioassays after one and two years in MOS and DDT treatments, respectively. After three years, all enzyme levels decreased compared to the pre-intervention period in all treatments, except GST levels in DDT treatment. Despite the reduction compared to the pre-intervention, monooxygenases in PYR treatment were significantly higher compared to the other treatments. The results indicate the benefits of ROT or MOS treatments in reducing the rate of PYR resistance selection over a 3-year period in the context of a large-scale malaria control programme.

[2959] ADVANCES AND ACHIEVEMENT IN PHLEBOTOMINE (DIPTERA: NEMATOCERA) STUDIES IN INDIA: AN OVERVIEW

Girish maheshwari, School of Entomology, St. John's College, Agra, India-282002. E-mail: Girish _ Maheshwari @ yahoo.com.

Phlebotomus or sandfly is the vector of several human diseases such as kala-azar, Oriental sore and sandfly fever in numerous states of India and in other tropical can subtropical regions of the world. These diseases are known to be endemic in many states of India, namely Bihar, Eastern Uttar Pradesh, Rajasthan (specially desert of Bikaner), West Bengal, Maharastra, Orissa, Tamilnadu, Andhra and Jammu and Kashmir. After the classical studies on Indian sandfly by Sinton (1922-1933), only sporadic studies have been carried out by Qutubuddin (1944); Nasiruddin (1951); Ratanaswamy and Ramakrishanan (1954); Mitra (1956, 1959); Dhandha and modi (1977); Modi and Dhandha (1972), Ipe and Singh (1993). Our knowledge of the present state of their distribution and prevalence is very fragmentary and needs thorough revision. Farooq and Qutubuddin (1945) studies some epidemiological factors of oriental sore in the Nizam's Dominians. Dhandha, Rodrigus and Ghosh (1970) isolated the chandipura vinus from sandflies of Aurangabad, India. Short (1931) has studied feeding habits of *P.minutus*.Goverdhan (1946) has isolated *Phlebotomus* fever virus from sandflies and human during the same season. The occurrence of Kala-azar in Gujrat state was studied by Munshi, Vadhya, Buranpuri and Gulati (1972). Epidemiological and entomological features of an outbreak of cutaneous Leishmaniasis in Bikaner were studied by sharma, Suri, Kalra, Mohan and Swami (1973). Very recently numerous deaths are caused by Leishmaniasis in the Nuxalbari Village in North Bengal, India (Mashewari 1999-2000, unpublished data).
Index Term: Leishmaniasis, India, Overview

[2960] AN ANNOTATED CHECKLIST OF THE CHIRONOMIDAE (DIPTERA) OF EGYPT

M. F. Ghonaim[1,2], A. Osheibah[1], A. Ali[2] & J. Moubayed[3], [1]Univ. of Al-Azhar, Faculty of Science, Dept. of Zoology, Nasr City, Cairo, Egypt, E-mail: mfathi@excite.com; [2]Univ. of Florida, Inst. of Food and Agricultural Sciences, Mid-Florida Research and Education Center, 2725 Binion Rd., Apopka, FL 32703-8504, USA, E-mail: aali@gnv.ifas.ufl.edu; [3]Ecologie Appliquee, 11 Rue des Fenouils, 34070 Montpellier, France.

On the basis of data from the literature, 37 chironomid species in 20 genera are hitherto recorded from Egypt: Tanypodinae (4 species), Orthocladiinae (4 species), and Chironominae (29 species). To date, limited work has been done on the midge fauna of Egypt, considering the citations going as far back as 1910, which often belong to *nomina dubia*. The exact number of the well-known species from both Palaearctic and Afrotropical regions present in Egypt are still to be determined. Afrotropical species already recorded from neighboring countries and probably present in Egypt are very numerous. Investigations on the exact number of species in Egypt are currently being conducted. In this paper, the authors give a recent inventory of chironomids collected in the Nile Basin, including Upper and Lower Egypt, Nile Delta, and the Sinai Peninsula. Distribution and richness of communities of the identified species will be mapped and presented.
Index terms: chironomid midges, faunal inventory, Middle-East region, geographical distribution.

[2961] *ANOPHELES DARLINGI* AND MALARIA IN AREAS OF SETTLEMENT IN AMAZÔNIA – MUNICÍPIO DE NOVO AIRÃO (AM)

W.P. Tadei, LB. Rodrigues & B. Dutary-Thatcher, Instituto Nacional de Pesquisas da Amazônia. Caixa Funding: PPG7-FINEP / FUNASA-AMAZONAS.Postal 478, Manaus(AM), Brasil. E-mail tadei@inpa.gov.br. Funding: PPG7-FINEP / FUNASA-AMAZONAS.

Construction of the roadway going to the Município of Novo Airão (AM) brought about an increase in malaria in the region. Prevalence indexes went from 6.16 to 246.57 per 1.000 inhabitants in 1994. In order to reach the objective of indicating the most suitable measures for controlling the disease within the region, malaria transmission dynamics was studied by analysing entomological parameters, evaluating controlling measures. Collections of Anopheles were carried out along the roadway, in road side settlements, and in the city extending to urban and periurban areas. We detected 11 species of Anopheles, An. darlingi being the most frequent, with the greatest activity from 18:00 to 20:00 h.. The highest indexes of seasonality of An. darlingi are from May to August, with the highest peaks in June and July. This phase coincides with the last rainfalls in the season and the beginning of the water reflux in Rio Negro. There is a higher incidence of Anopheles outdoors and the seasonal incidence of malaria cases reflects the seasonal availability of An. darlingi within the region. Natural infection data (ELISA)- point this species out as the most infected. Amongst the positive suspensions, four were for An.darlingi and one for An. nuneztovari. These data indicate an index of minimum infection of 1:177, thus it means that at least one mosquito was infected in each of the positive suspensions These natural infection indexes are compatible with the idea that few infected An. darlingi were enough to maintain an endemic disease within a determined area. Thermal-spraying as a measure of control indicated mosquito bite per man hour index (BMHI) in pre-application – 1.0 indoors - and 0.10 outdoors to be reduced to zero in up to 11 days following the application, both indoors and outdoors. Outdoors this index only returns to values near the ones at pre-application BMH = 0.11, after 13 days. In the evaluation of female pre and post thermal spraying parity percent index, it's verified that the index changes from 0.18 multiparous females in pre-application to zero 3 and 11 days following application. In the urban area, the Bacillus sphaericus 2362 effectiveness against anopheline larvae kept breeding sites with no immature forms for up to nearly 30 days, with a very low density of winged An. darlingi. In breeding sites located on the roadway, evaluations ascertained that recolonization by anophelines occurred 14 days following application. For controlling malaria in the city outskirts and rural areas, where household conditions are precarious one recommends using mosquito nets impregnated with pyrethroids.
Index terms: Anopheles, Natural Infection, Malaria Control, Biological Control, Bacillus sphaericus.

[2962] *ANOPHELES GAMBIAE* MIDGUT MICROVILLI: EFFECTS OF INDUCED IMMUNITY ON LONGEVITY, FERTILITY AND TRANSMISSION OF MALARIA

Almeida, A.P.G.[1], Lopes, D.K. [1,2], Merelo Lobo, A.R. [1,2], Silva, S.R. [1,2] Pinto, L. [1], [1]-Entomologia Médica/UPMM, 2-CMDT, Instituto de Higiene e Medicina Tropical, Universidade Nova de Lisboa, R. Junqueira, 96, 1300 Lisboa, Portugal . Fax- 351-21-3632105, Tel-351-21-3652643, E'mail: palmeida@ihmt.unl.pt. Acknowledgements- This work was funded by Project Imunopor (PEDIPII). Lisboa, Portugal. Protocols for enzyme assays were kindly offered by Dr. Clélia Ferreira, U. São Paulo, Brazil.

Extraction of microvilli (MV) from sugarfed *An. gambiae* midguts, was done according to the optimization of the procedure described by Houk *et al.* (1986), involving homogenisation in glass/glass grinder and differential centrifugation, obtaining MV extracts confirmed by transmission EM (uniform membrane vesicles), and enzyme activity (enrichment of amylase, aminopeptidase and gamma-glutamyl transferase). Separated by native-PAGE, Mv extracts presented several protein bands. BALB/c mice were immunized with sections of gel containing these proteins, for 5 sequential immunizations. Antibody titres, reached $1:10^5$ and different reactivities in immunoblotting. Mosquitoes that took three bloodmeals on these mice were monitored for survival and fecundity. The effect of these antibodies in the transmission of rodent malarial parasites, *P. berghei* was equally assessed. Possible implications for malaria vector control are discussed.

[2963] ANTHROPOPHILIC BEHAVIOUR OF CULICIDAE DURING SUNSET inside forest of Iguaçu regional park, Parana STATE, Brazil

M.C.V.C., Ribeiro[1] ; M. A. N., Silva[1] & R. L., Barreira [1], [1]Dept. of Zoologia, Univ. Federal of Paraná, P. O. Box 19020 Brazil, E-mail magda@garoupa.bio.ufpr.br.

Many investigations have underlined the influence of sunset on mosquito anthropophilic behaviour. The aim of this work, is to obtain more information about the species that habit the woodland inside of Iguaçu Regional Park, Curitiba city, (25° 26´ Lat. South and 49° 16´Long. West, alt. 923, 50 m) and to correlate it with the anthropophilic behaviour. Mosquitoes were collected at the evening crepuscular period, twice a month during the summer, to study the species prevalence inside the forest. The intervals of sampling was each 15 min. The rainfall and rising temperature were correlated. In the total of 6 sampling, we have collected 809 females and two males of Culicidae. Five species were identified: *Mansonia (Mansonia) titillans*, *Culex* sp, *Haemagogus (Conopostegus) leucocelaenus*, *Aedes (Stegomyia) albopictus* and, *Aedes* sp. Except by the first result, every sampling inside the forest showed a high biting activity cycle during the early evening. The literature report that the beginning of the sunset is a important period to promote an endogenous stimuli, resulting in a bloodfeed activity at this time.
Index terms: Culicidae, forest ecology, sunset

[2964] ANTIBODY AND BLOOD LEUKOCYTE RESPONSE IN *RHIPICEPHALUS SANGUINEUS* TICK INFESTED DOGS AND GUINEA PIGS

M.P.J. Szabó, V.L. Aoki, F.P.S. Sanches, R.Z. Machado & G.H. Bechara, Depto. de Patologia Veterinária, Fac. de Ciências Agrárias e Veterinárias, Univ. Estadual Paulista, Jaboticabal, SP 14870-000, Brasil, E-mail szabo@asbyte.com.br. Financial support: FAPESP.

The dog is considered to be the natural host of *R. sanguineus* and is unable to develop resistance even after repeated feeding whereas guinea pigs develop strong resistance after one infestation with adult ticks. Antibody (IgG) titres against tick salivary gland antigens and blood leukocyte numbers in dogs and guinea pigs undergoing experimental *Rhipicephalus sanguineus* tick infestations with, respectively, 25 female and 30 male and four female and five male adult ticks, were evaluated to detect a possible correlation with susceptibility and resistance of hosts. Antibody titres were evaluated by an enzyme-linked immunosorbent assay (ELISA) along three consecutive infestations of both hosts. Dogs and guinea pigs displayed low IgG titres against *R. sanguineus* salivary gland antigens along the three infestations suggesting an immunosuppressive effect upon this antibody class. Total and differential blood cell counts were determined in dogs and guinea pigs during primary and secondary infestation. In dogs a tertiary infestation and effect of a higher infestation (120 male and 100 female ticks) level was also evaluated. Infested dogs did not display any alteration in blood leukocyte counts throughout the experiment. Guinea pigs, on the other hand, developed a significant basophilia during primary infestation and which further increased during secondary infestation. Basophilia in guinea pigs and lack of eosinophilia in both hosts during infestations will be discussed.
Index terms: immunology, hematology, ixodid ticks, basophil

[2965] BASIC STUDIES OF HAEMATOPHAGOUS DIPTERA (MOSQUITOES) AS A MODEL FOR THE IMPLEMENTATION IN PROBLEM AREAS OF STRATEGIES OF BIOLOGICAL AND/OR INTEGRATED CONTROL

H. A. Marino, Centro de Estudios Parasitológicos y de Vectores – Calle 2 Nº 584 – La Plata, C.P.1900, Buenos Aires, Argentina. E-mail cepave@museo.fcnym.unlp.edu.ar

At present and as a consequence of agricultural, economic and urbanization developments, the environment shows deep transformations with direct impact in the use of land and water, implying a re-adaptation of insects to those areas, which in the case of mosquitoes leads to carrying out of basic studies in order to get a precise idea of the current bionomy and behaviour of each vector and their relationships with human ecology. These studies were carried out for 13 months in the municipality of Lavalle in the province of Mendoza, basically as a consequence of the mosquito-bites to rural worker population. Systematic samplings adequate to the obtaining of a maximum of information were conducted, dividing the studied zone into plots according to their hydrology and use of land. Population density of immature states were relatively estimated by the method of "sampling by effort unit", obtaining a number of larvae of a certain species by number of ladle (20 in each pond). Adult states were studied by fortnight captures in 5 definite places, using CDC traps for 24 hours, measuring "in situ" highest and lowest temperatures and rainfalls, parameters which were related to the population fluctuations, using Pearson's product-moment correlation coefficient, after data normalization. A total of 12 species were collected, of which the following were new to the province: *Culex bidens* Dyar, *Cx. eduardoi* Casal y García, *Cx. dolosus* Lynch Arribálzaga, *Cx. Maxi* Dyar, *Cx. saltanensis* Dyar, *Cx. tatoi* Casal y García and *Haemagogus (Haemagogus) spegazzini* Brethesi. The dominant mosquito species was *Aedes (Ochlerotatus) albifasciatus* Macquart (97 %), whose presence was true all the year long and which is the key species of this taxocenosis. The biggest larva population density was recorded in May, September and October, whereas the highest adult activity was recorded in February, coinciding with the highest human activity (grape harvest). Therefore it is fundamental to plan control measures one or two months prior to the detection of population peaks. Haematophagous diptera control with aquatic immature states (Culicidae and Simulidae) requires an adequate knowledge of their reproduction areas, ways, season, density and aggressiveness. The use of biocides such as *Bti* and mechanical control imply a higher efficiency and low or non-existent contamination. These studies allow for the development of predictive models, basic for the anticipation of treatment with their resulting operative benefits.
Index terms: vector, *Culex bidens, Cx.eduardoi, Cx.dolosus, Cx.maxi, Cx.tatoi, Haemagogus spegazzini, Aedes albifasciatus, Bti.*

[2966] BITING ACTIVITY OF DIURNAL MOSQUITOES INSIDE FOREST OF IGUAÇU REGIONAL PARK, PARANA STATE, BRAZIL.

M.C.V.C., Ribeiro[1] & M. A. N., Silva[1].[1]Dept. of Zoologia, Univ. Federal of Paraná, P. O. Box 19020, Brazil, E-mail magda@garoupa.bio.ufpr.br

Ecological studies are carried out on mosquitoes due to their important role played in the transmission of diseases to humans and animals. In the purpose to get information about the species in a woodland inside of Iguaçu Regional Park, Curitiba city, (25° 26´ Lat. South and 49° 16´Long. West, alt. 923, 50 m). Systematic collections of Culicidae were made on human bait at land level, between 9:00 am to 4:00 pm from September/1999 to February/2000 (72 hours) have been caught 846 mosquitoes. This study has shown complex influence of the endogenous and exogenous factors relating to the blood feeding habit de Culicidae when correlated with rainfall and rising temperature. The most common species was *Mansonia (Mansonia) titillans* , aproximately 95% mosquitoes collected. *Culex* sp, *Haemagogus (Conopostegus) leucocelaenus, Aedes* sp were collected in low numbers. The members of Mansoniini are reported as numerous in various anthropogenically modified areas, except in the article of Shannon (1931), regarded as a group presenting some tendency to adapt to artificially modified environments (Dorvillé, 1996). From the epidemiological point of view *Mansonia titillans* and *Haemagogus leucocelaenus* are reported as arbovirus vectors species.
Index terms: Culicidae, forest ecology, vector.

[2967] BITING PATTERNS AND DEVELOPMENTAL SUBSTRATES FOR *CULICOIDES PARAENSIS* (DIPTERA; CERATOPOGONIDAE), THE VECTOR OF OROPOUCHE VIRUS, IN IQUITOS, PERU

D. R. Mercer[1], D. M. Watts[2] & R. B. Tesh[3], [1]Dept. of Biology, Univ. Northern Iowa, Cedar Falls, IA 50614-0421 USA, [2]U. S. Naval Medical Research Inst. Detachment, Lima, Peru, [3]Dept. of Pathology/Center for Tropical Diseases, Univ. Texas Medical Branch, Galveston, TX 77555-0609 USA.

Oropouche virus causes a non-fatal but high incidence fever. An epidemic of Oropouche fever occurred in Iquitos, Peru, during 1992. Oropouche virus is now endemic in Iquitos, a port city on the Amazon River with more than 300,000 residents. To understand their roles in virus transmission, non-culicid biting flies were collected at human sentinels at 16 periurban and rural sites around Iquitos between October 17, 1996 and June 22, 1997. *Culicoides paraensis*, the vector of Oropouche virus, was the most commonly collected species (9,086 flies) with *Culicoides insinuatus* second (7,222 flies). Three additional *Culicoides* spp. were rarely caught and were patchy in distribution. One Simuliidae was rare but widely distributed. Although the northern-most and southern-most sampling sites were separated by <20 km, *C. paraensis* dominated northern collection sites (>90%) whereas *C. insinuatus* dominated southern collection sites (>60%). Unlike previous reports of bimodal daily biting patterns, *C. paraensis* were collected at human sentinels at a constant rate throughout daylight hours, and regardless of rainfall. Residents of Iquitos are exposed to high numbers of bites by *Culicoides* spp. throughout their periods of activity, and local biting populations are not depleted. Larval developmental substrates for *C. paraensis* were identified by collecting materials from the field and allowing adult insects to emerge into collection containers. *Culicoides paraensis* adults emerged from decaying *platano* stems, stumps and fruits, and from soil beneath a fruiting *mamay* tree. *Culicoides insinuatus* adults also emerged from decaying *platano* stems, stumps and fruits. Despite high numbers of biting adults near putative substrates, adults of neither species emerged from soil or straw beneath *platano* trees, *aguaje* stems, axils, fruits or surrounding soil, sawdust, citrus, *guaba* fruits, *mamey* fruits, lakeside sand or mud, phytotelmata (water-filled fruit pods and treeholes) or artificial containers. Because both species of biting midges emerged in high numbers from all parts of *platano* and because *platano* plants are ubiquitous in Iquitos, it is unlikely that control of these pests can be achieved through sanitation of surroundings.

Biting midge, Bunyaviridae, arbovirus, host-seeking

[2968] BLOOD SOURCES OF THE TRIATOMINE BUGS COLLECTED AT THE RURAL VILLAGES IN GUATEMALA (HEMIPTERA: TRIATOMIDAE)

Hitoshi Sasaki[1], **Regina Rosales**[2] **& Yuichiro Tabaru**[3], [1]Laboratory of Entomology, Rakuno Gakuen University, Ebetsu, Hokkaido 069-8501, Japan, E-mail h-sasaki@rakuno.ac.jp; [2]School of Biology, University of San Carlos, Guatemala, Guatemala; [3]JICA, Tokyo, Japan.

The triatomine bugs, the serious vectors of Chagas' disease, were collected inside of the houses at the remote rural villages in Zacapa and Santa Rosa, Guatemala, Central America. In the previous examination, the infection rate of *Trypanosoma cruzi* of the investigated area were determined to be 13.2% (202/1534) in *Rhodnius prolixus* at Zacapa and 29.1% (226/776) in *Triatoma dimidiata* at Santa Rosa. A total of 293 *R. prolixus* (1st: 26, 2nd: 37, 3rd: 43, 4th: 17, 5th: 27, female: 64 and male: 79) and 170 *T. dimidiata* (1st: 0, 2nd: 14, 3rd: 30, 4th: 25, 5th: 24, female: 32 and male: 45) were collected. *R prolixus* was collected mainly from the straw-thatch and *T. dimidiata* was collected mainly from the cracks and crevice of the wall. Among them, 202 (68.9%) *R. prolixus* (1st: 11(42.3%), 2nd: 23(62.2%), 3rd: 21(48.8%), 4th: 11(64.7%), 5th: 27(100.0%), female: 51(79.7%) and male: 58(73.4%)) and 157 (92.4%) *T. dimidiata* (2nd: 7(50.0%), 3rd: 28(93.3%), 4th: 23(92.0%), 5th: 23(95.8%), female: 32(100.0%) and male: 44(97.8%)) were engorged. The ELISA technique was used to analyze the blood meals. The gut contents of 91(45.1%) reacted to one or more of 8 different antisera in *R. prolixus*, and those of 72(45.9%) did to one or more of 6 different antisera in *T. dimidiata*. Feedings from human accounted for 61.3% of all identified blood meals, followed by feedings from chicken (15.1%), cow (8.6%) and rat (6.5%) in *R. prolixus*. In *T. dimidiata*, feedings from human accounted for 62.3% of all identified blood meals, followed by cow (14.3%), cat (11.7%) and chicken (9.1%). No distinct different patterns in both number and source of host identifications were showed among nymph and adult blood meals. Multiple blood meals were found to be very few in number in both species: 4 (2.0%) in *R. prolixus* and 3 (1.9%) in *T. dimidiata*.

Index terms: triatomine bug, Chagas' disease, blood source, ELISA, Guatemala

[2969] BRAZILIAN SPOTTED FEVER TRANSMITED BY *AMBLYOMMA AUREOLATUM* (ACARI) IN MOGI DAS CRUZES, BRAZIL: REPORT OF FOUR HUMAN CASES AND ENVIRONMENTAL CONTROL MEASURES

L. R. Fontes[1], **S. M. A. Gomes**[2], **E. D. Anjos**[2] **& J. C. R. Andrade**[1], [1]SUCEN, R. Cardeal Arcoverde, 2878, 05408-003 São Paulo, SP. [2]Secr. Munic. Saúde, Av. Narciso Y. Guimarães, 277, 08780-900 Mogi das Cruzes, SP, Brazil.

Brazilian spotted fever (BSF) is a tick-borne rickettsiosis transmitted in rural areas and in the surroundings of vegetation preserved areas, in SE Brazil. Humans are accidentally infected when bitten by *Amblyomma* spp., either carried by domestic and wild animals, or being acquired when humans invade savannas and forests for recreation or work. The main hosts of the tick in nature are wild animals. **Human cases.** Four cases of BSF were notified from June to December 1998, in the Taiçupeba District, Mogi das Cruzes, SP. Three women, aged 16, 18 and 40 died, only a 6 years old boy survived. Two previous deaths (a man and a boy, respectively 70 and 11 years old) are also suspected to be undiagnosed cases of BSF. All patients belonged to 2 poor blood-related families. **Environment.** Tourist place in the margin of the city water reservoir, surrounded by dense Atlantic forest. Capibaras are very common in the area. In the site about 1 km^2 where the cases occurred there are few recreational rural properties. There are also degraded areas with sparse eucalyptus trees, many trunks and root remains, wastelands with scattered sewage, and 2 decrepit wood hut in the water reservoir margin. Sparse termite mounds with large cavities beneath complete the picture. The 2 victim families live in 2 poor brick houses about 100m from each other. They had 12 dogs and 3 cats as pets. They referred that rats are common, also inside their houses. **Control.** Control measures just followed the first clinical evidences of BSF: education program, site sanitation, a detailed rat control program, and pets treatment. Pets had their ticks mechanically removed and were elected for subsequent chemical control. However, the unexpected death of a woman aged 40, only 1 week after our search for ticks on their fierce dogs, obliged an emergency unpleasant measure to abort transmission: all pets were immediately killed in the field. **Conclusions.** The transmitter tick is *A. aureolatum*, instead of *A. cajennense*, common in other endemic BSF areas in SE Brazil. Capibaras are elected as the main natural hosts of the ticks and patogens. Adult ticks are common in dogs, that run capibara trails. Immatures of *A. aureolatum* are also carried by domestic and wild small rodents, thus preventive and control measures should include a thorough long-term rodent control program in houses and their neighborhood, in addition to traditional measures. Finally, despite controversial and maybe subjected to disapprove of animal protection agencies, pets are highly undesirable in BSF endemic areas.

Acknowledgment: Dr. T. Schumaker kindly identified the ticks.

Index terms: rickettsiosis

[2970]CHARACTERIZATION AND CARBON METABOLISM IN FUNGI PATHOGENOUS TO CHAGAS DISEASE VECTORS

M. P. Juárez[1], **R. Crespo**[1], **G. Calderón**[1], **R. Lecuona**[2] and **L. F. R. Cafferata**[3], [1]Inst. Investig. Bioquím. La Plata, Fac. Cs. Méd, UNLP, calles 60 y 120, La Plata 1900. [2]IMYZA-CICA-INTA, Castelar, C.C. 25, 1712, Castelar, Bs As. [3]Lab. Quím. Org., Ladecor, Fac. Cs Exactas, UNLP, calles 47 y 115, La Plata, 1900, Argentina. E-mail: mjuarez@isis.unlp.edu.ar.

In this paper we report the pathogenicity of *Beauveria bassiana* isolates to *Triatoma infestans*, the vector of Chagas disease in Argentina. A 100% mortality was achieved with mean lethal times varying from 7.7 to 11.1 days. Degradation of their insect host epicuticular hydrocarbons was previously shown to be a major metabolic pathway for energy provision (Napolitano R. and M. P. Juárez. 1997. Arch. Biochem. Biophys. 344: 208-214). *B. bassiana* cultures induced to grow on a hydrocarbon-enriched agar as the sole carbon source were able to reduce the mortality time of *T. infestans* in 20%.The unsaturated/saturated ratio for fungal fatty acids was markedly diminished for alkane-grown cells, in addition, the composition of the saturated fraction was modified showing large amounts of heptacosanoic, hydroxy-methyl-heptacosanoic and eicosanoic acids. The hydrocarbon profile of *B. bassiana* showed a saturated chain length distribution, with a marked prevalence for straight chains, ranging from C18 to C37 in the carbon squeleton. Alkane-grown cells showed a homogenous distribution of their hydrocarbon fraction, with a similar ratio for odd/even chains. After 48 hr-incubation assays, carbon metabolism from [1-^{14}C]acetate was largely diminished following a period of alkane-growth induction; glucose-grown cells readily incorporated 19% of the label into fungal lipids, incorporation was reduced to 5.3% for alkane-grown cells. These data provide evidence towards the potential of improving current biocontrol agents performance by modification of the supplemented carbon source.

Index terms: *Beauveria bassiana*, *Triatoma infestans*, hydrocarbon catabolism, fatty acids

[2971] CHARACTERIZATION OF *LONOMIA OBLIQUA* AND *PERIGA CIRCUNSTANS* (LEPIDOPTERA, SATURNIIDAE) OCCURING IN RIO GRANDE DO SUL STATE, BRAZIL

E. Corseuil[1], A. Specht[1,2], F.Z.da Cruz[3] & B.R. Roth[1], [1] PPG-Biociências, PUCRS, Av. Ipiranga, 6681, C. Postal 1429 CEP 90619-900, Porto Alegre, RS, Brasil, E-mail corseuil@pucrs.br; [2] Curso de Agronomia, UNISUL, Av. José Acácio Moreira, 787, CEP 88704-900, Tubarão, SC, Brasil, E-mail spechta@pucrs.br, [3] Curso de Agronomia, UFRGS, Av. Bento Gonçalves 7712, CEP 91540-000, Porto Alegre, RS, Brasil.

In the least decade occurred an expressive increase on people number involved in hemorrhagic accidents by contact with *Lonomia obliqua* caterpillars, in Southern Brazil, especially in Rio Grande do Sul State. The death number occurred carry out the peoples and scientist to study biology and taxonomy of these moth. An expressive publications number about these group fundamented on individuals of collections of research institutions were performed. In the collection of Entomology Laboratory of Museu de Ciências e Tecnologia da PUCRS were observed the specimens captured on several districts of Rio Grande do Sul State, expressive morphological variations, suggest, probably multiplicity of species. Were examined 23 genitalia adult males with the aim to verify the morphological variation in *L. obliqua*. The genitalia were submitted for 10 minutes in sodium hydroxide solution at 10% and heat until ebullition and transferred to distilled water in Petri dish. The material were examined with stereoscopic microscopy. The coloration observed on *L. obliqua* varied since yellowish until a "red form" and *Periga circunstans* since yellowish to yellow shade. The late specie, easily confounded with yellow forms of *L. obliqua* and only recently was separated from *Lonomia* genus. The wing span ranged between 55.06 to 64.39mm. *L. obliqua* wing span ranged between 71.35 to 85.11mm. Expressive differences were observed in the two genitalia groups; particularly in valves, uncus and vinculus.
Index terms: Moth, Morphology, Systematic, Hemileucinae.

[2972] COMPARISON OF VECTORIAL CAPACITY IN INSECTICIDE RESISTANT AND SUSCEPTIBLE *CULEX QUINQUEFASCIATUS* FROM FILARIASIS ENDEMIC SRI LANKAN FIELD POPULATIONS

L. M[c]Carroll[1], S.H.H.P. Karunaratne.[2], M. Paton[1] & J. Hemingway[1], [1]School of Biosciences, University of Wales Cardiff, P. O. Box 915, Cardiff CF10 3TL, UK, email: Hemingway@cardiff.ac.uk. [2] Dept of Zoology, Faculty of Science, University of Peradeniya, Sri Lanka.

Esterase gene amplification is the commonest mechanism of insecticide resistance in *Culex* mosquitoes. One esterase based resistance phenotype occurs worldwide. Resistant insects have two esterases and an aldehyde-oxidase over-expressed. Esterase expression is in the gut epithelium, malpighian tubules and salivary glands, where they form ~20% of the soluble proteins in these tissue, compared to >0.5% in susceptible insects. The gut and mouth parts are tissues with which *Wuchereria bancrofti* is closely associated in the insect vector. This parasite is responsible for the majority of filariasis cases in Sri Lanka. The effect of the esterases on the insects ability to vector has never been considered. In this study, wild populations of *Culex quinquefasciatus* from seven filariasis endemic areas of both inland and coastal regions of Sri Lanka were analysed to determine whether resistant and susceptible mosquitoes have a similar vectorial capacity. Esterase activity was determined individually for one hundred wild caught blood-fed mosquitoes from each of the field populations. An accurate estimation of *W. bancrofti* in each mosquito was determined using quantitative PCR. Results demonstrate that mosquitoes with the highest esterase levels harbour the lowest number of parasites. These interesting and exciting results provide the first information on the possible interactions between insecticide resistance and the vectorial capacity of the mosquitoes.
Index terms: *Wuchereria bancrofti*, esterase, quantitative PCR

[2973] CORRELATION BETWEEN THE WEIGHT OF THE THIRD INSTAR LARVAE AND THE SEX OF ADULTS OF *DERMATOBIA HOMINIS* (LINNAEUS, JR) (DIPTERA: CUTEREBRIDAE)

L.G. Brito[1], G.E. Moya Borja[1] & M.J. Paes[2], [1]Dep. of Animal Parasitology, Univ. Fed. Rural of Rio de Janeiro, 23.851-970, RJ, Brazil, E-mail lgatto@ufrrj.br; [2] Dep. of Medicine Veterinary, ESAM, 59.629-900, RN, Brazil, E-mail paesmj@esam.br.

Dermatobia hominis (Linnaeus, Jr) is particularly important as a parasite of cattle, and causes a furuncular cutaneous myiasis in a wide range of mammalian hosts, including human beings. *D. hominis* is primarily a forest species; it occurs chiefly in the wooded tracts and forest margins of the lowlands and river valleys, but it may range up to an altitude of 1500 m. It is endemic to the Neotropical region where it occurs from the southern part of Mexico to the northern part of Argentina. Trying to observe the correlation between the weight of the larvae and the adults' sex, 598 3rd instar larvae of human bot fly collected from bovine hides of slaughterhouses were weighted. Each larva was weighted and placed in test tubes containing humid sawdust and maintained in climatic chambers (BOD) at 25ºC and 70±10% of RH. Adults were sexed pressuring the abdomen and observing the ovipositor. The average weight of female larvae was 566.1 mg, and the average weight of the male larvae was 451.2.
Index terms: flies, *Dermatobia hominis*, weight, larvae

[2974] CORRELATION BETWEEN THE WEIGHT OF THE THIRD INSTAR LARVAE AND THE SEX OF ADULTS OF *DERMATOBIA HOMINIS* (DIPTERA: CUTEREBRIDAE)

L.G. Brito[1], G.E. Moya Borja[1] & M.J. Paes[2], [1]Dep. of Animal Parasitology, Univ. Fed. Rural of Rio de Janeiro, 23.851-970, RJ, Brazil, E-mail lgatto@ufrrj.br; [2] Dep. of Medicine Veterinary, ESAM, 59.629-900, RN, Brazil, E-mail paesmj@esam.br

Dermatobia hominis (Linnaeus, Jr) is particularly important as a parasite of cattle, and causes a furuncular cutaneous myiasis in a wide range of mammalian hosts, including human beings. *D. hominis* is primarily a forest species; it occurs chiefly in the wooded tracts and forest margins of the lowlands and river valleys, but it may range up to an altitude of 1500 m. It is endemic to the Neotropical region where it occurs from the southern part of Mexico to the northern part of Argentina. Trying to observe the correlation between the weight of the larvae and the adults' sex, 598 3rd instar larvae of human botfly collected from bovine skins of slaughterhouses were weighted. Each larva was weighted and placed in test tubes containing humid sawdust and maintained in climatic chambers (BOD) at 25ºC and 70±10% of RH. Adults were sexed pressuring the abdomen and observing the ovipositor. The average weight of female larvae was 566.1 mg, and the average weight of the male larvae was 451.2.
Index terms: flies, *Dermatobia hominis*, weight, larvae

[2975] DENGUE CONTROL IN MANAUS: LARVAL DENSITY AND PREFERRED CONTAINERS FOR *AEDES AEGYPTI*

V.C.S. Pinheiro & W.P. Tadei, Instituto Nacional de Pesquisas da Amazônia – INPA. Caixa Postal 478, 69.083.000, Manaus (AM), Brasil. E-mail valeria@inpa.gov.br E-mail tadei@inpa.gov.br. Funding: PPI-INPA / FUNASA-AMAZONAS

Dengue is today one of the most important arboviruses in the world. Studies related to adaptation conditions of *Aedes aegypti*, are of fundamental importance, since control of the disease is focused on the vector on account of there being no vaccines or no other kinds of immunisation. In Manaus *Aedes aegypti* was detected in 1996 and the first dengue epidemic totalling 29,033 cases occurred two years later. In the beginning of the infestation the mosquito spread itself throughout the central areas of the city and can presently be found in almost all neighbourhoods. Studying the breeding sites of *Aedes* in Manaus is the first activity necessary for the performance of the controlling actions. In this work the preferred containers were studied by assessing larval density during the rainfall and dry periods, stratifying results as to the preferred containers, types of households and city blocks. Studies were carried out in Praça 14 and Coroado, the former one having conditions pertaining to a higher social economic level. During collection of the data health agents recorded the total of existent containers, inspected those with water and collected all larvae and pupae found there. Out of 2,700 inspected premises, 5,2% were positive. Out of 13,120 containers with water 1,5% had larvae. The most frequent kinds of containers in both neighbourhoods were big and small bottles, and domestic water storage. Other kinds of containers are of different importance according to the neighbourhood being considered. Larval density was calculated relating to the total of inspected houses, positive houses and positive containers. Larval density calculated relating to all inspected premises showed higher values for containers outdoors during the rainy period. Indoors, density values showed little variation from one period to the other. Productivity calculated through positive containers, however, revealed an average of nearly 43/44 larvae per container in the premises in either neighbourhood regardless from rainy or dry period. Containers in Manaus are very productive even in the Summer time. The most productive containers in either neighbourhood were small bottles, tires and construction equipment material. Domestic water storage showed to be more important in Coroado. Indoors, in either neighbourhood flower pots and small bottles were most important for maintaining *Aedes*, in both periods. In Manaus containers showed higher larval density averages than containers studied in Araçatuba, São Paulo state. Results of Productivity stratification in city blocks enabled us to make an equation for the role of each block in the maintaining of *Aedes*, in both periods.
Index terms: Dengue Control, breeding sites, *Aedes aegypti*, larval density.

[2976] DEPLOYING TRANSGENIC ARTHROPODS IN IPM PROGRAMS: RISK ANALYSES

Marjorie A. Hoy, Department of Entomology and Nematology, University of Florida, P.O. Box 110620, Gainesville, FL 32611-0620 USA.

It is now possible to transform various species of arthropods using recombinant DNA methods. A number of genes have been identified and cloned that may be of value for pest management programs and a variety of transposable element and viral vectors can be used to deliver genes. There is, however, the possibility that the release of transgenic arthropods could have negative effects on the environment or on biodiversity. A number of risk issues must be considered before it is feasible to release transgenic arthropods for permanent establishment in the environment. Risk analyses may include: evaluation of the stability of the transgenic strain, risk associated with the specific construct inserted into the strain, and the likelihood that the transgenic strain will become a pest because it performs differently than expected once it is released into the environment. In addition, while difficult to evaluate, some consideration should be given to the possibility that the transgene will escape and move horizontally to nontarget species in the environment. Horizontal gene transfer is difficult to evaluate because the mechanism(s) by which it occurs are poorly understood and it is believed that horizontal gene transfer is rare. Release of transgenic arthropods for genetic or biological control programs will require that the genetically-manipulated arthropod be fit and able to compete in the environment. A substantial amount of knowledge about the behavior and population dynamics and genetics will be required to effectively deploy such organisms.
control workers.

[2977] DIAGNOSTIC MORPHOLOGICAL CHARACTERS IN DIFFERENT LIFE STAGES OF *HERMETIA ILLUCENS* STUDIED BY VP SCAN MICROSCOPE: A NEW NOT DAMAGING METHOD FOR UNTREATED ORGANISMS

M. Turchetto[1] & S. Vanin[1], [1]Dept. of Biology, Univ. of Padova, v.U.Bassi 58/B, 35131 Padova, ITALY, E-mail turchet@civ.bio.unipd.it.

Larvae of the black soldier fly, *Hermetia illucens*, were collected and reported, for the first time in Italy, on human remains in badly decay; none other diptreran specimens were found except for the larvae of one species of *Piophila*. For the forensical importance attributed to this species by the main Authors in measuring the postmortem interval (PMI) in advanced decomposition stages, we collected a lot of larvae and bred them in our laboratory under the actual environmental conditions (mean summer temperature: 27 °C), for estimating the lenght of all developmental stages. This way we calculated the time required by all the life steps: the eggs development, from their laying to haching, time between the larvae instars, from pupation to adults emergence, and finally from mating to oviposition. So, in add to the developmental times data, we obtained many individuals daily aged for the morphological characterization. The species diagnosis in Dipteran, in fact, is very difficult to do with the classic morphological parameters (like mouthpars and respiratory spiracula) particularly in some stages as eggs and first instar stages and, in *Hermetia*, also in the last and prepupa instars because of their polymorphism. For this purpose we drew a parallel between the observations by light microscope and by a Variable Pressure Electroscan (LEO 435VP, Zeiss-Leica). This advanced tecnique allows imaging in VP mode of fresh dried or liquid stored organisms with no sample preparation (uncoated, untreated in vacuum, etc.), so that the samples can be later recovered and preserved or screened with other different methods. The paramount of this method, usually emploied for other purpouses, is, beside the stunning resolution, its ease of use and reproducibility. An additional feature of the VP mode that made it useful in forensic entomology, is the very fast analysis system that allows to obtain data on the just collected and untreated organisms. This can be a determinant factor in medicolegal investigations in add to the capaibility of the same not collapsed samples for further investigations.
Index terms : black soldier fly, life stages, forensic investigations, PMI , LEO 435VP.

[2978] DOMICILIATION OF SELVATIC CHAGAS DISEASE VECTOR *PANSTROGYLUS GENICULATUS* (TRIATOMINAE:REDUVIIDAE) IN VENEZUELA

M. Reyes-Lugo[1] & A. Rodriguez-Acosta[2], Universidad Central de Venezuela. Institute of Tropical Medicine, Medical Entomology Section Dr. Pablo Anduze[1] & Immunochemistry Section[2]. Apartado 47423, Caracas 1041, Venezuela

Pastrongylus geniculatus (Latreille 1811) is possibly the species of triatomine that has the widest geographical distribution in the Americas (Argentina, Bolivia, Brazil, Colombia, Costa Rica, Ecuador, Surinam, French Guayana, Guyana, Nicaragua, Panama, Peru, Paraguay, Trinidad, Uruguay and Venezuela) where it has been found in all parts of the country. It is an important vector of the wild cycle of *Schizotrypanum cruzi* and up until now only an occasional visitor of the human housings arriving them by directional flight lighten attracted. Since the human point of view, only some species have acquired up until now the adaptation capacity to human environment, and the resulting domiciliation, varying from specie to specie and also according with the region. The area under study was located in a mountainous sector known as Loma Baja at 25 km from south-western Caracas, between 10° 22′ north latitude and 67° 10′ west longitude. Inside the house, twenty-seven were the total numbers of *Panstrongylus geniculatus* specimens and their eggs collected, by direct methods and using vacuum cleaner: 14.8% infected with *Schizotrypanum cruzi*, discriminated as follows: 25.92% eggs, 3.70% II nymphs, 11.11% III nymphs, 29.62% IV nymphs, 18.51% V nymphs and 11.11% adults. In this work is interesting to observe that *Panstrongylus geniculatus* was associated with *Rattus rattus* presence, living inside the house, something that we think was the fundamental factor for the triatomine domiciliation. The study house was treated with external and internal application of 36 mg ai/m^2 Responsar SC® (Betacyflutrin 12.5%) using a Hudson Pump. The insecticide was active against triatomins, scorpions, spiders and blatids.
Index terms: *Pastrongylus geniculatus, Schizotrypanum cruzi*, domiciliation, Betacyflutrin.

[2979] EFFECT OF CONSTANT TEMPERATURES ON THE DEVELOPMENT AND VIABILITY OF *AEDES ALBOPICTUS* IMMATURES STAGES, FROM REGISTRO (SÃO PAULO BRAZIL)

D. C. Calado[1, 2] & M. A. N da Silva[1], [1]Dept. de Zoologia. Univ. Federal do Paraná, P.O. Box 19020, ZIP 81531-990, Curitiba - PR, Brasil, E-mail: dcalado@garoupa.bio.ufpr.br; [2] CNPq fellow.

Even after fourteen years that *Aedes albopictus* presence was confirmed in brazilian land, there are some doubts in the informations about the biological aspects of the brazilian population. The effects of constant temperatures (15°C, 20°C, 25°C and 30°C) were analised for the *Aedes albopictus* stages of eggs, larva and pupa at laboratory. Immatures were kept in B.O.D. with relative humidity of 70-90% and photoperiod LD 12:12. There was a complete development in all temperatures and the lowest viability was at 15°C. Immatures that grown up at 30°C showed the smaller development period. At 30°C, the eclosion began in the third day after the oviposition. The larval stage showed the mean time of 34.80 days (15°C), 14.65 (20°C), 7.55 (25°C) and 5.94 (30° C). The pupal stage lasted one day at 30°C and 8 days at 15°C. The temperature really affected the development and viability of immatures stages.
Index terms: *Aedes albopictus*, larval biology, egg biology, immature stages, hatch

[2980] EFFECT OF TEMPERATURE AND GREGARINES INFECTION ON DISTRIBUTION OF *AEDES ALBOPICTUS* AND *AEDES AEGYPTI* IN TAIWAN

C. S. Chen[1], J. J. Hwang[2], [1]Dept. of Biology, Tunghai University, P. O. Box 851, Taichung, Taiwan, E-mail cschen@mail.thu.edu.tw; [2]Dept. of Entomology, National Taiwan University, Taipei, Taiwan.

Aedes aegypti (L.) and *Ae. albopictus* (Skuse) are dengue vectors. In Taiwan, *Ae. albopictus* is found throughout the island below 1,000 m in elevation, while *Ae. aegypti* is distributed in the southern part of the island below 300 m. These two species are very similar in morphology and ecology, but have very different distributions. Here we investigate the effects of temperature and gregarine infectionon *Ae. aegypti* and *Ae. albopictus*. Data of gregarine infection were collected in the field from June 1995 to March 1997. In the laboratory, a 3-factor (temperature, competition condition and different gregarine infection conditions) experiment was conducted. Field data shows that both gregarine infection intensity and percentage are significantly lower for *Ae. aegypti* than *Ae. albopictus*; *Ae. albopictus* cooccurring with *Ae. aegypti* experience a lower percentage of gregarine infection; and the high infection rates of *Ae. albopictus* are positively correlated with experiment duration and negatively correlated with water temperature. From the 3-factor experiment, we found: effect of infection by *Asocgregarina taiwanensis* increases with the length of male wing for both *Ae. aegypti* and *Ae. albopictus*, and lower the emergence rate of *Ae. aegypti* only; emergence rate of *Ae. aegypti* is higher than *Ae. albopictus* under high temperature condition (30□) and there is no difference under low temperature condition. These results suggest that *Asc. taiwanensis* is the key factor limiting the distribution of *Ae. aegypti* in Taiwan.
Index terms: *Ascogregarina taiwanensis.*

[2981] EFFICACY OF DIFFERENT INSECTICIDES ON THE CONTROL OF THE ADULT *MUSCA DOMESTICA* (L.) IN LABORATORY CONDITIONS

E. C. Tucci[1], A.E.de C. Campos-Farinha[2], M.R. Potenza[2], A.P. Takematsu[2] & J.P. Gomes[3], [1]Centro de Sanidade Animal, Instituto Biológico, CP 12.898, CEP 04010-970, São Paulo, BRASIL, E-mail tucci@biologico.br [2]Centro de Sanidade Vegetal, Instituto Biológico São Paulo, SP. [3]Bayer S/A - Departamento de Saúde Ambiental.

This work was conducted in order to evaluate the efficacy of different insecticides on the control of adult domestic flies. The flies provinient from the Instituto Biológico rearing, were kept in the laboratory under controlled temperature, relative humidity and photoperiod of 27 °C, 70-80% and 12:12 (D:L), respectively. Five days old flies were taken from the rearing cases, sedated with CO_2 and put into plastic containers covered with nylon screen. Containers and flies were treated under the Potter tower, at the rate of 4 liters/square meters. Statistic outline was done at random. Twenty flies were used per treatment, with 5 repetitions. Treated insects were kept under the same temperature conditions, humidity and photoperiod of rearing. After 2 and 24 hours treated flies were evaluated noting mortality. Four commercial products with indication of sanitary domestic use were tested, in the following dosage : Beta-cyfluthrin (Responsar® SC 1,25) 150, 250, 300 and 350 mL/10L, Cyfluthrin (Solfac® CE 5) 20, 40, 60 and 80 mL/10L, Dichlorvos (Dedevap® CE50) 50, 70, 100 and 120 mL/10L Propoxur (Baygon® Emulsão 20) 200, 250, 300 and 350 mL/10L. Flies used as control were treated with only water. Results were submitted to the Tukey test at the 5% level of probability and corrected by the Abbott's formula. One hundred per cent of mortality was observed 2 hours after treatment with Solfac, Responsar and Dedevap, in the 4 studied doses. There were no significant statistic changes between the flies treated with Baygon in the 4 studied dosages which differed only from the control group: 83,65% (200mL/10L), 87,98% (250mL/L), 93,31% (300mL/10L) and 100% (350mL/10L). Control group showed no mortality.

[2982] EMERGENCE OF A NEW NEOTROPICAL MALARIA VECTOR FACILITATED BY HUMAN MIGRATION AND CHANGES IN LAND USE

J.E. Conn[1], R.C. Wilkerson[2], M.O. Segura[3], R.T.L. de Souza[3], C.D. Schlichting[4], R.A. Wirtz[5] & M. M. Póvoa[3] 1. Dept. Biology, Marsh Life Sciences Bldg., Univ. of Vermont, Burlington, VT, USA05405-0086. 2. Walter Reed Biosystematics Unit, Dept. Entomology, Walter Reed Army Institute of Research, 4210 Silverhill Road, Suitland, MD USA 20746. 3. Inst. Evandro Chagas/Fundação Nacional da Saúde, Servico de Parasitologia, Av. Almirante Barroso 492, Belém, Pará 66090-000, Brazil. 4. Dept. Ecology and Evolutionary Biology, 75N Eagleville Road, U-43, Univ. of Connecticut, Storrs, CT USA 06269-0043. 5. Entomology Branch, Division of Parasitic Diseases, Centers for Disease Control, 4770 Buford Highway NE, Atlanta, GA USA 30341-3724.

In a region of northeastern Amazonia, we find a species previously of minor importance, *Anopheles marajoara*, to be the principal malaria vector. In a total of five collections during 1996-97 in three replicated sites near the city of Macapá, Amapá state, this species occurs in much greater abundance (n=4,841) compared with the presumed vector *Anopheles darlingi* (n=273; P<0.001). Also, a significantly higher proportion of *A. marajoara* is infected with malaria parasites (P<0.01), determined by the ELISA technique. This appears to be the result of increased abundance of *A. marajoara* species due to alterations in land use, invasion of its primary breeding sites by human immigrants, and its anthropophilic behavior. This discovery highlights one of the challenges of neotropical malaria control, namely that the targeting of specific vectors may be complicated by a changing mosaic of different locally important vectors and their interactions with human populations.
Index items: *Anopheles marajoara, Anopheles darlingi*, ELISA, new vector, changes in land use

[2983] EXPERIMENTAL OBSERVATIONS ON THE OUTBREAK OF INFESTATION BY *KNEMIDOKOPTES PILAE* (ACARINA: KNEMIDOKOPTIDAE) IN PARROTS (*MELOPSITTACUS UNDULATUS*)

F.Cianficconi [1], M.Principato [2] & G.Spinelli [1], [1] Dipartimento di Biologia Animale ed Ecologia, Università di Perugia, Via Elce di Sotto,06123 Perugia, ITALIA; [2] Dipartimento di Scienze Biopatologiche Veterinarie, Via S.Costanzo,4,06100 Perugia,ITALIA.

The mange of parrots caused by *Knemidokoptes pilae* is a serious infestation, which though withslow course, can lead the bird to death for cachexia. Although it occurs frequently,the factors favouring its outbreak are not well known. The biological behaviour of *K. pilae* seems to be similar to that of other mites,such as *Sarcoptes scabiei* in mammals which determines a deep mange, but contrarily of that mite, it does not seem to be infectious at all. In fact, if parrots affected with serious mange are kept for months in captivity with other healthy birds, the illness does not pass on these ones. On the other hand, it seems inexplicable how the infestation can suddenly rise up in groups of healthy birds. We effected therefore some experimental tests with the aim of trying to understand the factors favouring the outbreak of mange. Two couples of parrots, one of which affected with mange, were placed under conditions of high relative humidity (80% RH), maintained constant by a NaCl saturated liquid and two more couples, one of which affected with mange, were kept at a reduced level of RH (55%). In both cases the temperature was stabilized around 20°C. After 46 days, two of the parrots kept at 80% HR showed the first evident signs of infestation: two small holes in their beaks, under their nasal cavities. After 38 more days the infestation was evident on the limbs showing hyperkeratosis and a tiny hole containing a *K. pilae* female. Three months later the infestation was clinically evident and the first lesions began to rise up on the wings and on the perianal skin. After such period the experimental was stopped. Throughout the experiment, one of the parrots did not show any sign of illness. The birds kept at low RH (55%) were not infected. This simple experiment shows how the rate of environmental humidity is relevant for the infestation outbreak, though some subjects may turn up particularly resistant. We can also assume that the infestation is maintained quiescent for the presence of nymphal instar of the mite remaining among the feathers and penetrating into the skin only when the conditions of RH become favourable.

Index terms: mange, mites, Relative Humidity.

[2984] HYDROCARBONS OF THE CHAGAS DISEASE VECTOR *RHODNIUS PROLIXUS*

M. P. Juárez [1], G. J. Blomquist[2], D. R. Carlson [3] and C. J. Schofield [4], [1]Instit. Investig. Bioquím. La Plata, Fac. Cs. Méd, UNLP, calles 60 y 120, La Plata 1900, Argentina. [2]Dept. Biochem., Univ. Nevada, Reno, NV 89557, USA. [3]USDA-ARS, Gainesville, Fl 32604, USA and [4]Dept. Infect. Trop. Diseases, LSHTM, London WC1 E7HT, UK, E-mail: mjuarez@isis.unlp.edu.ar.

The blood-sucking insect *Rhodnius prolixus* is the major Chagas disease vector in Venezuela, Colombia and Central America. The surface hydrocarbons were characterized by capillary gas chromatography coupled to mass spectrometry (CGC-MS). Hydrocarbons are important components of the cuticular lipids, and distinctive CGC profiles could be obtained from insect wings. Major components were n-alkanes of C27, C29, C31 and C33 carbons. Adult males and females differ in the relative amounts of their methyl branched chains, mostly among the C29 and C31 mono-, tri- and tetramethyl derivatives. Methyl groups were inserted internally at positions 7-, 11-, 13-, 15- or anteiso for monomethyl isomers, and separated by three or five methylene groups for the trimethyl or tetramethyl derivatives. Heavier molecular weight isomers of 37, 39 and 41 atoms in their carbon esqueleton, with mono-, tri- or tetramethyl branching separated by three and sometimes five methylenes were also identified. The internal hydrocarbon pool contained large amounts of the high molecular weight methyl branched fraction. No major sexual dimorphism was detected for the adult stage, but a significant shift in the major n-alkane components, from n-C27 and n-C29 in the adults to n-C31 and n-C33 in the nymphal stages was evident, together with larger amounts of the higher molecular weight methyl branched chains. Comparison of the hydrocarbon structures to that of other Chagas disease vectors will be discussed.

Index terms: Triatominae, methylalkanes, cuticular lipids, gas chromatography

[2985] INFLUENCE OF DIFFERENT AGES OF FISH PUTREFATION ON THE POST EMBRIONIC DEVELOPMENT OF *LUCÍLIA CUPRINA* (DIPTERA:CALLIPHORIDAE) UNDER LABORATORY CONDITIONS

G. E. Moya Borja[1], L. G. Brito[1], M. J. Paes[2], M. P. Castelo Branco[1], A. Chaaban[1] & A. C. Arnaut[1], [1]Dep.of Animal Parasitology, Univ. Fed. Rural of Rio de Janeiro, 23.851-970, RJ, Brazil, E-mail lgatto@ufrrj.br; [2] Dep. of Medicine Veterinary, ESAM, 59.629-900, RN, Brazil, E-mail paesmj@esam.br

Lucilia cuprina it is an important dipteran which has been recognized as a major myiasis blowfly of sheep in Australia In Brazil this insect can act as potential vector of pathogenic microorganisms which cause diseases in animals The objetive of this study was to compare the post-embryonic development of *L.cuprina* reared on sardine exposed for different periods under laboratory conditions. Sixty gm of sardine was exposed at 2, 24, 48, 72 or 96 hours at 25ºC before inoculating with 30 newly first instar larvae. Each treatment was replicated four times. Each mature larvae was weighted and placed in one test tube containig humid vermiculite to stimulate the pupation. After the emergence of the adults they were sexed The data indicated that larval duration in the diferent diets was around 7 days. The larval weight from sardine exposed during 72 and 96 were significantly different smaller than the weight of the larvae reared on sardine exposed to 2, 24 and 48 hours. The sexual ratio was close to 1:1.

[2986] INFLUENCE OF DIFFERENT MIXTURES OF BOVINE FECES WITH SOME INGREDIENTS TO REAR STOMOXYS CALCITRANS UNDER LABORATORY CONDITIONS.

D. M. Macedo[1], M. J. Paes Santos[2], G. E. Moya-Borja[1] & A. Chaaban[1],[1]UFRRJ-IB- Dept. of Animal Parasitology, Km 47 Antiga Rodovia Rio-S. Paulo. 23.851-970 Seropédica, RJ, Brazil, e-mail:dmacedo@ufrrj.br [2]ESAM/RN- Pesquisadora Visitante do Departamento de Medicina Veterinária.

Stomoxys calcitrans is one of the most important ectoparasite of the livestock in Brazil. This pest transmit many pathogenic agents to the domestic animals. In Latin America the stable fly is a common vector of *Dermatobia hominis*. The objetive of this experiment was to compare different diets for rearing *S. calcitrans* under laboratory conditions. The basic diet (T1) used commonly in our laboratory was composed of bagasse of sugar-cane, wheat meal, meat powder, sodium bicarbonate and water. Diet T2 was composed of 50 % of the basic diet and 50% of bovine feces. Diet T3 was composed of 25% of basic diet and 75% of bovine feces. Diet T4 was composed of 100% of bovine feces. Twenty five first instar larvae were placed in glass containers with fifty gm of the different diets. Each treatment was replicated three times. The data indicated that best diet was the treatment T2 because we obtained the highest average of pupal weight (14.1 mg) and the adult emergence (14 females and 16 males).

Index terms: Stable fly, diets, post-embrionic development

[2987] ISOENZYMATIC CHARACTERIZATION OF *TRIATOMA INFESTANS* POPULATIONS FROM EASTERN AND WESTERN REGIONS OF PARAGUAY

Acosta N, López E, González N, Fernández MJ, Rojas de Arias A. Departamento de Medicina Tropical, Instituto de Investigaciones en Ciencias de la Salud. Río de la Plata y Lagerenza, CP 2511, Asunción, Paraguay

This study determined the isoenzymatic characteristics of original populations of *Triatoma infestans* for eventual comparison with reinfesting groups and was carried out as a support to the National Program of Chagas Disease Control. *T. infestans* population from 4 departments endemic for Chagas disease, corresponding to the two main regions of Paraguay, were characterized by isoenzymes electrophoresis in cellulose acetate plates. Twenty five specimens from the Chaco region were studied; 12 from Boqueron and 13 from Presidente Hayes; Twenty specimens from the Eastern region were studied; 10 from Cordillera and 10 from Paraguari (domicile and peridomicile). Six enzyme systems were analyzed: alfa-GDP, GPI, PGM, 6PGD, IDH and MDH which involve 8 loci. Only alfa-GDP system showed differences. The profiles observed correspond to the denominated: alfa-GDP-a, found in 38 specimens (84.44%) and alfaGDP-1 in 7 specimens (15.5%). The alfa-GDP-1 profile was only observed in seven domiciliary specimens out of the 25 studied in the Chaco (28%). It was observed in higher proportion in Presidente Hayes where it was found in 6 out of 13 examined specimens (46%). In the other systems, the same phenotypes were obtained in all specimens including 6PGD and PGM which have been described as polymorphic in other populations. Consequently, it can be said that the genetic variability found was low. The specimens of the Eastern Region were all the same without any differences between domiciliary and peridomiciliary populations.The marked monomorphism in this study would be in agreement with the authors who suggest an evolution from a small initial population (founder effect) and a genetic drift process for *T. infestans* populations. The small variability observed could constitute an advantage for the control, as genetic variants which could give origin to resistant individuals were not found. However, it should be pointed out the difference found in the Chaco specimens.

Index terms: *T. in*festans, Paraguay, isoenzymes, monomorphism, Chagas control

[2988] IXODID TICKS COLLECTED FROM ARMADILLO *EUPHRACTUS SEXCINCTUS* AND ANTEATER *MYMERCOPHAGA TRIDACTYLA* AT EMAS NATIONAL PARK, STATE OF GOIÁS, BRAZIL.

G.H. Bechara[1], M.P.J. Szabó[1], M.C. Pereira[2], W.V. Almeida Filho[1], J.N. Bechara[1], R.J.G. Pereira[1] & J.E. Garcia[3],[1]Depto. de Patologia Veterinária, Univ. Estadual Paulista, Jaboticabal, SP 14.870-000, Brasil, E-mail bechara@fcav.unesp.br; [2]Inst. de Ciências Biomédicas, Univ. de São Paulo, SP 05508-000, Brasil; [3]Depto. de Genética, Univ. de São Paulo, Ribeirão Preto, SP 14049-900, Brasil.

Many species of wild animals, common in several regions of developing countries, were not studied in relation to ticks and tick-borne pathogens that are associated with them. A study of ticks associated with anteater and armadillo was conducted in October 1998 and November 1999 in the Emas National Park (131,868 há), a savanna-type cerrado region situated in the far south of Goias State, Brazil, near the geographic center of South America, 15°-23°S; 45°-55°W. The climate is tropical and the highly seasonal rains give about 250 mm rainfall between October and March. The greater part of the park is covered by scattered bushland. Animals were captured with the aid of nets and anaesthetized (15 mg/kg ketamine + 1 mg/kg xylasine) in order to collect ticks for identification and laboratory colonies and included: anteaters *Mymercophaga tridactyla* (n=4) and armadillos *Euphractus sexcinctus* (n=6). Free-living ticks (larvae, nymphs and adults) collected from the field by using a 1x2 m flannel cloth were identified as *Amblyomma sp, A. cajennense* and *A. triste*. Adult ticks collected from anteaters were identified as *Amblyomma cajennense* and *A. nodosum* and from armadillo as *A. pseudoconcolor* and *A. nodosum*. The relevance of these host-tick relationships to possible mechanisms underlying emergence of tick-borne pathogens of Public Health will be discussed.

Index terms: *Amblyomma cajennense, Amblyomma pseudoconcolor, Amblyomma nodosum*, wild animals.

[2989] L-LACTIC ACID IS AN IMPORTANT HOST STIMULUS FOR THE ANTHROPOPHILIC *ANOPHELES GAMBIAE S.S.*

T. Dekker[1], M. Geier[2], B. Steib[2], J. Boekch[2] & R.T. Cardé[1]

L-lactic acid, a human-specific skin component, is synergistic with both CO_2 and other skin components for *Aedes aegypti*. Without l-lactic acid, the other skin components fail to attract *Ae. aegypti*. The role of l-lactic acid in host-seeking by other anthropophilic species is unknown. Similarly, it is not known whether l-lactic acid plays a role in host selection by anthropophilic mosquito species. It has, however, been shown that tsetse flies, which rarely bite humans, are repelled from flying upwind in an cow-odor plume containing l-lactic acid, and that cows impregnated with l-lactic acid have a reduced biting rate. This study investigates whether l-lactic acid is important for the anthropophilic *Anopheles gambiae s.s.* A Y-tube olfactometer was used to test the response of *An. gambiae s.s.* to l-lactic acid, CO2, human-skin odors, human-skin extracts, cow-skin extracts and combinations thereof. This bioassay method has been used to demonstrate synergism between CO2 and skin extracts for *Ae. aegypti*. The results show that l-lactic acid is also an important host stimulus for the anthropophilic *An. gambiae s.s.* and might be important in discriminating between hosts and non-hosts.

[2990] LOCAL POPULATION DYNAMICS OF ANOPHELES MOSQUITOES AND MALARIA TRANSMISSION IN WESTERN KENYA

P. Schneider, A. K. Githeko & W. Takken, E-mail: Petra.Schneider@Users.ENTO.WAU.NL

A longitudinal field study is in preparation to study risk factors of malaria transmission in relation to environmental factors. This poster will present some preliminary results on dynamics of the local mosquito populations in Western Kenya. Malaria in this area is transmitted by mainly three mosquito species: Anopheles funestus, Anopheles gambiae s.s and Anopheles arabiensis, of which the last two species both belong to the Anopheles gambiae complex and are not morphologically distinguishable. During approximately one year, entomological and parasitological information has been collected in 10 sentinel houses. Temporal and spatial variation in density and species composition are shown, as are differences in parasite prevalence over time and age groups. These results are shortly discussed in comparison with data compared in another village, at 500-m higher altitude, where malaria transmission is less intense.

[2991] MALARIA AND MOSQUITOES: PARASITE-INDUCED APOPTOSIS REDUCES VECTOR REPRODUCTIVE FITNESS AND MAY ENHANCE TRANSMISSION

H. Hurd, J. A. Hopwood, A. Polwart & G. T. Williams, Centre for Applied Entomology and Parasitology, School of Life Sciences, Keele University, Staffordshire, ST5 5BG, UK. E-mail: h.hurd@keele.ac.uk.

Anopheline mosquitoes become infected with, and transmit, malaria parasites during the process of bloodfeeding. This is a risky feeding strategy during which the mosquito obtains a proteinaceous meal for egg production but, in the process she is vulnerable to host defence behaviour. Thus a trade-off exists between reproductive success and mosquito longevity. Strategies adopted by a mosquito during a gonotrophic cycle will also affect the survival and transmission success of pathogens that infect her. In particular, malaria parasites will only be transmitted if their host survives 3 or more gonotrophic cycles post-infection, because they take 1-2 weeks to develop as oocysts on the mosquito midgut before sporozoites are formed and salivary gland infections occur. Infection affects both feeding behaviour and nutritional resource management such that feeding persistence and egg production are reduced during the period of malaria sporogony. These strategies may improve the chances of parasite transmission by increasing mosquito longevity. Several aspects of vitellogenesis are affected by infection including the uptake of vitellogenin into ovarian terminal follicles. In infected females, many follicles undergo atresia and are resorbed. Using the rodent malaria, *Plasmodium yoelii nigeriensis* infection of *Anopheles stephensi,* we have shown that follicle resorption is associated with programmed cell death or apoptosis. DNA fragmentation was identified using TUNEL and shown to occur in the follicular epithelial cells and nurse cells of terminal follicles at 16 and 18h post infection. Using acridine orange staining of whole follicles, apoptotic nuclei were visualised in 11-15% of follicles per ovary between 20 and 24h post infection. In addition, examination of ultrathin sections showed that some follicles contained epithelial cells that were not developing patency and that contained nuclei with condensed chromatin typical of apoptosis. Oocytes in these follicles did not contain developing yolk spheres. Apoptosis and follicle resorption may be induced directly by the malaria parasite or as the indirect result of a vector's response to infection. However, by reducing nutrient invested in egg production, a better environment may be provided for the developing parasite.

Index terms: *Anopheles stephensi, Plasmodium yoelii nigeriensis,* follicular epithelium, reproductive fitness

[2992] MALARIA CONROL: SIMPLE- ENVIRONMENTALLY SOUND-EFFICACIOUS AND SUSTAINABLE

M. J. Perich[1], [1]Dept. of Entomology, Walter Reed Army Inst. of Research, Washington, DC 20307-5100,USA,E-mail mjperich@gateway.net.

Malaria vector control due to increasing resistance to conventional synthetic insecticides by the anopheline mosquito vectors and detrimental effects to the environment by such compounds has increased the need for new, simple environmentally sound, efficacious and sustainable (S.E.S.E.) vector methodology. Integrated and varied approaches are necessary for global malaria vector control because of the diverse ecology and behavior of the many anopheline species, which are primary, and secondary vector species. Malaria vector strategies such as barrier spraying for Neotropical exophilic vectors or insecticide treated bednets for endophagic malaria vectors are designed on this premise. Such strategies and selected others will be discussed on a SESE bases.

Index terms: Anophelines, Integrated Pest Management, Vector Control

[2993] MOLECULAR MECHANISMS AND COMPETITION BETWEEN PATHOGENIC AND NONPATHOGENIC RICKETTSIAE IN ARTHROPODS

Abdu F. Azad*, Department of Microbiology and Immunology, University of Maryland School of Medicine, 655 West Baltimore street, Baltimore, MD 21201

In nature, individual ticks can be concomitantly infected with more than one species of intracellular bacteria. Some may be important human pathogens acquired either from an infectious bloodmeal or transovarially. Others may be nonpathogenic symbionts acquired transovarially. The consequences and epidemiological significance of multiple bacterial infections in arthropods are largely unexplored. The interactive effects between certain intracellular bacterial species within individual arthropods may be of sufficient prevalence and magnitude to alter their vector competence. Ovaries of *Dermacentor andersoni* ticks harboring nonpathogenic rickettsiae have been shown to be refractory to subsequent co-infection with a pathogenic *R. rickettsii.* Thus the survival mechanisms that underlying the maintenance of *R. peacockii* ovarial infection operate to block normal transovarial transmission of closely related but invasive rickettsial species. While ticks infected with nonpathogenic rickettsiae continue to transmit *R. rickettsii* horizontally they would fail to transmit pathogenic rickettsiae to their progeny. Thereby, over the course of several tick generations, interference mechanisms would favor long-term maintenance of nonpathogenic rickettsiae and eventual collapse of enzootic cycling of pathogenic rickettsiae. The potential of exploiting the interference phenomenon as an intervention strategy to replace pathogenic rickettsiae in nature will be discussed.

[2994] MONITORING OF HEMATOPHAGOUS VECTORS IN THE AREA OF INFLUENCE OF THE YACYRETA DAM

A.E. Tricio, P. M. Morawicki, F. J. Krsticevic, A. N. T. Pascual, A. S. Araki & A. Goñi, Misiones Entomological Survey Project (PREM). Fac. of Exact, Chemical and Life Sciences. Universidad Nacional de Misiones. Félix de Azara 1552. (3300) Posadas - Misiones. Tel: 0054-3752-422186. Fax: 0054-3752-425414. E-mail: atricio@rector.unam.edu.ar.

This is the lastest report on hematophagous vector (mosquitoes) in the area of influence of the Yacyreta Dam. It has permitted to obtain information and state predictions according to the circumstances in which Culicidofauna populations were found. The appraisal took 12 months, from january to december of 1999. Special attention was paid to species transmittig illnesses to man, like yellow fever, dengue and malaria, and to the ones able to affect his economic interests (equine encephalitis and others). Captures were made monthly with CDC traps (alcohol and dry one) in the stations at Bella Vista, Encarnación, Corate-í and Aguapey in Paraguay; in Argentina, in Corpus and Posadas (province of Misiones) and Garapé (province of Corrientes). Human baits were used to ensure the diversity and presence or other species and the possible places of breeding were investigated in the sampling stations. Twelve trips of capture were carried out. From the analysis of reviewing, counting and the comparison with existing data, the conlusion is that 189 species have been registered in the area of study before 1993. 113 species were recorded in 17 sampling stations from 1993 to 1996, 48 species were found in 6 sampling stations from february 1993 to january 1998 and 68 species in the present period. It is remarkable the presence of *Haemagogus leucocelaenus* in Corpus in january, and *Anopheles darlingi* in Corpus in october. In Encarnacion their presence was noted in january, april and september, being involved in the trasmission of illnesses to man.

Index term: Mosquitoes, Culicidae, human disease, Misiones.

[2995] MOSQUITO REPELLENT PLANTS

K. Pålsson, A. Lindström & T. G.T. Jaenson, Medical Entomology Unit, Department of Systematic Zoology. Evolutionary Biology Centre, Uppsala University, Norbyvägen 18 D, SE- 752 36 Uppsala, Sweden.

In Guinea Bissau, West Africa several species of plants are used traditionally to reduce biting by mosquitoes. We interviewed people in 23 rural villages in the Oio region (northern Guinea Bissau) to obtain data on which plant species and plant derived products or methods people use to reduce mosquito biting activity. Fresh or smouldering *Hyptis suaveolens* (Lamiaceae), smoke of the bark of *Daniellia oliveri* (Caesalpiniaceae), smoke of the infructescence of *Elaeis guineensis* (Arecaceae), smoke of the seed capsules of *Parkia biglobosa* (Mimosaceae), smoke of the leaves of *Azadirachta indica* (Meliaceae) and *Eucalyptus* sp. (Myrtaceae), fresh *Ocimum canum* (Lamiaceae), and fresh *Senna occidentalis* (Caesalpiniaceae) were commonly used to reduce numbers of mosquitoes indoors at night. In two field experiments we estimated the "repellent activity" of some of these plants and compared their activities with those of two commercially available mosquito repellents, i.e., "positive" controls. In the first experiment we tested: smoldering *H. suaveolens* (85.4% repellency); fresh *H. suaveolens* (73.2%); burning of the bark of *D. oliveri* (74.7%); and smoke of the leaves of *Eucalyptus* (72.2%). In the second experiment we tested: smoldering *H. suaveolens* (83.6% repellency); fresh *H. suaveolens* (66.5%); burning of the bark of *D. oliveri* (77.9 %); smoke of the leaves of *A. indica* (76.0%); smoke of the infructescence of *E. guineensis* (69.0%), fresh *O. canum* (63.6%); and fresh *S. occidentalis*, (29.4%). All the products tested, except *S. occidentalis,* reduced mosquito activity significantly more effectively than the negative control. [These experiments are presented in more detail in Acta Tropica 72 (1999): 39-52]. Recent laboratory experiments confirm the arthropod repellent activities of some of these plants.

Index terms: *Azadirachta*; *Daniellia*; *Hyptis*; mosquito repellent; plant products.

[2996] MULTIPLE ACETYLCHOLINESTERASE PHENOTYPES IN DANISH FIELD POPULATIONS AND LABORATORY STRAINS OF THE HOUSEFLY *MUSCA DOMESTICA*

M. Kristensen, A.G. Spencer & J.B. Jespersen, Danish Pest Infestation Laboratory, Ministry of Food, Agriculture and Fisheries, Skovbrynet 14, DK-2800 Kgs. Lyngby, Denmark, E-mail m.kristensen@ssl.dk.

The sequential development and persistence of resistance in wild housefly *Musca domestica* (Diptera: Muscidae) populations has been followed on Danish livestock farms from 1948 and we have established >20 strains representing a wide variety of resistance mechanisms. The housefly is one of the insect species that has shown a great ability to develop resistances to all major insecticide groups. Insensitivity to organophosphates (OP) and carbamates by acetylcholinesterase (AChE) has been shown to cause resistance in a large number of species and several cases have been reported from the housefly. Houseflies from 21 field populations and 14 insecticide resistant laboratory strains were tested in bioassay with the OPs dimethoate, azamethiphos and the carbamate methomyl. Following this, the activity of AChE was determined in the presence of insecticide (omethoate, azamethiphos and methomyl) at a concentration inhibiting 90% of the activity in the susceptible housefly strain. Trivariate plots of the percentage AChE activity remaining at the susceptible I_{90} of three insecticides were used to define phenotypes of the OP target site AChE. Through this we have been able identify a number of distinct phenotypes and calculate their frequency in the field. OP-resistance results from selection of specific phenotypes conferring a significant level of insensitivity of the insecticide used. We will discuss the correlation of and the value of bioassay and the biochemical phenotyping method and try to answer the question: which phenotypes are selected by which insecticides ? The refined methods of resistance detection will enable us to define resistance phenotypes for which fitness parameters and their contributions to the resistance problem can be determined. This approach can provide us with information on how to predict and manage resistance problems and gives excellent possibilities of fundamental studies of the evolutionary process.

Index terms: insecticide resistance, *Musca domestica*, acetylcholinesterase

[2997] OBSERVATIONS ON SOME *COLEOPTERA DERMESTIDAE* SPECIES OF ZOOTECHNICAL INTEREST IN UMBRIA,CENTRAL ITALY

C.Corallini [1], M.Principato [2] & G.Spinelli [1], [1] Dipartimento di Biologia Animale ed Ecologia, Università di Perugia, Via Elce di Sotto, 06123 Perugia, ITALIA; [2] Dipartimento di Scienze Biopatologiche Veterinarie, Via S.Costanzo, 4, 06100 Perugia, ITALIA.

The *Dermestidae* beetles are known mainly as insects infesting food stuffs and everything being of animal origin. A lot of species are found in the carcasses of animals after the process of desiccation has begun and the tissues are already well dry; other species instead, such as the *Anthrenus verbasci*, attack collections of stuffed animals preserved in museums and produce serious damages. The incidence that these beetles can have in some breedings of pigeons or pheasants was little known and was learnt through our careful observations of two different and even curious phenomena of merely parasitological interest, frequently occurring in Umbria in overpopulated breedings: the high mortality of young pigeons and the broken tails of pheasants. In both kinds of breedings, organic material such as broken eggs that soiled the young animals' abdomens still in the nest, or the tails of pheasants often soiled by faeces, or dead young animals not systematically and quickly removed from the breeding, while desiccating, during the night attracted the voracious larvae of *Dermestidae* beetles, identified as *Dermestes frischii* and *Dermestes maculatus,* that cut off both the dirty skin and the birds' feathers by their jaws. As for pigeons, a consequence was an increasing incidence of young animals dead for peritonitis or infection of the numerous skin wounds; as for pheasants, the breaking up of their wing and tail feathers, causing depreciation of the birds and even their unsaleability. We made the very useful observation that this occurred in all breedings without perches on which pheasants could rest at night, instead of being forced to sleep on the ground. It was sufficient to place those structures in the breeding and to take care of tiding and removing quickly the dead young animals to solve an important problem that caused great economic losses to breeders.

Index terms: high mortality, pigeons, broken tails, pheasants, beetles.

[2998] OCURRENCE OF *AEDES ALBOPICTUS* IN PORTO VELHO – RONDONIA – BRAZIL

V.J. Martins,[1] R.L.P.Martins[2] & J. V. Silva[2], [1-] Health National Foundation[2] Health Municipal Secretary of Porto Velho – Ro.

The mosquito *Aedes aegypti*, vector of yellow fever and dengue, is not endemic in Brazil, but was imported into Brazil during the period of colonization. It was found in Porto Velho – Ro for the first time in 1992. Since this year its presence has increased from 0,18% sites positive in 1992 to 4,08 % positive in 1999. On the other hand *Aedes albopictus* was found in Brazil in 1986 in the Rural University of Rio de Janeiro in Itagauí municipitily. In december 1999 three larvae were found between a lot of immature specimens of others mosquitoes from the Mato Grosso locality and brought to the laboratory of Entomology by the control team of yellow fever and dengue of Health National Foundation. From this moment were distributed 46 oviposition traps in the Mato Grosso locality from January 19 – 25 2000. Seven days later the 46 oviposition traps were collected and brought to the laboratory where the eggs were transferred to water trays for eclosion and development into adults. From the eggs collected in the 46 oviposition traps, 1275 adults mosquitoes developed of which 51 were *Aedes albopictus*. The ocurrence of this vector of yellow fever and dengue in Porto Velho is another preoccupation to Health National Foundation and Health Municipal Secretary because of the extra control efforts that has to be made to prevent further distribution of this vector which may increase the risk of yellow fever and dengue and this area as it the link between wild and urban transmission yellow fever.

[2999] OVERVIEW OF FORENSIC ENTOMOLOGICAL INVESTIGATIONS AND RESEARCH IN RUSSIA

M.L Marchenko[1], M. Benecke[2,3], [1] pr. Obuchovskoi Oborona 21, 63, 193019 St. Petersburg C-19, Russia, [2] speaking in behalf of M. Marchenko, [3] Univ. of Cologne, Forensic Biology Research Unit, Inst. f. Zoology, 50923 Köln, Germany, E-mail benecke@uni-koeln.de, http://www.uni-koeln.de/~akr05/

Influenced by the works of Megnin between 1883--1894, Forensic Entomology started to develop in Russia with a detailed account by N. A. Oblonski published in "Posobnik" (St. Petersburg, 1894). In 1902, experimental work set in with the work of E. K. Niezabitowski who made observations different from those reported by Megnin. This raised doubts as to the practical use of Forensic Entomology, and the method was seldomly used in forensic investigations in Russia. Only the publication of a section on forensic entomology authored by N. S. Bokarius in the Handbook of Legal Medicine (1930) where many of Megnin´s data were cited led to the first published case reports, amongst which A. M. Arutjunov´s report deals with a corpse that was found in a sea water reservoir (1963). In this case, it became clear that numerous fly larvae on the corpse had been dead for two days; the overall PMI was considered to be 7--10 days. It was concluded that the corpse had been moved. Furthermore, in a car suspected to be connected to the crime, a puparium was found. Then followed articles of Lopatenok, Boiko & Budjakov (1964, dealing with insects, and nematodes on corpses), Rubezhanski & Ochapovski (1964/65 detailing the entomological examination of 167 exhumated corpses), Gornaev (1967), Samogenov (1970), and Rubezhanski & Karshenboim (1972, proposing a design for a breading chamber). An interesting case report was the one by Levkov (1968) on the natural mummification of a child´s corpse missing since May, 1947. Levkov thought that an entomological analysis was not possible but Marchenko states that at least a determination of the season of death could be made. Of great importance are the works of V. P. Petrov (published in 1961, 1966, 1967). Petrov proposes a classification of the cadaver fauna based on trophic specializations; he subdivides the cadaver fauna into a "proper", and a "random" fraction. Petrov´s works are considerd to be the main motor for the field of modern forensic entomology in the Soviet Union. In the early 1980´s, systematic observations by Marchenko, Skrizhinski, Nainys, and Kazak were published, with experimental decomposition of dog carcasses being in focus. Ecological observations on Sarcophagid flies were published by Artamonov in 1980, 1983, and 1984. Since 1985, M. I. Marchenko worked continuously on the development of systematic tables of growth rates of maggots, climatic influences, successional patterns, "thermal constants" and "effective temperatures" for completion of development from egg to adult (a type of *accumulated degree hours*) including mathematical description of his observations.

Index Terms: Forensic Entomology, history, Soviet Union, Russia, V. P. Petrov.

[3000] PARATRANSGENESIS OF REDUVIID VECTORS OF CHAGAS DISEASE

R.V. Durvasula[1], F.F. Richards[1], C.B. Beard[2] & C. Cordon-Rosales[3], [1] Yale University School of Medicine, Room 700, 60 College St., New Haven, CT 06510
2 Centers for Disease Control and Prevention, DPD, 4770 Buford Hwy., Chamblee, GA 30341, 3 MERTU/G, CDC, Universitad del Valle Guatemala, Guatemala City, Guatemala

Chagas disease is an important parasitic disease of man throughout much of Central and South America. It is caused by the protozoan Trypanosoma cruzi and is transmitted to man by blood-sucking reduviid bugs. Neither an effective cure for chronic Chagas disease nor a vaccine exists. Concerns about use of insecticides necessitate alternate methods of control. Paratransgenesis is a "Trojan Horse" approach in which symbiotic bacteria of disease-transmitting insects are isolated and genetically transformed to export molecules that interfere with pathogen transmission. Our work on paratransgenesis has focused on Rhodnius prolixus, a principal vector of Chagas disease, and its symbiont, the actinomycete, Rhodococccus rhodni . Initially, we modified R. rhodnii to express a gene encoding the 38 amino acid pore-forming peptide L-cecropin A[1]. In 65% of insects that carried cecropin A -producing symbionts, T. cruzi were eliminated. In the remaining 35%, T. cruzi counts were reduced by 2-3 log. These studies provided initial evidence that a genetically altered symbiont could be used to eliminate carriage of an infectious agent from a host vector. Next, we demonstrated expression of an active single chain antibody,rDB3, by genetically altered R. rhodnii in paratransgenic R. prolixus[2]. The antibody fragment, a murine VH-Kappa that binds progesterone, was used as a model for single chain antibody expression. This study established the foundation for expression of single chain antibodies directed at T. cruzi epitopes in paratransgenic R. prolixus. Symbiont acquisition amongst emerging nymphs of R. prolixus involves coprophagy, the ingestion of feces of other colony bugs. We created the synthetic paste, CRUZIGARD, composed of Guar gum, India ink and 10^8 colony forming units (CFU)/ml of Rhodococcus rhodnii, to simulate natural feces of R. prolixus. At MERTU/G in Guatemala City, cages were constructed of building materials from the Chagas disease-endemic region of Olopa, Guatemala[3] and were impregnated with CRUZIGARD. Adult R. prolixus were placed in the cages and removed after eggs were laid. In approximately, 50% of sampled F1 bugs in the experimental group, genetically altered R. rhodnii were detected. More importantly, genetically altered R. rhodnii comprised nearly 90% of CFU in the bugs that tested positive. CRUZIGARD may be useful as a gene dispersal strategy under conditions of microbial competition. More detailed studies of symbiont fitness and dispersal will be discussed.

[3001] PHLEBOTOMINAE SAND FLIES AND LEISHMANIASIS IN ARGENTINA

M. Lizarralde de Grosso[1], E. Córdoba Lanús[1], M. Bogado[2], F. Krsticevic[3] & O. D. Salomón[4], [1] Inst. Superior de Entomología- Fac.Cs.Nat. e I.M.L.- Univ.Nac.Tucumán, Miguel Lillo 205, 4000 Tucumán, Argentina; [2]Ministerio de Salud Pública Provincia de Chaco; [3]Univ. Nac. Misiones; [4] CeNDIE, Av.Paseo Colón 568, 1063 Buenos Aires, Argentina.

The first mucocutaneous leishmaniasis (MCL) outbreak in Argentina in the last sixty years, took place in the middle of the '80s, in the Province of Salta (22° 30' to 24° 10' S, 63° 10' - 64° 25' W), close to the NW border. The Salta incidence rate rose from 6.4 /100,000 in 1984 to 28.7/100,000 in 1985. The parasite was identified as *Leishmania (Viannia) braziliensis*. After this date several confirmed outbreaks were reported in 9 endemic Provinces. In 1998 Argentina reported 1,243 MCL cases in two main foci: 1) Salta (23° 03' 27" S, 64° 24' 29" W), with an incidence rate for the Province of 96.1/100,000, 2) Province of Misiones (26° 00' 41" S, 54° 35' 09" W), in the NE border, with an incidence rate of 28.0/100,000. In 1999 the National Ministry of Health endorsed a Leishmaniasis National Program. One of the authors of this abstract is the entomological coordinator of the Program (ODS). Since 1985 the authors performed epidemiological studies in 9 foci, 6 of them with associated Phlebotominae captures Pichanal, Tartagal, Carmelitas (Salta), Concepción (Tucumán), Vedia (Chaco), and Puerto Esperanza (Misiones). From 49,476 MCL foci related sand flies identified up to now, *Lutzomyia intermedia* relative abundance ranged from 93.8% to 100% in each focus. It is the prevalent species in peridomestic environments associated with secondary forest and modified river related gallery forest. In the NW *Lu. cortelezzii* and *Lu. migonei* are also occasionally present in peridomestic habitats, while in the NE these sporadic collections belong to *Lu. whitmani, Lu. shannoni, Lu. migonei* and *Lu. quinquefer. Lutzomyia punctigeniculata, Lu. fischeri, Lu. pessoai, and Lu. misionenesis* were also found in low numbers mainly associated with primary forest. *Lutzomyia intermedia* has a time and space distribution consistent with its involvement in peridomestic transmission. Furthermore it was incriminated as vector of *L.V. braziliensis* in many Brazil's foci. The high abundance of this species does not presuppose its role as primary vector, but according to its vector competence and capacity, it could be inferred some role at least in the amplification of the outbreak once the parasite is introduced in the proper reservoirs. Taking into account the entomological and epidemiological results, the outbreaks in Argentina may be driven by: 1) weather exceptional conditions – peridomestic transmission. 2) Deforestation – traditional forest related activity transmission. 3) Human settlements close to residual primary forest. Experimental control designs are being developed for each of these scenarios.

[3002] PHLEBOTOMINAE SAND FLIES IN TUCUMAN, ARGENTINA

E. Córdoba Lanús[1], M. Lizarralde de Grosso[1] & O. D. Salomón[2], [1]Instituto Superior de Entomología- Fac. de Cs. Nat. e I.M.L- Univ. Nac. Tucumán, Miguel Lillo 205, 4000 Tucumán, Argentina; [2]CeNDIE, Av. Paseo Colón 568, 1063 Buenos Aires, Argentina.

Mucocutaneous Leishmaniosis has been endemic in Argentina since 1918. The disease was usually diagnosed in isolated human cases, due to the contact or permanence in the primary forest during the night. Nevertheless an outbreak (due to *Leishmania braziliensis*) took place in Salta Province from 1984 to 1987 in periurban and rural areas, with similar incidence in both sexes and cases among children. Since that outbreak the report of new cases in the whole country increased. In Tucuman Province between 1991 and 1996, 232 cases of leishmanosis were reported. The current knowledge about Phlebotominae in Tucuman belongs to entomological literature up to the '50s. These papers are related with isolated captures at different places associated with Leishmaniosis actual transmission or sites identified as risk ones. Since 1999 we are collecting sand flies in localities of Trancas, Famailla, Chicligasta and Alberdi departments. The methods of capture were mini light traps type CDC like, and a modified Shannon trap for 3 hours since the dusk. The preliminary data exhibit *Lutzomyia intermedia* as the predominant species in all the capture sites. These results are consistent with Salomon data from other outbreaks in different provinces (1994), who proposed this species as the main vector involved in the transmission of Leishmaniosis to man, in secondary forest and other modified areas in Argentina. In such situation we started the study of density and distribution of sand flies in Tucuman. That will provide of valuable information for Public Health. Further, taking into account that development programmes in the north west of Argentina implicate an increase in the infection risk, because they are related to human activities that bring man directly in contact with phlebotominae.

[3003] POPULATION DYNAMICS OF *TRIATOMA INFESTANS* (HEMIPTERA: REDUVIIDAE), VECTOR OF CHAGAS DISEASE, IN EXPERIMENTAL HUTS UNDER NATURAL CLIMATIC CONDITIONS

M. C. Cecere[1], D. M. Canale[2] & R. E. Gürtler[1], Lab. Ecología Gral., Fac. Exactas y Naturales, Univ. Buenos Aires, Ciudad Universitaria, (1428) Buenos Aires, Argentina, E-mail carla@bg.fcen.uba.ar; [2] Servicio Nacional de Chagas, 9 de Julio 356, (5000) Córdoba, Argentina.

We tested whether variations in host and refuge availability affect the population dynamics of *T. infestans*. In Córdoba Province (Argentina), we built 16 experimental huts mimicking houses found in endemic rural areas. Eight huts had maximum availability of refuges, with roofs of "jarilla" (*Larrea sp*, a shrub) and unplastered mud-bricked walls; whereas the other 8 huts had minimum availability of refuges, with roofs of "simbol" (*Pennisetum sp*, a grass) and plastered mud-bricked walls. In each house group, each of the huts hosted 3 chickens whereas the other 4 hosted one chicken. Each hut (≈1 x 1 x 1 m) was colonized with 4 *T. infestans* adults, 296 nymphs and 88 eggs in February 1996, which developed as a closed population under natural climatic conditions. Twelve huts were disarmed each month during the first year and bimonthly during the second year, to count the number of live and dead bugs by stage and mark new individuals. Four huts were disarmed and bugs counted only at the end of the first and second year (controls of disturbance). The density of *T. infestans* significantly differed over time but not among treatment levels when analyzed by MANOVA. The mean density of bugs was maximum or close to the maximum in huts with maximum refuge availability and 3 chickens after a 12 (1296) or 24-month follow-up (3447). Fecundity significantly differed over time and refuge availability levels, but neither with host availability nor with the interaction between factors. The huts with maximum refuge availability and one chicken reached greater *T. infestans* fecundities than the other types of huts along the first (5 eggs/female/day, January 1997) and second study year (3 eggs/female/day, January 1998). These results show that refuge availability affects the fecundity of *T. infestans* population reared with different host numbers. Environmental management measures aimed at reducing the availability of refuges and accesibility of domestic animals in rural houses may exert a strong adverse impact on *T. infestans* population dynamics.
Index terms: *Triatoma infestans*, population dynamics, Chagas Disease.

[3004] POTENTIAL GEOGRAPHIC RANGE OF *AEDES ALBOPICTUS* (DIPTERA: CULICIDAE) IN ARGENTINA

M. T. Vera[12], P. Orellano[1], J. Kuruc[1], D. Vezzani[1], R. Rodriguez[3] & N. Schweigmann[1], [1]Depto. Biología, Univ. Bs. As., Pab II, Ciudad Universitaria (1428), Bs. As., Argentina. [2]Inst. de Genética, INTA Castelar, CC 25, Castelar (1712), Bs. As., Argentina. [3]Inst. de Clima y Agua, INTA Castelar, CC 25, Castelar (1712), Bs. As., Argentina.
E-mail: tvera@cnia.inta.gov.ar

The presence of the Asian tiger, *Aedes albopictus*, in America dates from the 1980's, and since then has spread all over the continent. In Argentina, it was detected in several locations in Misiones province in early 1998. Misiones presents a subtropical climate and holds adequate conditions for the mosquito to breed. It is not known whether its absence in other areas of the country is because it hasn't been introduce yet, or the conditions do not permit its establishment. With the aim of estimating the potential geographic range of *Ae. albopictus* as a result of climatic constrains, the simulation program CLIMEX was run using a database of 24-yr-average meteorological recordings from 152 meteorological stations located along the country. This program computes an Ecoclimatic Index (EI), which combines potential population growth for a given range of temperature and soil moisture levels and the negative effect on growth during adverse conditions. According to CLIMEX predictions, *Ae. albopictus* has a potential geographic range that covers half of Argentina's provinces where approximately 28 million people reside. The highest EI values appeared in locations of the Mesopotamia area (Misiones, Corrientes and Entre Rios provinces). The southern limit appears at the parallel 36.3° S, being also absent in locations north of this latitude situated along the Andes (west of 65.5° W), principally as a consequence of a water deficit. In lowland Patagonia it is excluded due to excess of drought and in highland Patagonia due to permanent diapause inducing conditions (short daylength coupled with minimum temperatures below 11°C). Interestingly in the Yungas (Northwest tropical rainforest), the EI values resulted not as favorable as in Mesopotamia (Northeast of the country). In conclusion this important vector could breed in most of the biggest cities of Argentina, including Buenos Aires City and its metropolitan area of ca. 12 million people. Its possible spread should be taken as a serious threat regardless of its still unclear importance as a vector of Dengue in this continent. Moreover, the ability of *Ae. albopictus* to survive cold temperatures as diapausing eggs may enable this species to colonize areas that probably exclude *Ae. aegypti*, thus extending the area of the country with a vector population for Dengue.
Index terms: CLIMEX, Mosquito, Dengue vectors, *Aedes aegypti*.

[3005] PRELIMINARY FOUNDINGS OF NECROPHAGOUS FAUNA ON DOMESTIC PIG IN ARGENTINA

N.D Centeno [1]; M. Maldonado[1]; A. Oliva[2], [1]PIIB, Univ. Nacional de Quilmes, Sáenz Peña 180, Bernal (1876), Argentina, E-mail: ncenteno@unq.edu.ar ; [2]Museo Argentino de Ciencias Naturales, Angel Gallardo 470, Buenos Aires, Argentina, E-mail: adroliva@muanbe.gov.ar

The purpose of this project is to study the necrophagous fauna in the urban area around Buenos Aires, Argentina (34°7S, 58°3W). Two domestic pigs each 15-16 Kg were killed with a knife and placed inside cages of meshed wire, one roofed, the other unroofed. Six pitfall traps were placed around each cage; six more were placed in a similar pattern at a nearby area. After 24 h the first samples were taken. Sampling was repeated for each stage of decomposition, and included Arthropoda found on the body or in the soil under and around it, insects flying nearby, and specimens from pitfall traps. The eggs and half of each sample of dipteran larvae were kept for rearing; the rest of the larvae were killed in water at 80°C and fixated in Ethanol 70%. Rearing took place in a hothouse at 24°C; the emerged adults were determined with the remaining material. This report concerns the samples from Fall and Winter; the experience was carried on through Spring and Summer. Five stages of decomposition were recognized, but they may occur simultaneously in the same body, in a mosaic pattern. Assocciated fauna as follows: Fresh stage: Diptera Calliphoridae: Adults, eggs and larvae I of *Calliphora vicina* and *Cochliomyia macellaria*. Diptera Fanniidae: adults of *Fannia* sp. Coleoptera Silphidae: larvae and adults of *Hyponecrodes*. Also: Staphylinidae, Carabidae (adults). Hymenoptera: Formicidae: "red ants" *Solenopsis* sp.; Bloated stage: Calliphoridae: Adults and larvae I, II and III of *C. vicina*, larvae I, II and III of *C. macellaria*, adults of *Chrysomya albiceps*. Sarcophagidae: larvae of *Sarcophaga*. Muscidae: adults and larvae II of *Ophyra* sp. Fanniidae: adults and larvae of *Fannia* sp. Phoridae: *Puliciphora* adults (parasitoids). Silphidae: larvae and adults of *Hyponecrodes*. Staphylinidae: adult *Creophilus maxillosus*. Histeridae: adult *Hister*. Carabidae and Trogidae: adults. Formicidae: *Neivomyrmex* sp. Heteroptera Pyrrocoridae (adults); Active decay stage: Calliphoridae: Larvae I and III of *C. vicina*; larvae II and III of *Phaenicia sericata*, larvae III of *C. macellaria*; larvae I, II and III of *C. albiceps*. Sarcpphagidae: larvae III of *Sarcophaga* sp. Muscidae: larvae II and III of *Ophyra* sp. Fanniidae: adult *Fannia* sp.; Phoridae: adult *Megaselia scalaris* and *Puliciphora*. Dermestidae: adult *Dermestes maculatus*. Silphidae: adults and larvae of *Hyponecrodes*. Staphylinidae: adult *C. maxillosus*. Histeridae: adult *Hister*. Trogidae (adults). Formicidae: *Neivomyrmex* sp. and *Solenopsis* sp. The recolonization ability of the Calliphoridae is remarkable, as eggs were found in all the stages, although this family is supposed to comprise primary and secondary species. The appearance of *C. albiceps* and *C. macellaria* at the cold season is also to be remarked.
Index terms: Arthropods, forensic entomology, carrion, succession , Argentina

[3006] PRODUCTIVITY OF BREEDING ARTIFICIAL OF CULICIDAE, CAMPUS FEDERAL UNIVERSITY OF PARANA, Parana STATE, Brazil.

M.C.V.C., Ribeiro[1]; A. C. , Tissot[1] & M. A. N. , Silva[1] , [1]Dept. of Zoologia, Univ. Federal of Paraná, P. O. Box 19020 Brazil, E-mail magda@garoupa.bio.ufpr.br

The use of artificial recipients containing water for the laying of the Culicidae eggs, may indicate an opportunistic behavior or a habits change. Several authors have described that tires were characterized as the receptacle most acceptable to the mosquitoes. In the purpose to get information about the species that has tendency to this kind of behavior, we installed three tires in three different places into the residual secondary forest (interior of the forest, near to the most preserved area and near to the most impacted area), situated inside the campus of Federal University of Parana, Curitiba city (25° 26´ Lat. South and 49° 16´Long. West, alt. 923, 50 m). The immature specimens were collected twice a month (março/1999 to february/2000). The recipients were hold on the trees 1.5m height, with distillated water in. The immatures were collected and separated in laboratory. The 4th instar forms and pupas were used to get adult form. The other, younger form, were separated until to get the 4th instar form and fixed in alcohol 80% to posterior studies. 1.300 immature *Culex* (*Culex*) *eduardoi* species were collected. Most of the species on the interior of the forest (55%) and in the impacted area (44%). These results provide that species indicates higher adaptability to anthropogenic environments and a great breed in reservoirs with a low degree of oxygen and high concentration of organic matter.
Index terms: Culicidae, ecology, breeding artificial.

[3007] REARING TECHNIQUES OF *ALPHITOBIUS DIAPERINUS* (COLEOPTERA: TENEBRIONIDAE) USING DIFFERENT TEMPERATURES, DIETS AND HUMIDITIES

A. M. Chernaki[1] & **L. M. Almeida**[1], [1]Dept. of Zoology, Univ. Fed. of Parana, P.O.Box 19020, 81531-990, Curitiba, Parana, Brazil. E-mail chernaki@garoupa.bio.ufpr.br.

The poultry industry is in continuous expansion in Brazil and has conquered the international market. Chicken confinement system has solved many production problems but, on the other hand, has created others such as disease spreading and accumulation of chicken manure. The lesser mealworm, *Alphitobius diaperinus* r) colonize the manure substratum, reaching very high populations and causing sanitary and economic problems. They affect the chicken health and performance, and may also transmit diseases. The bioessays were carried out under controlated conditions of 22, 25, 28 and 31oC ± 1oC, ≥ 75% of relative humid and darkness. Different diets were tested: rabbit ration with destilated water humidity sawdust; mouse diet; and a mixture of wheat flour, bread flour and peanut, shaked. The insects were reared on petri-dishes and in plastic glasses (500 ml), closed with voile. It was possible to obtain the complet life cycle only in the diet of rabbit ration with humid sawdust with about 165 g of food at all temperatures. At 22°C it was observed a longer development period and low viability. The optimal temperature was 31°C, at which the development was shorter and egg viability higher. The basal temperature and thermal constant for egg, larva and pupa development were: 17,86°C; 19,26°C and 16,53°C and 40,09 DD; 239,48 DD and 59,56 DD, respectively. The basal temperature and thermal constant for life cycle was 18,85°C and 335,90 DD. Comparing the results obtained with those of other authors it seems clear that the high humidity in meal is essential for the development of a small increase of fungus, providing a good larval performance and an ideal condition to study this insect in laboratory.
Index therms: Biology, lesser mealworm, thermal required.

[3008] REVIEW OF THE RESEARCH AND APPLICATION OF THE MOSQUITO LARVICIDE *BACILLUS SPHAERICUS* IN CHINA

Zhiming Yuan

Early in the 1980s, Chinese researchers began to study the properties of *Bacillus sphaericus* of strains 2362, 1593 and SSII-1, as well as several local isolates. The principal areas of research presented in this review include investigations on the isolation of toxic strains, fermentation and production, field applications and efficacy, and resistance and resistance management. Large scale production of *B. sphaericus* in China began in 1984 with 100 tons and has steadily increased to 150 tons in 1998. Field and laboratory efficacy studies have been done on 12 species of mosquito representing 4 genera including *Aedes*, *Culex*, *Anopheles* and *Armigeres*. Due to long-term continuous use of *B. sphaericus* in southern China, *Culex* populations became highly resistant. By implementing an application scheme using both *B. sphaericus* and *Bacillus thuringiensis* var. *israelensis* the resistant *Culex* populations returned to near normal susceptibility to *B. sphaericus*.

[3009] SARCOSAPROPHAGOUS INSECTS ASSOCIATED WITH DECOMPOSITION OF PIG CARCASSES EXPOSED TO DIFFERENT ALTITUDES AND PLUVIOMETRIC REGIONS IN THE SERRA DO JAPI RESERVATION-SP, BRAZIL

M. C. D. Tavares & A. X. Linhares, Departamento de Parasitologia, Instituto de Biologia – IB/Unicamp, Campinas – SP, Brasil. CP 6109, CEP 13083-970, E-mail: mcrisht@unicamp.br. Supported by FAPESP (98/09521-1).

In the turnover of nature, the decay of terrestrial vertebrates is dominated not only by the action of fungi and bacterias but also by sarcosaprophagous insects specially flies belonging to Calliphoridae and Sarcophagidae families. After death, the body undergoes natural changes, going through different stages of decomposition that are attractive to flies. The knowledge of the species that use carrion for breeding, as well as their successional pattern associated to temperature, rainfall, altitude and vegetation are of great importance in forensic medicine, for it may provide crucial information to estimate the time of death.The study was done during the Summer and the Winter in four environments with different rainfall and altitudes, located in the Serra do Japi Reservation, Jundiaí, state of São Paulo. Pig carcasses weighing 10Kg each were used as baits. They were killed mechanically with a blow to the head and immediately placed inside metal frame cages. Underneath the cages, metal trays with sawdust were placed to collect larvae leaving the carcass. The adult insects were collected by emergence traps, consisting of na iron frame in form of inverted funnel and covered with transparent fabric. The immature forms were collected from the sawdust placed under the bait and were transfered to the plastic vials and took to the laboratory until the adults emergence. In Summer, the calliphorids were predominant as collected and reared adults. On the other hand, in Winter the sarcophagids were more frequent. The most important species of Calliphoridae for both seasons were: *Chrysomya albiceps*, *Paralucilia* sp., *Hemilucilia semidiaphana* and *Hemilucilia segmentaria*. The calliphorids and sarcophagids collected in Summer were more numerous on the stage of decomposition III (black putrefaction) and IV (fermentation); while in Winter they were predominant on the stage of decomposition II (putrefaction) and III. Apparently the preference of the insects by different stages is influenced by season variations (temperature, humidity and rainfall). This study contributes to Forensic Science since it can be used in criminal investigations to estimate the postmortem interval.

[3010] SEASONAL FLUCTUATION OF *DERMATOBIA HOMINIS* (LINNAEUS, JR) (DIPTERA: CUTEREBRIDAE) ON HIDES OF BUTCHERED BOVINES AT THE SLAUGHTERHOUSE OF PIRAI COUNTY, RIO DE JANEIRO, BRAZIL

L.G. Brito[1], **G.E. Moya Borja**[1] & **M.J. Paes**[2], [1]Dep. of Animal Parasitology, Univ. Fed. Rural of Rio de Janeiro, 23.851-970, RJ, Brazil, E-mail lgatto@ufrj.br; [2] Dep. of Medicine Veterinary, ESAM, 59.629-900, RN, Brazil, E-mail paesmj@esam.br.

Dermatobia hominis causes a furuncular cutaneous myiasis in a wide range of mammalian hosts, including human beings, and is particularly important as a parasite of cattle. It is endemic to the Neotropical region where it occurs from the southern part of Mexico to the northern part of Argentina. *D. hominis* is primarily a forest species; it occurs chiefly in the wooded tracts and forest margins of the lowlands and river valleys, but it may range up to an altitude of 1500 m. Although chemical insecticides targeted at the larval stage have been the most successful method of reducing *Dermatobia* populations, alternative management strategies must be investigated. Studies on pest population dynamics are indispensable before treating the animals with insecticides or releasing biological control agents. The effect of climatic factors on seasonal fluctuation of *D. hominis* was carried out counting the larvae on hides of butchered bovines at the slaughterhouse of Pirai country from November 1995 to October 1997. The higher peaks of parasitized hides were observed in November, 1995 and December, 1996 followed by a second lower peaks in May, 1996 and March, 1997. High parasitism through the summer seasons was associated with mean temperatures above 25°C and rainfall above 200 mm. The larvae populations declined in both years from June to October, probably due to low temperatures and especially to rainfalls under 50 mm. In total, 5,142 hides were checked during two years study and 2,710 hides (52,7%) were parasitized.
Index terms: Human bot fly, myiasis, ecology

[3011] SPREAD OF *IXODES SCAPULARIS* AND *AMBLYOMMA AMERICANUM* (ACARI: IXODIDAE) IN INDIANA AND OTHER MIDWESTERN STATES HAS PRECIPITATED INCREASES IN TICK-BORNE DISEASES

R. R. Pinger, Ball State Univ., Muncie, IN, USA, E-mail: rpinger@bsu.edu

The reintroduction of white-tailed deer, *Odocoileus virginianus*, into Indiana and other Midwestern states in the 1930s and the successful management of the resulting deer herds throughout the remainder of the century have generated large populations of deer in these states. The increased availability of deer as hosts has resulted in the proliferation and expansion in range of two important tick vectors: *Ixodes scapularis* which transmits Lyme disease, babesiosis, human granulocytic ehrlichiosis and *Amblyomma americanum* which transmits human monocytic ehrlichiosis. *Ixodes scapularis*, the blacklegged tick (or deer tick), once confined to foci in east-central Minnesota and western Wisconsin has spread southward and eastward to the neighboring states of Iowa, Illinois, Indiana and Michigan. *Amblyomma americanum*, the lone star tick, has expanded from well-established populations in the southeastern and south-central states northward into the southern portions of Indiana, Illinois and Ohio. The diseases transmitted by these ticks, which were not even recognized 25 years ago now account for more than 90% of the vector-borne illness in the Midwest. This report documents the expansion of the range of these ticks and the concomitant increases of these tick-borne diseases.
Index terms: ticks, Lyme disease, human granulocytic ehrlichiosis, white-tailed deer, Lyme borreliosis.

[3012] STUDIES OF THE EFFECT OF CLIMATIC FACTORS ON SEASONAL FLUCTUATION OF *DERMATOBIA HOMINIS* (DIPTERA: CUTEREBRIDAE) ON SKINS OF BUTCHERED BOVINES AT THE SLAUGHTERHOUSE OF PIRAI COUNTY, RIO DE JANEIRO, BRAZIL

L.G. Brito[1], G.E. Moya Borja[1] & M.J. Paes[2], [1]Dep. of Animal Parasitology, Univ. Fed. Rural of Rio de Janeiro, 23.851-970, RJ, Brazil, E-mail lgatto@ufrrj.br; [2] Dep. of Medicine Veterinary, ESAM, 59.629-900, RN, Brazil, E-mail paesmj@esam.br

Dermatobia hominis causes a furuncular cutaneous myiasis in a wide range of mammalian hosts, including human beings, and is particularly important as a parasite of cattle. It is endemic to the Neotropical region where it occurs from the southern part of Mexico to the northern part of Argentina. *D. hominis* is primarily a forest species; it occurs chiefly in the wooded tracts and forest margins of the lowlands and river valleys, but it may range up to an altitude of 1500 m. Although chemical insecticides targeted at the larval stage have been the most successful method of reducing *Dermatobia* populations, alternative management strategies must be investigated. Studies on pest population dynamics are indispensable before treating the animals with insecticides or releasing biological control agents. The effect of climatic factors on seasonal fluctuation of *D. hominis* was carried out counting the larvae on skins of butchered bovines at the slaughterhouse of Pirai country from November 1995 to October 1997. The higher peaks of parasitized skins were observed in November, 1995 and December, 1996 followed by a second lower peaks in May, 1996 and March, 1997. High parasitism through the summer seasons was associated with mean temperatures above 25°C and rainfall above 200 mm. The larvae populations declined in both years from June to October, probably due to low temperatures and especially to rainfalls under 50 mm. In total, 5,142 skins were checked in the two years study and 2,710 skins (52,7%) were parasitized.
Index terms: flies, *Dermatobia hominis*, seasonal fluctuation, slaughterhouse

[3013] SUCCESSFUL INTERRUPTED FEEDING OF ADULT *RHIPICEPHALUS APPENDICULATUS* (IXODIDEA) AND INTRA-STADIAL TICK-BORNE THOGOTO VIRUS (ORTHOMYXOVIRIDAE) TRANSMISSION

H. Wang & P. A. Nuttall, CEH Virology & Environmental Microbiology, Mansfield Rd., Oxford OX1 3SR, UK, Email:HUW@wpo.nerc.ac.uk.

Ixodid female ticks take one comparatively large blood meal which they convert to a single large egg mass and then they die. To examine the outcome of interrupted feeding, equal numbers of male and female *Rhipicephalus appendiculatus* adult ticks were fed on guinea pigs (host 1) for either 2, 4, or 6 days, or to engorgement (8 days). All of the fully engorged (D8) females laid a single large egg mass (80-160 mg/tick), while 85 % of the day 6-fed (D6) female ticks (n=20) each laid a small egg mass (6.1 mg/tick). None of females that had fed for 2 or 4 days oviposited. Ninety percent (n=20) of the day 2-fed (D2) females survived for 4 weeks after their feeding was interrupted, whereas 65 % (n=20) of the day 4-fed (D4) females survived. All of the surviving partially fed female ticks (D2 and D4) attached to a second guinea pig (host 2) and attained engorged body weights that were not significantly different from those of the control females ($P<0.05$). Female ticks that engorged following interrupted feeding layed egg masses comparable to the controls, indicating that engorgement on host 2 was successful. The salivary gland protein profile of female ticks changed constantly during feeding. However, when feeding was interrupted, the protein expression pattern switched back to that of the non-parasitic state, presumably to enable the partially fed ticks to survive and reattach on the new host. This observation indicates that female ixodid ticks have a natural ability to survive and re-establish successful feeding on a new host if the first attempt at feeding is unsuccessful. Such an interrupted feeding mechanism supports the hypothesis that partially engorged ticks can mediate intra-stadial tick-borne pathogen transmission, as we demonstrated using the Thogoto virus-*R. appendiculatus*-hamster system. When clean ticks (nymph, male, and female) infested a virus infected hamster, they became infected at the time of host death (in 3-4 days post infection). These partially fed infected ticks intra-stadially transmitted Thogoto virus to subsequent hosts. A single female tick can infest and consequentially cause death of 4 hosts. Intra-stadial transmission significantly accelerates the transmission rate among susceptible hosts, and thus is important for epidemiological studies of tick-borne pathogens. Additionally, it provides an increased risk of tick-borne pathogen transmission to humans and domestic animals during slaughter and game hunting.
Index terms: *Rhipicephalus appendiculatus*, interrupted feeding, Thogoto virus, tick-borne pathogen transmission

[3014] TAXONOMIC AND PHYLOGENETIC STUDIES OF PERUVIAN *LUTZOMYIA* SPECIES BASED ON MOLECULAR DATA

L. Beati [1], A.L. Cáceres[2], R.L. Regnery[3], D. Fish[1] & J. Lee [3], [1] Dept. of Epidemiology and Public Health - Yale School of Medicine, PO BOX 208034, New Haven, CT 06520, USA, e-mail:lorenza.beati@yale.edu; [2] Inst. de Medicina Tropical Daniel Carrion, Lima, Peru; [3] Viral and Rickettsial Zoonoses Branch - CDC, 160 Clifton Road, Atlanta GA 30333, USA.

Several species of *Lutzomyia* are responsible for the transmission of human diseases in the New World, among them bartonellosis and leishmaniases. The global taxonomy and classification of this genus of sand flies is mainly based on morphological characters. Molecular tools may help in identifying and classifying specimens that are difficult to differentiate based solely on their morphology. We developed primers for the amplification of fragments of the 12SrRNA gene, the cytochrome *b* gene, and ITS gene sequences of sand flies, in order to establish the discrimination level provided by each of these markers. Our beginning sample of taxa includes members of the *Helcocyrtomyia* (*L. noguchii*, *L. peruensis*, and *L. tejadai*) and *Pifanomyia* subgenera (*L. verrucarum*, *L. robusta*, *L. serrana*, and *L. maranonensis*). Our preliminary results indicate that the cytochrome *b* gene sequences is more variable (similarity of 79% between subgenera and 82-86% within a subgenus), when compared to the 12SrRNA gene sequences (89% between subgenera vs. 93-95% within a genus), and seem to provide us with a better tool for distinguishing closely related specimens. Moreover, the differences between *L. serrana* and *L. robusta* seem to be compatible with co-specificity. Our sample of taxa is limited, and more species of *Lutzomyia* will need to be studied, in order to fully evaluate the usefulness of these markers for phyloganetic and taxonomic analyses.
Index terms: Sand flies, Peru, phylogeny, systematics

[3015] TERMICS EXIGENCY, LONGEVITY AND REPRODUCTIVE ASPECTS OF *AEDES ALBOPICTUS* AT LABORATORY CONDITIONS

D. C. Calado[1, 2] & M. A. N da Silva[1], [1]Dept. de Zoologia. Univ. Federal do Paraná, P.O. Box 19020, ZIP 81531-990, Curitiba - PR, Brasil, E-mail: dcalado@garoupa.bio.ufpr.br; [2]CNPq fellow.

Aedes albopictus was detect by the first time at Brazil in 1986. Because of the expanding area of distribuition and the probability of being a dengue and yellow fever vector, it´s necessary o know the biology of this specie to stablish a way to contract. In order to analise the termics exigengy of *Aedes albopictus*, colonies from Registro city, were kept at laboratory. *Aedes albopictus* males and females were kept in B.O.D. at 15, 20, 25 and 30° C, relative humidity of 70-90% and LD 12:12. Longevity, fecundity, the number of blooodsucking and oviposition were analised, at four temperatures. At 25°C, the longevity of males changed to 2 till 96 days and 13 till 110 for females. There was a great variation of the number of eggs per female, it changed to 1 till 469. The females were able to make the first bloodsucking 1 to 7 days after emergence. The number of bloodsucking changed to 1 till 11. The ovipositions were done in a fragmented way.
Index terms: adult biology, bloodsucking, oviposition

[3016] THE DISCOVERY OF NATURAL FOCI OF TSUTSUGAMUSHI DISEASE IN SOUTHERN SHANXI PROVINCE, NORTH CHINA, AND ITS ZOO-EPIDEMIOLOGIC FEATURES

J. Zhang, H. Zhang & T. Guo, Dept. of Vector Biol. & Control, Inst. of Microbiol. & Epidemiol., 20 Dongdajie Str., Fengtai D., Beijing 100071, P. R. China, E-mail Zhangjt@nic.bmi.ac.cn.

A new discovered natural focus of tsutsugamushi disease existed in Yicheng and Jiangxian Counties, southern Shanxi Province, north China where the disease has been epidemic for several years with a yearly incidence of 38~121 cases. A zoo-epidemiological survey sustained for couple of years was conducted to bring the nature and features to light of the natural focus. It has been revealed that the local epidemics of scrub typhus showed a typical feature of autumn-winter abundance. 8 species of small mammals were collected (*Sorex araneus, Citellus dauricus, Rattus norvegicus, Mus musculus, Apodemus agrarius, A. speciosus, A. sylvaticus* and *Cricetulus triton*), the last one (*Cricetulus triton*, Rodentia: Cricetidae), a locally species abundant all the year round, played as the major rodent reservoir. The vector mite may be *Leptotrombidium apodemi* (Acariformes: Trombiculidae) based on the facts as follows: 1. The mite takes a dominant position among all the locally collected mite species with highest parasitic rate and index on its hosts; 2. The seasonal abundance of the mite is accordant with that of local epidemics of scrub typhus; 3. The mites distribute over the same area where the cases occurred; 4. Its major host, *Cricetulus triton*, is a locally dominant species described above; and 5. The other species known as vectors of scrub typhus have not been found in herewith mentioned areas.
Index terms: *Leptotrombidium apodemi, Cricetulus triton*, scrub typhus, Vector, Reservoir

[3017] THE EFFECTS OF MANAGEMENT STRATEGIES ON RESISTANCE IN THE HORN FLY, *HAEMATOBIA IRRITANS*

L.D. Foil[1] & A.T. M. Barros[2], [1]Dept of Entomology, 402 Life Sciences , Louisiana State Univ Ag Center, Baton Rouge, LA 70803, USA. [2]Embrapa Pantanal, Rua 21 de Setembro 1880, 79320-900, Corumbá, MS, Brazil

The effect of different management strategies on insecticide resistance in horn fly populations was evaluated. Weekly fly counts were conducted to evaluate control efficacy of the treatments, and bioassays were conducted at least twice per year to measure fly susceptibility to organophosphates (OP's) and pyrethroid insecticides. Field studies demonstrated that use of a single class of insecticidal ear tag during the horn fly season resulted in product failure within three to four years for pyrethroids and OP's, respectively. At one site, ear tags impregnated with OP's were used yearly for 10 years; and in a four year period, the efficacy of 20% diazinon-impregnated ear tags was reduced from >20 to just 1 week of control. Subsequently, mid-summer treatment with ivermectin pour-on apparently reversed resistance to OP's during the following fly season on two different occasions. The yearly alternated use of synergized pyrethroid (lamda-cyhalothrin + piperonyl butoxide) and organophosphate (pirimiphos-methyl) ear tags was evaluated for control of two pyrethroid-resistant horn fly populations in Louisiana over a seven year period. Control achieved by synergized pyrethroid ear tag treatments was reduced from seven to two weeks and from four to zero weeks at St. Joseph and Winnsboro, respectively. Control by organophosphate ear tags decreased from fifteen to three weeks and from ten to seven weeks at St. Joseph and Winnsboro, respectively. The yearly rotation of synergized lambda-cyhalothrin and pirimiphos-methyl ear tags did not improve pyrethroid ear tag efficacy or prevent further development of resistance to the pyrethroid or OP compounds. However, a two-year use of organophosphates resulted in partial reversion of pyrethroid resistance. When pyrethroid and organophosphate ear tags were used in a mosaic strategy at two different locations, efficacy of products did not change during a three-year period.
key words: control, livestock, flies

[3018] THE IMPORTANCE OF DEVELOPING NOVEL STRATEGIES FOR PESTICIDE USE IN CONTROLLING VECTOR-BORNE DISEASES

K.B. Platt[1], M.J. Perich[2], J.A. Mangiafico[3], O. J. Rocha[4], M.E. Zaldivar[4], J. Mora[4], G. Trueba[5] and W.A. Rowley[1], [1]Iowa State University, Ames IA, USA, [2]Walter Reed Army Institute of Research, Washington, DC., USA, [3]U.S. Army Medical Research Institute of Infectious Diseases, Fort Detrick, Frederick, MD, USA. [4]Escuela de Biologia, Universidad de Costa Rica, San Jose, Costa Rica, [5]Colegio de Ciencias de la Salud, Universidad San Francisco de Quito, Quito, Ecuador.

Vector borne diseases can be expected to emerge and re-emerge as human populations continue to grow, global trade increases, exploitation of the rain forest continues and economic pressure on urban areas causes declines in public services that are essential in controlling insect and rodent populations. Accordingly there will be a need not only to increase our understanding of the natural history of vector-borne disease agents but also for continued development of pesticides and novel strategies for their efficient use in controlling known and potential vectors. A recent serological survey for neutralizing antibody to dengue virus serotypes DEN-1, 2, 3, and 4 in bats captured in 2 Costa Rican cities (Puntarenas and Liberia) and in Tena, Ecuador demonstrates this point. Results of the survey suggest that bats can be infected with dengue virus. Twenty-two percent (12) of 53 Cost Rican bats sampled had 80% plaque reduction neutralization titers ($PRNT_{80}$'s) that ranged from 20 to 80. Two of these serums with $PRNT_{80}$'s of 80 and 40 for DEN-1 also had DEN-2 titers of 20. All other serums were monotypic and reacted only with DEN-1. In a similar assay, 3 of 10 Ecuadorian bats had $PRNT_{80}$ titers of 40 or 80 for DEN-2. Two of these bat serums also had $PRNT_{80}$'s of 20 and 80 for DEN 3 but did not neutralize DEN-1or 4. Houses in all 3 of these cities provide roosting sites for bats. If ongoing studies confirm that bats can serve as a reservoir for dengue virus, then novel approaches to minimize the bat's potential role in the natural history of this disease will have to be developed. The use and application of pesticides with residual activity in roosting sites used by bats in urban areas is a likely approach. Results of a field trial recently completed in Puntarenas, Costa Rica indicates that ULV or thermal fog application with a hand-held Terrier sprayer of the pesticide, λ-cyhalothrin suspended in oil microcapsules, can significantly reduce the *Ae. aegypti* population in houses for 2 to 3 weeks after application. Consequently a similar approach may be feasible to control mosquito populations in urban structures used by bats for roosting without harming the bat population.
Index Terms: dengue, bats, mosquitoes

[3019] THE IMPORTANCE OF MOSQUITO LARVAL SURVEYS IN THE MAPPING OF MALARIA TRANSMISSION RISK.

C. Bøgh[1], C.J. Thomas[2], S.E. Clarke[1], M. Jawara[3] and S.W. Lindsay[1,2],1Danish Bilharziasis Laboratory, Jægersborg Allé 1D, DK-2920 Charlottenlund, Denmark, E-mail: cb@bilharziasis.dk; [2]Department of Biological Sciences, University of Durham, South Road, Durham DH1 3LE, UK; [3]The Medical Research Councils Laboratories, Fajara, The Gambia.

Considerable variation in the level of malaria exists between neighbouring villages in the Sahel region of Africa. Here we present the findings from extensive surveys of the larval breeding of vector mosquitoes in The Gambia and the variation in malaria transmission risk in villages in nearby areas. Mosquito larvae were sampled in the central region of the country during the rainy seasons of 1996 and 1997. Sampling was done along transects in the flooded areas along the river and supplemented by purposive sampling to establish the position and extent of the major mosquito breeding areas. PCR analysis of specimens collected along transects showed that *Anopheles melas* was the dominant species followed by *An. gambiae s.s.* and *An. arabiensis*. The surveys demonstrated that even during the peak rainy season, the breeding areas of the most important malaria vectors were restricted to the alluvial areas along the river. Characteristics of the breeding habitats will be presented. Entomological investigations in 48 villages within a 2500 km^2 area of The Gambia during the 1996 rainy season, demonstrated large variation in malaria transmission risk in the area. The entomological inoculation rate (EIR) experienced in different villages varied from 0-165 infective bites per season. There was an ten fold decrease in the mean seasonal EIR in villages less than 1 km from breeding sites compared to villages 3-5 km away from breeding sites. These results illustrate the importance of knowing the extent and location of the vector breeding areas in order to explain the pattern of malaria transmission risk in a given area.

[3020] THE PLANT DIET OF SAND FLIES IS A MIXED BLESSING FOR THEIR *LEISHMANIA* PARASITES

Y. Schlein & R. L. Jacobson, Dept. of Parasitology, Kuvin Center for Tropical & Infectious Diseases The Hebrew Univ.-Hadassah Medical School POB 12272 Jerusalem 91120, Israel. E-Mail schlein@md2.Huji.Ac.Il Acknowledgments: This study was supported by NIH grant RO1 Ai40926, the Center for the Study of Emerging Diseases and Deutsche Forschungsgemeinschaft

Phlebotomus papatasi the vector of *Leishmania major* in arid foci in the Jordan valley obtains carbohydrates by feeding on plants and the sources were identified. At the end of the dry summer when the fly population was the highest, only a small proportion of them had plant tissue residues (cellulose particles) or sugar in the gut. The life span of the flies was very short and this allows only a small proportion of flies to complete a gonotrophic cycle or transmit *L. major*. In the dry season the plants are under heat and dehydration stress that arrests the photosynthesis and reduces the amounts of the main end products in leaves, sucrose and starch. We presumed that the paucity of sugar in the sand fly diet resulted from the arrest of photosynthesis. This assumption was supported by the comparison of sand fly feeding on *Capparis spinosa* (caper plant) branches that had been kept for 24 hrs in darkness and on branches that had been cut after a normal day of photosynthesis. In darkness the branches had lost more than a half of their sugar contents, the proportion of flies that fed on them decreased by a half and the ingested meals were much smaller. Laboratory experiments also showed that plant-feeding sand flies often ingest starch grains and such grains were also found in a high proportion of field caught flies. Alpha-amylase activity that was found in *Ph. papatasi* and in *L. major* promastigotes indicated that starch could be utilized by both. Sand fly plant-tissue meals also include cellulosic cell-wall residues however, only the parasites possess a cellulase enzyme complex. Thus, the ingested cellulose is degraded and utilized only in *Leishmania* infected flies. Another aspect of the plant feeding is the agglutination and killing of *L. major* promastigotes in the gut of infected flies, by the ingested tissues of some plants. Inhibition of these effects by sugars, in experiments with cultured parasites and plant extracts, indicated that the parasite death was caused in most cases by lectins. The cytotoxicity of *Solanum* sp. was apparently caused by solanaceous alkaloids since the effect of the plant extract was not inhibited by sugars. In addition to their effect on the parasites the feeding on some plants was deleterious to the sand flies and compared to controls, a single meal could shorten their median survival by more than a half.

Index terms: *Phlebotomus papatasi*, *Leishmania major*, photosynthesis, lectins.

[3021] THE PROGRESS AND TENDENCY OF THE CHEMICAL MEASURES ON CONTROLLING THE HYGIENIC PESTS IN CHINA

J. Zhang, H. Zhang & W. Miao, Dept. of Vector Biol. & Control, Inst. of Microbiol. & Epidemiol., 20 Dongdajie Str., Fengtai D., Beijing 100071, P. R. China, E-mail Zhangjt@nic.bmi.ac.cn.

In the social practices of today, chemical method still plays as one of the most important measures on the hygienic pest management in China. Since 1984 when the agrochemical administrative system of China established, the variety and type of registered pesticides have increased year after year, and the sum total had exceeded 5400/year in 1997. Of them some 10.1% (about 550) were those varieties used for controlling the hygienic pests. As to all that 550 varieties of insecticides, the domestic products shared some 80.2%, and the remains were import products from over 20 countries and regions of the world. Japan, USA, Germany and Britain occupied the former 4 positions among those countries and regions which export pesticide products to China. During the year of 1998, a hygienic pesticide market of 674.4 million US dollars formed in China. The main assortments of domestic hygienic pesticide in Chinese market are those varieties of aerosols, spray fluid, mosquito coils, vaporizing mats, liquid vaporizer and roach baits. The consumption amount of hygienic pesticide in 1998 are (in Million): aerosol, 180~185 (bottles); mosquito coil, 13.3~14.2 (boxes, 60 packages/box, 10 plates/pack.); vaporizing mat, 58.3~60 (packages, 30 pieces/pack.) and liquid vaporizer, 7~7.5 (bottles). As to the dustable powder, wettable powder, smoke generator, ULV concentrate, etc., they were used mainly by the professional teams and companies, and the yearly consumption amount may reach several hundred tons. The pyrethroids and organic phosphorus composed the majority of hygienic pesticide components. Besides, some new types of hygienic pesticide, such as bacterial and virus pesticide, and gene-transfer algae, are in research and development.

Index terms: Pest management, Hygienic pesticide, Variety, Consumption amount, Chinese market

[3022] TOWARD INTERRUPTING MALARIA TRANSMISSION BY GENETIC MANIPULATION OF THE MOSQUITO VECTOR

L. A. Moreira[1], M. Edwards[2], F. Adhami[1], N. Jasinskiene[3], A. A. James[3] & M. Jacobs-Lorena[1], [1]Dept. of Genetics, School of Medicine, Case Western Reserve University, 10900 Euclid Avenue, Cleveland, OH 44106-4955, USA, E-mail lam4@po.cwru.edu; [2]Dept. of Zoology, Ohio Wesleyan Univ., Bigelow-Rice 102, Delaware, OH 43015, USA; Dept. of Molecular Biology and Biochemistry, Univ. of California, Irvine, CA 92697-3900, USA.

Malaria remains an important public health problem with an incidence of more than 270 million cases and approximately 2 million deaths every year. Efforts to eradicate or at least diminish the problem by the development of new drugs, vaccines and insecticides have been partially successful at best. Interference with mosquito vectorial capacity is an approach that needs to be explored. One strategy would be to introduce into the mosquito a gene that drives secretion into the gut of a product that is harmful to the parasite but innocuous to the mosquito. Previous results from our laboratory demonstrated that blood ingestion induces abundant carboxypeptidase mRNA expression in the gut of *Aedes aegypti* [peak expression at 24 h after a blood meal (ABM)] and of *Anopheles gambiae* (peak expression at 3 h ABM). A 1.4 kb putative promoter fragment of the *Ae. aegypti* carboxypeptidase (AeCP) gene or a 3.4 kb fragment of the *An. gambiae* carboxypeptidase (AgCP) gene were linked to a luciferase reporter and introduced into the *Ae. aegypti* germ line using Hermes or Mariner transposons, respectively. Six independent transgenic lines were obtained with the AeCP construct and one with the AgCP construct. Northern blot analysis indicated that the luciferase reporter is abundantly expressed in the guts of transgenic mosquitoes in 4 of the 6 AeCP lines and in the AgCP line. Expression was gut-specific and reached peak levels at 24 h ABM for the AeCP construct and already strong at 3 h ABM for AgCP, consistent with the temporal profile of both endogenous carboxypeptidases. Southern blot analysis indicated that gene rearrangements had occurred in 1 of the 2 non-expressing lines of AeCP. An anti-luciferase antibody detected a 51 kD protein band on Western blots, even though no luciferase enzyme activity could be measured. The reasons for this are currently being investigated. We conclude that the 1.4 kb AeCP and 3.4 kb AgCP fragments contain the necessary regulatory elements to drive abundant transcription in the gut. The AgCP promoter is now being used to drive the expression of anti-malarial genes in the gut of transgenic mosquitoes.

Index terms: *Aedes aegypti*, *Anopheles gambiae*, Malaria, germ-line transformation, luciferase

[3023] TRIATOMINES AND OTHER ARTHROPODS IN BIRD NESTS IN NATIVE AND MENNONITE COMMUNITIES OF THE PARAGUAYAN CHACO

N. González, C Vega, M Rolón, A Rojas de Arias, Departamento de Medicina Tropical, Instituto de Investigaciones en Ciencias de la Salud, Rio de la Plata y Lagerenza, CP2511, Asunción, Paraguay

This study was carried out in different localities in order to contribute to the knowledge of the arthropofauna of bird nests of the Chaco region. The objectives were to identify triatomines and other infesting arthropods and to characterize the ecotopes. Besides, the possible associations between species, geographic distribution and season were evaluated. One hundred and ten nests from native and Mennonites localities were dissected. They were then characterized according to construction material, chamber number and hosting species. Contingency tables X^2 were used to study associations. Forty two point seven percent of the nests was infested and 87% belong to the Furnariidae family. 185 adults, 90 nymphs and 82 eggs of five different species were collected. Three hundred and two were adults, nymphs and eggs of *Psammolestes coreodes* Bergroth; 26 adults, nymphs and eggs of *Triatoma sordida* Stal; 18 adults nymphs and eggs of *Triatoma platensis* Neiva; 8 adults and nymphs of *Triatoma guasayana* and 3 adults of *Triatoma melanosoma*. They were all negative to *Trypanosoma cruzi* infection.The arthropod fauna in the infested nests was as follows: Coleoptera order (83%), Aranea (73%), Himenoptera (48%) and others in lower proportion. The diversity of triatomine species that use bird nests as natural ecotopes is confirmed. *Psammolestes coreodes* was the most often and abundant species. Significant differences in their distribution were not observed considering both communities and year season (hot-cold). The other species did not show any season or community preference either with the exception of *Triatoma guasayana* which was only present in the Mennonite communities ($p< 0.05$). Coleoptera, Aranea e Himenoptera orders did not show any significant difference in relation to the presence or absence of triatomines in the nests but the low frequency of Blattaria order in nests infested by triatomines ($p<0.05$) suggests a predating behavior of the latter.
Index terms: arthropofauna, Furnariidae, nests, Paraguayan Chaco.

[3024] TRIATOMINES INVOLVED IN DOMESTIC AND WILD *Trypanosoma cruzi* TRANSMISSION IN CONCEPCIÓN, CORRIENTES, ARGENTINA.

M. E. Bar[1], E. B. Oscherov[1], M. P. Damborsky[1], B. M. Alvarez[1], G. Avalos[1] & M. C. Wisnivesky-Colli[2]., [1]Cátedra de Artrópodos, Univ. Nacional del Nordeste, 9 de Julio 1449, (3400) Corrientes, Argentina, E-mail mebar@exa.unne.edu.ar; [2]Unidad Ecología Reservorios y Vectores de Parásitos, Facultad Cs. Exactas y Naturales, UBA, Ciudad Universitaria, Pab. II 4° Piso (1428), Buenos Aires, Argentina.

In 3 localities of the Department of Concepción, Province of Corrientes, an entomological and serological survey was performed in 1999, to identify triatomines species involved in domestic and wild transmission of Chagas disease. Triatomines were collected by man/hour capture, using dislodging substances (tetramethrin 0,2%) in 22 houses randomly selected and 32 nearby outdoor ecotopes: hen and pigeon houses, pens, piled trunks, kennels, bird nests and palms. *T. cruzi* infection in triatomines was assessed by direct microscopic observation (400X) of feces and Polymerase Chain Reaction. Serological techniques used for people were Indirect Hemagglutination Test and Indirect Fluorescent Test, and a person was considered positive when simultaneously react to both tests at serum dilutions 1:32.Triatomines were collected in 27,0% of the houses and 37,5% of the wild ecotopes. *Triatoma infestans* was exclusively found indoors and *T. cruzi* infected 60,0% of them. *T. sordida was* mainly found in extradomestic ecotopes where trypanosome infection rate reached 13,4%, but hatched eggs were found in a bed frame and a female *T. sordida* positive to *T. cruzi* was collected in a pigpen, indicating that domestic invasion of this species do occur. In other peridomestic premises, only signs (fecal streaks) of triatomines were found. Serological study of 50 local people (1-60 years old) living in dwellings infested or negative for *T. infestans* showed that 30,0% were seroreactive; most of their houses were closed to wild biotopes colonized by *T. sordida*. Results indicate that a) this is the first mention of the presence of *T. sordida* in the Department of Concepción and it enlarges its known distribution area; b) there is an active *T. infestans* mediated transmission of Chagas disease in this zone that yields important human prevalence and c) populations of *T. sordida* in wild biotopes not only sustain the wild *T. cruzi* cycle but represent an actual risk for people living in the area.
Index terms: *Triatoma infestans, Triatoma sordida,* infestation, infection, seroprevalence.

[3025] TRIATOMINES SPECIES (HEMIPTERA, REDUVIIDAE, TRIATOMINAE) AND *TRYPANOSOMA CRUZI* IN FRENCH GUYANA

C. Aznar[1], J.M. Bérenger[2], R. Garrouste[3], M. Hontebeyrie[4], B. Carme [1] & D. Pluot-Sigwalt[2], [1]Parasitologie and Mycologie,Equipe JE 21-88, UFR Medecine of Antilles-Guyane, Campus Saint-Denis, F-97336 Cayenne, French Guyana. [2] Laboratoire de Biologie et Evolution des Insectes, Ecole pratique des Hautes Etudes (EPHE), et Muséum National d'Histoire Naturelle (MNHN), 45 rue Buffon, F- 75005 Paris , France ; [3]Antenne de Guyane du MNHN, c/o IRD, BP165 F-97323 Cayenne, French Guyana. [4]Immunologie, Institut Pasteur, 28 rue du Dr Roux, F-75724 Paris cedex, France.

Chagas disease was first noted in French Guyana (FG) in 1940, although to date only 17 autochtonous cases have been reported. In contrast with such a low occurrence of human infection, there is a highly active primary cycle of *Trypanosoma cruzi* (*T. cruzi*) in wild populations of forest-dwelling marsupials. During the years 1980-1985, height species of Triatomines have been reported (with *Panstrongylus geniculatus* as the most important in sylvatic area) in all parts of French Guyana. Hight percentage were found to be infected with *T. cruzi*. Recent field works and natural history collection surveys (UFR Medecine, MNHN) where realized to study Reduviid diversity in French Guyana and to appreciate the percentage of infestation with *T. cruzi* in these different Triatomines species. In this previous works, the autors report : - 12 Triatomines species in 6 six genera (8 species known with addition of 4, including 2 *Rhodnius* sp.) - the results of preliminary study bases on polymerase chain reaction (PCR) amplification of a portion of the minicircle of kinetoplast DNA of *T. cruzi* in the samples of Triatomines feces. Among, the 46 fecal samples recovered from 34 *Panstrongylus geniculatus*, 3 *P. lignarus*, 3 *Eratyrus mucronatus*, 1 *Rhodnius sp.* and 5 entomophagous reduviids, 19 showed an amplified band of *T. cruzi* by PCR. Future works on Triatomines populations in FG will include seroprevalence studies on vertebrates (with molecular biology on *T.cruzi* populations) and population biology and ecology of vectors, associated to changes in land use and development.
Index terms: *Rhodnius, Panstrongylus ,Eratyrus,* PCR.

[3026] USE OF A GEOGRAPHICAL INFORMATION SYSTEM TO EVALUATE THE EFFICACY OF A LETHAL OVITRAP FOR THE CONTROL OF THE MOSQUITO VECTORS OF DENGUE IN THAILAND

R. Sithiprasasna[1], M.J. Perich[2], & R.E. Coleman[1], [1]Dept. of Entomology, U.S. Army Medical Component, Armed Forces Research Institute of Medical Sciences, 315/6 Rajvithi Road, Bangkok 10400, Thailand, E-Mail: ratanas@thai.amedd.army.mil; [2]Dept. of Entomology, Walter Reed Army Institute of Research, Walter Reed Army Medical Center, 503 Robert Grant Road, Forest Glen Annex, Silver Spring MD 20910

Geographical Information System (GIS) technology provides a sophisticated tool with which to conduct epidemiological studies on vector-borne diseases. GIS, with new advances in image processing and Global Positioning System (GPS) to georeference databases, can provide a powerful tool to efficiently store, retrieve and interpret data required for effective control of the mosquito vectors of dengue. Ovitraps have been extensively used as a method of sampling populations of dengue mosquito vectors, particularly *Aedes aegypti*. In this project, we modified a standard ovitrap by incorporating deltamethrin insecticide into the trap, resulting in a lethal ovitrap that could be used to control dengue vectors. The goals of this study were to 1) use GIS to evaluate the efficiency of lethal ovitrap in Ratchaburi Province, Thailand, and 2) determine whether the lethal ovitrap could suppress vector populations below a threshold needed to protect a core area. Field tests were conducted in 3 villages. Within each village we identified 2 blocks of 50 houses each that were separated by a minimum of 1 kilometer. One block of houses in each village was randomly selected to serve as the treated area, while the other block served as an untreated control. In the treated area, all 50 houses each received 10 lethal ovitraps. Thirty houses in the center of each block were selected as sample sites. By only sampling for mosquitoes within the center of the block we created a buffer zone that controlled the movement of mosquitoes from untreated areas into the control area. Ovitraps were monitored weekly. *Aedes* sps. abundance was monitored in treated and control areas by 1) counting the number of containers with water, 2) counting the number of containers with larvae or pupae, and 3) by collecting adult mosquitoes in the 30 sampling houses in each area using whole house aspiration. GPS instruments were used to create a detailed map of each of the 3 villages involved in this study. Differentially-processed GPS data with a spatial resolution of approximately 1-meter was incorporated into a GIS for analysis. Database information associated with the village GIS included village name, house number, number of containers with water, number of containers with larvae or pupae, and number adults mosquitoes collected in each house. The GIS was used to evaluate the degree of oviposition suppression that was necessary to impact adult mosquito biting populations.

[3027] VACCINE DELIVERY BY TRANSGENIC HAEMATOPHAGOUS INSECTS - A MODEL SYSTEM

S.L. Stowell[1], M. Karras[2], R.E. Sinden[2], J.M. Crampton[3], [1]Liverpool School of Tropical Medicine, Liverpool, UK. [2]Imperial College of Science, Technology and Medicine, London, UK. [3]University of Liverpool, School of Biological Sciences, Liverpool, UK

Vaccination programmes face a number of problems which must be overcome if sustainable delivery to the target human or animal population is to be achieved. Such problems include the stability and shelf-life of the vaccine, it's transport and storage and achieving repeated boosting of the population. We are interested in developing a novel passive system of vaccine delivery using transgenic haematophagous insects. These would express the vaccine encoding gene in their salivary glands and secrete the recombinant protein in their saliva so that it will be delivered to the host at the time a bloodmeal is taken. The model system we have chosen uses the *Ae. aegypti* mosquito and two candidate vaccine genes Pbs 21 and HBs. Pbs 21 is a sexual stage-specific antigen of the rodent malaria parasite *P. berghei*. The gene encoding this antigen has previously been expressed in cultured mosquito cells and salivary glands. Comparable studies using *D. melanogaster* have shown that transgenic flies which have the Pbs 21 gene stably incorporated into their genome secrete recombinant Pbs 21 in their saliva and this protein is immunogenic. HBs is a surface antigen expressed on the Hepatitis B virus which has also been expressed in cultured mosquito cells and salivary glands. We have constructed expression vectors for embryo microinjection in which the Pbs 21 and HBs encoding genes were placed under the control of an upstream region of the salivary gland-specific apyrase gene. This cassette was cloned within the invented terminal repeats of the *Mariner* transposable element, together with the *Drosophila cinnabar* eye colour marker gene. Results of experiments will be discussed.

Index terms: *Aedes aegypti*, mosquito, Genetic transformation

[3028]VARIABLE TIMING OF EGG HATCH AND ITS RELATION TO ANNUAL PRECIPITATION IN POPULATIONS OF *AEDES TRISERIATUS*

C. Vitek, J. Dennehy, S. Prager & T. Livdahl, Dept. of Biology, Clark Univ., Worcester, MA 01610, USA, E-mail tlivdahl@clarku.edu

The desiccation-resistant egg of *Aedes* mosquitoes might be credited for the genus' ability to occupy small larval habitats that are subject to drying, particularly in combination with the requirement by some eggs for more than one hatching stimulus. This asynchronous onset of larval development may constitute a form of "bet hedging" against the uncertainty of the larval habitat, by providing a reservoir of unhatched eggs among a female's offspring that will be less vulnerable to drought-induced mortality that larvae may experience. This hypothesis was tested by sampling 24 populations from a wide variety of precipitation in the Eastern USA. Using a collection of 30-year weather records from the USA National Weather Service, collecting sites within the range of the Eastern Treehole Mosquito, *Aedes triseriatus*, were selected according to the criteria of moderate annual average temperature (within 1 standard deviation of the Eastern USA. average, ranging between 10.3°C and 13.8°C) and maximum variation in mean annual precipitation, ranging from 81.9 to 207.6 $cm \cdot y^{-1}$). Oviposition traps were left at each location for 30 d, after which wood substrates were returned to the laboratory, where unhatched eggs received a sequence of nine weekly hatch stimuli (nutrient broth). For each egg batch, a probability of hatching was estimated by fitting the hatch fractions to an exponential hatch model, which assumes a constant hatch probability for each successive hatch stimulus. The hatch probability estimate for each batch, obtained through nonlinear fits, showed a highly significant positive association with precipitation, suggesting that lower hatching fractions may have been favored in more drought-prone habitats. However, precipitation accounts for only a small fraction of the variation in hatch probability, suggesting that this trait is subject to other environmental and evolutionary factors. Future hatching studies may benefit from the practical observation that the fraction hatching on the first stimulus accounted for more than 97% of the variation in estimates of hatch probability across all stimuli. Thus, long series of stimuli may not be necessary for some types of population comparisons of egg hatch rate.

Index terms: *Aedes triseriatus*, egg hatch, life-history evolution.

[3029] VECTOR-*TRYPANOSOMA CRUZI* RELATIONSHIP: CHANGES IN THE HEMOLYMPHATIC PROTEIN COMPOSITION OF *DIPETALOGASTER MAXIMUS* AFTER EXPERIMENTAL INFECTION

R.C. Cano[1], M.B. Marcato[1], L.E. Canavoso[2], M.A. Wells[2] & E.R. Rubiolo[1,2], [1] Depto d Bioquímica Clínica. Fac. de Ciencias Químicas. Univ. Nac. de Córdoba. CP 5000. Córdoba Argentina. E-mail: rcano@bioclin.fcq.unc.edu.ar; [2] Dept of Biochemistry and Center fc Insect Science. Univ. of Arizona, Tucson, AZ 85721-0088, USA. This work was supporte by a grant nº 163/99 from SECyT. UNC. Argentina.

Chagas´disease is a serious public health problem in Latin American countries. Different species of vectors (Hemiptera:Reduviidae) are responsible for the most important way of transmission of *T. cruzi* to the mammalians. Despite its epidemiological relevance, the biochemical aspects that regulate the ability of the vector to transmit the parasite are scarcely known. Our purpose was to contribute to a better understanding of the factors that may influence on the vector-parasite relationship, which could be useful to explain why the parasite is maintained for life in the insect gut. We studied the changes in the hemolymph proteins of *D. maximus* (fourth instar) after an infective blood meal with Tulahuen strain, on inbred BALB/c mice. A group of control insects, was fed on uninfected mice. Hemolymph was collected at day 16 after feeding, from both infected and control insects, in presence of D-L dithiothreitol and protease inhibitors. Hemolymph and the three fractions obtained by gel filtration chromatography (FI, FII and FIII) were subjected to native and denaturing gel electrophoresis. FI and FII were subjected to an additional fractionation by precipitation with polyethyleneglycol 6000. Qualitative and quantitative changes were found in the hemolymph proteins between the infected and control insects. The most significant changes were observed in FII from plasma of the infected insects that showed a diminution in a catodic band, and the appearance of two anodic proteins, one of 15 kD and the other, of molar weight lower than 15 kD. By denaturing and reducing electrophoresis, the catodic band in FII showed a multimeric structure. The FII from plasma of the infected insects was electroblotted to a PVDF membrane and the aminoacidic composition of the 15 kD protein was determined, revealing that glutamic acid and glycine, were the most abundant whereas isoleucine and tyrosine were the less abundant aminoacids. The results herein reported, revealed that experimental infection of *D. maximus* by natural route with *T. cruzi* induces: I- a diminution in a catodic protein, which may be indicating a higher metabolic demand of the infected insects and, II- the appearance of two anodic proteins of low molar weight. It is possible that these proteins may be synthesized in response to the gut colonization for the parasite.

Index terms: Chagas´disease, *Dipetalogaster maximus*, *Trypanosoma cruzi*, proteins, hemolymph.

[3030] OOGENESIS IN SCALE INSECTS (HEMIPTERA, COCCINEA)

T. Szklarzewicz, Dept. of Systematic Zoology, Inst. of Zoology, Jagiellonian Univ., R. Ingardena 6, PL-30060 Kraków, Poland, E-mail szkla@zuk.iz.uj.edu.pl.

Developing ovaries of scale insects are spindle-shaped and contain numerous cystocyte clusters that originate as a result of consecutive divisions of single stem cells. Since the divisions are incomplete, cystocytes in clusters are connected by intercellular bridges. Within the cluster, cystocytes are arranged into a rosette, a centre of which is occupied by a polyfusome. Staining with rhodamine-phalloidin revealed that polyfusomes of scale insects contain F-actin filaments. The number of cystocytes in clusters is family specific and amounts: 15-58 in Ortheziidae, 12-19 in Margarodidae, 8-20 in Kermesidae, 8 in Pseudococcidae, 4-11 in Eriococcidae, 4 in Cryptococcidae, Coccidae, and Diaspididae. During the last larval instar the clusters of cystocytes grow out of the ovary and ovarioles are formed. Simultaneously, the cystocytes residing within the ovarioles differentiate into oocytes and trophocytes (nurse cells) and polyfusomes vanish. The number of ovarioles is species specific (*e.g.*, 20-30 in *Orthezia urticae*, about 300 in *Porphyrophora polonica*, about 200 in *Gossyparia spuria*). The ovarioles are devoid of terminal filaments. During the larval-adult transformation the tropharium (trophic chamber), vitellarium, trophic core, and nutritive cords are formed. Tropharia of adult females of primitive families (Ortheziidae, Margarodidae) and some advanced (Kermesidae, Eriococcidae) consist of trophocytes and arrested oocytes, whereas those of advanced ones (Pseudococcidae, Cryptococcidae, Coccidae, Diaspididae) of trophocytes only. In families Ortheziidae and Margarodidae arrested oocytes are capable of further development. In the vitellarium at the given moment only one oocyte develops. Both trophocytes and oocytes are connected to the trophic core: oocytes by nutritive cords, trophocytes by cytoplasmic projections. Common characters of scale insect ovaries such as: the lack of terminal filament (1), the existence of only one developing oocyte in the vitellarium (2), the same mechanism of ovariole development (3), seem to confirm the concept of a monophyletic origin of scale insects. It may be also concluded that during the anagenesis of scale insect ovaries, a gradual reduction in the number of germ cells in clusters took place, from 58 in Ortheziidae to 4 in the most specialized families.

Index terms: anagenesis, cystocyte, oocyte, ovariole, trophocyte.

[3031] OVARIAN DIFFERENTIATION IN THE WORKER OF *APIS MELLIFERA* (HYMENOPTERA, APIDAE)

C. Cruz-Landim & R. D. Reginato, Depto. de Biologia, Instituto de Biociências de Rio Claro (Unesp). P.O. Box 199, 13506-900, Rio Claro, SP, Brazil. E-mail: cclandim@rc.unesp.br

The female caste in *Apis mellifera* is trophically determined. To larvae which are to be raised as workers are fed a mixture of royal jelly, polen and honey in variable percentages according to the larva's age, while the queen larvae are fed only with royal jelly. This differential nutrition leds to the development of the castes dimorphic characteristics, among which the number of the ovarioles in the ovary is the most prominent. The ovary primordium appears in the 50-58 hr embryo as a mass of mesodermal cells compactly arranged, dorsal to the mesenteron. In the newly hatched larva it consists of two elongate masses of cells surrounded by an irregular layer of epithelial-like, flattened cells, dorsal to midgut. The development of individual ovarioles begins in the 3rd larval instar from the outer to the inner ovarian surface. Individualization occurs by inward penetration of envelope flat cells, delimitating strings of round mesodermal cells. At this stage queen and worker larvae have similar ovaries, but with the commencement of differential feeding some worker ovarioles begin involution. Cell death was observed by Feulgen staining, dye exclusion and acid phosphatase reaction. The results show that the involution of worker ovaries begins in the 3rd larval instar, proceeds until the pupae, and affects several ovarian components. In the 3rd instar some of the larger inner cells in the developing ovariole die and therefore, the ovariole failed to continue differentiation. Later during 4th and 5th instar cellular death was observed within the ovarioles in both the germinative and somatic cells disrupting the affected ovariole. Some of the remaining cells of the disrupted ovariole become filled with glycogen and are incorporated to the ovary stroma. In pre-pupae and pupae even the stromatic cells desintegrate. Dying cells from the early larvae ovariole show fragmented nuclei, exclude dyes and have morphological features of apoptotic cells. Some of their components also react to acid phosphatase. The somatic and stromatic cells, first become filled with glycogen and later with lipids before being desintegrated by citoplasmic disruption. Cellular death occurring in early 3rd instar larvae impairs the development of some ovarioles, cell death that occurs during the 4th and 5th stage eliminates some of the already differentiated ovarioles and during the pre-pupae and pupae modelates the ovary by eliminating most of the stromatic cells among remaining ovarioles. Therefore the differences between the queen and worker ovaries in honey bees are established by death in specific cells along the differentiation.

Index terms: bee, castes, ovary, differentiation, cell death

[3032] A HIGH JUVENILE HORMONE TITER IS REQUIRED FOR ORGANIZING THE ACTIN CYTOSKELETON AND PREVENTING CELL DEATH IN LARVAL OVARIES OF THE HONEY BEE, *APIS MELLIFERA*

I.C. Schmidt Capella[1] & K. Hartfelder[2], [1]Zoologisches Institut, Universität Tübingen, D-72076 Tübingen, Germany; [2]Depto. Biologia, FFCLRP, Universidade de São Paulo, Av. Bandeirantes 3900, 14040-901 Ribeirão Preto, SP, Brazil, E-mail: khartfel@rgm.fmrp.usp.br. Financial support by the DFG,, FAPES, a doctoral felloship from CAPES to ICSC, and a CAPES/DAAD visiting professor fellowship to KH.

Reproductive division of labor in most of the highly eusocial insects depends on caste-specific differentation of the reproductive system during preimaginal development. In the honey bee, *Apis mellifera*, these processes initiate during the late larval stages under the control of juvenile hormone (JH). Germ cell clusters with a central fusome are an early marker for stabilized ovariole development in queens, whereas in workers most ovarioles start to exhibit signs of programmed cell death. Since fusome fomation involves a precise organization of the cytoskeleton we analyzed the localization of actin filaments and their interaction with spectrin by TRITC-phalloidin and anti-spectrin-FITC labeling, respectively. The cytoskeleton of queen and worker ovaries turned out to be quite similar during the fourth larval instar, with each ovariole exhibiting one or two small fusomes composed of spectrin and actin. The germ cells themselves showed a typical peripheral actin cytoskeleton. Caste differences became apparent after the molt to the fifth instar. In queen larvae, the number and size of the fusomes started to increase, always showing a tight integration of spectrin with actin rings, the precursors of the future ring canals. In worker larva, the actin cytoskeleton of the germ cells apparently disintegrated. This was marked by the occurrence of strongly labeled diffuse actin deposits in these cells, and a separation of fusomal actin from spectrin, while spectrin maintained its fusomal localization. When investigating the effects of JH applications to fourth instar worker larvae on the organization of the ovarian cytoskeleton during the subsequent critical stages of caste development we noted that the beginning dissociation of actin from spectrin was reverted, and the structural organization of actin in the germ cells was apparently rescued. We interprete the disorganization of the actin cytoskeleton as a result of the low JH titer in early-fifth-instar worker larvae and as an initial step towards programmed cell death. To reveal the dynamics of programmed cell death we used a TUNEL assay. The first cells exhibiting this marker were detected in the germ cell region of ovaries from late-feeding-stage worker larvae. In ovaries of queens and JH-treated workers, apoptotic nuclei were only rarely noted, indicating that the high JH titer in queen larvae prevents degeneration of primordial germ cells.

Index terms: *Apis mellifera,* juvenile hormone, caste polymorphism, ovary, cytoskeleton

[3033] OOCYTE DIFFERENTIATION AND MEIOSIS INITIATION IN *RHYNCHOSCIARA AMERICANA*: DECISION MAKING IN A TWO CELL MEROISTIC SYSTEM

G. M.Machado-Santelli[1] and R. V. Santelli[2], [1] Departamento de Histologia e Embriologia, Instituto de Ciências Biomédicas, Universidade de São Paulo, Av. Prof. Lineu Prestes, 1524, 05508-900, São Paulo, SP, Brazil. (gmmsante@usp.br) and [2]Departamento de Bioquímica, Instituto de Química, Universidade de São Paulo. Acknowledgements: financial support by CNPq and, FAPESP.

The *Rhynchosciara americana* ovary development provides an interesting opportunity to study a different model of insect oogenesis. The ovarian follicle has a single nurse cell per oocyte, surrounded by follicular cells. This system offers some advantages in the study of the relationship between those cells, in issues like nurse cell-oocyte transport, organelle distribution and developmentally programmed chromosome changes through polyploidy and polyteny. The last mitotic division of undifferentiated germ cells occurs early in larval life of *R. americana*. Each oogonia gives rise to two cells, with different fates: the oocyte and the nurse cell. The oocyte will be arrested in meiosis while the nurse cell will undergo polyploidy/polyteny processes. The DNA ploidy of nurse cells reaches at least 300C. The ovary starts to grow considerably during the stage of DNA puffs formation in salivary gland chromosomes, and enlargment progresses throughout pupation. The meiotic oocyte chromosomes are very long in the late larval stage and seem to become shorter in later stages. Their morphology was analyzed by 3D-reconstruction from optical sections obtained with laser scanning confocal microscopy. They showed typical zygotene figures, being synchronous in all analyzed follicles. For the first time in *Rhynchosciara* it was observed that nurse cell and oocyte cytoplasms are interconnected by a ring canal. Transmission electron microscopy preparations showed that both cell nuclei present very pronounced invaginations facing the ring canal. Especilly in that region the nuclear envelope of the nurse cell is rich in pores. TRITC-phalloidin plus sytox green stained ovary preparations showed normal actin distribution in follicle cells and visualized the ring canal region as an actin-containing structure. It is possible that the synchrony observed in the overall aspects of ovary development is the consequence of a previous, also synchronous, burst of oogonia divisions.

Index terms :oogenesis, Diptera, ring canal, actin , confocal microscopy

[3034] THE OVARY STRUCTURE AND OOGENESIS IN NEUROPTEROID ORDERS

J. Kubrakiewicz, Zoological Inst., Univ. of Wroc law, 50-335 Wroc law, Sienkiewicza 21, Poland, e-mail: jkubrak@biol.uni.wroc.pl

Three different ovariole types have been described in the Neuropteroidea (Neuroptera, Raphidioptera and Megaloptera). Neuropteran ovarioles are polytrophic, those of the Raphidioptera and Megaloptera: Sialidae - telotrophic, whereas those of the Megaloptera: Corydalidae and Chauliodidae are panoistic (for the description of the latter see the **contribution by Biliński et al.: The ovaries of chauliodids, as those of corydalids, are** panoistic (secondary panoistic).). Neuropteran ovaries exhibit deviations from the basic polytrophic pattern. Asynchronous divisions of germ cells result in a variable and unfixed number of cystocytes per cluster. In contrast to the typically branched system, spatial organization of the cystocyte connections in neuropteran egg chambers is almost linear. Comparative analysis of ovary structure and germ cell activity showed several structural and functional differences between the coniopterygids and all the remaining neuropterans. Discrepancies observed consist in the diversification of germ cells within clusters, oocyte nucleus activity, rate of previtellogenic growth and organization of follicular epithelium. The results of comparative histochemical and ultrastructural studies indicate that among extant neuropterans at least two phylogenetic lineages can be distinguished: one represented by the coniopterygids and the other including all the remaining neuropteran families. Coniopterygids retained several plesiomorphic characters and thus seem to constitute an early off-shoot of the main neuropteran lineage. Ovarioles of Raphidioptera and Megaloptera: Sialidae represent a distinct type of telotrophic organization. The centre of the tropharium is filled with multinuclear syncytium, while its cortex is formed by one cell thick layer of trophocytes (referred to as tapetum cells). Early previtellogenic oocytes differentiate in the basal zone of the tropharium. Throughout oogenesis both the tapetum cells and the oocytes remain connected with the central syncytium by means of intercellular bridges. During previtellogensis the anterior regions of the oocytes become extended to form long cytoplasmic projections termed trophic (nutritive) cords. The occurrence of three distinct types of ovary organization in related neuropteroid taxa was considered within the phylogenetic context. The contemporary data seem to favour the hypothesis assuming an independent origin of neopanoism and telotrophy from the polytrophic background and a separate position of the Neuroptera.

Index terms: polytrophy, telotrophy, neopanoism, germ cell clusters, phylogeny

[3035] OOGENESIS IN COLEOPTERA AND NEUROPTERIDA: COMMON ROOTS

J. Buening, Inst. of Zoology, Univ. of Erlangen-Nuremberg, Staudtstr. 5, D-91058 Erlangen, Germany, E-mail jbuening@biologie.uni-erlangen.de.

During the recent 10 years we have learned that a set of genes is necessary to build the ovary of *Drosophila*: There are intrinsic genes in germ cells, working autonomously, as well as extrinsic genes whose activities are necessary for communication between germ cells and somatic cells. In most taxa of Holometabola, the females have polytrophic meroistic ovaries. This strongly suggests a common origin (Büning: The Insect Ovary, Chapman & Hall, London, 1994). Few taxa are panositic, a type that is assumed to be a reduction of the basic polytrophic meroistic ovary. In addition, two entirely different types of telotrophic meroistic ovaries are described, one is the Sialis-type, found in two sister taxa: the Megaloptera: Sialidae and the Raphidioptera. The second type of telotrophic ovary occurs in all families of Coleoptera: Polyphaga. However, the Coleoptera: Adephaga have polytrophic meroistic ovaries. Two additional, but small taxa complete the Coleoptera: the Archostemata and the Myxophaga. Only recently I have analysed the ovary structures of five species, *Cupes capitatus* (Archostemata), *Microsporus* sp., *Torridincula rhodesica*, *Delevea namibiensis*, and *Hydroscapha natans*; the last four belonging to the taxon Coleoptera: Myxophaga. Four of them (*C. capitatus* and *Microsporus* sp., *T. rhodesica*, *D. namibiensis*) are panoistic with clearly different family characteristics. One species, *H. natans*, surprisingly had a telotrophic meroistic ovary of the *Sialis*-type! Taking together these results, I prefer the following phylogenetic cladogram: Among foremothers of Coleoptera and Neuropterida the telotrophic meroistic ovary of the Sialis-type developed from foremothers in wich polytrophic meroistic ovaries of the basic type existed. A reduction to this polytrophic ovary occurred in those lines from which todays Neuroptera, as well as the Coleoptera: Adephaga and Coleoptera: Archostemata: Micromalthidae derived. Further reductions to panoistic ovaries happened among foremothers of Megaloptera: Corydalidae, as well as at the base of Coleoptera: Archostemata: Cupedidae, and among foremothers of Coleoptera: Myxophaga: Microsporidae and, in parallel, in those of Coleoptera: Myxophaga: Torridinculidae. The telotrophic ovary of Coleoptera: Polyphaga developed from the *Sialis*-type ovary by dramatic changes in cluster formation of germ cells. However, during the period in which telotrophic meroistic ovaries existed at the common base of Neuropterida and Coleoptera, the set of genes necessary to build a polytrophic ovary, must have been preserved silently for long evolutionary periods.

Index terms: ovary , phylogeny, insect, development

[3036] THE OVARY STRUCTURE AND OOGENESIS IN MECOPTERANS

B. Simiczyjew[1], J. Büning[2] & S. M. Bilinski[3], [1] Zoological Inst., Univ. of Wroc law, Sienkiewicza 21, 50-335 Wroc law, Poland, E-mail simicz@biol.uni.wroc.pl; [2]Inst. of Zoology, Univ. of Erlangen, Staudtstätstrasse 5, Erlangen D-91058, Germany; [3]Inst. of Zoology, Jagiellonian Univ., Ingardena 6, 30-060 Kraków, Poland.

Two different types of ovaries have been described in mecopterans. In panorpids, panorpodids, bittacids and meropeids the ovaries are of the polytrophic-meroistic type, while in boreids they are panoistic. Polytrophic ovaries of Mecoptera are composed of several ovarioles that are differentiated into terminal filament, germarium, vitellarium and ovariole pedicel. In the germaria the differentiation of the germ cell clusters takes place. Each cluster arises as a result of 2 consecutive mitoses of a cystoblast and consists of 4 sibling cells. The vitellaria contain growing egg chambers. Each egg chamber comprises an oocyte and three nurse cells surrounded by follicular epithelium. In all studied species the nurse cells are voluminous, polyploid and contain polymorphic nuclei. These cells are highly active in producing macromolecules (RNAs) that are transported via intercellular bridges to the oocyte. The oocyte is inactive in RNA synthesis. Its nucleus is transparent and contains chromosomes condensed into a karyosphere. In representatives of Boreidae the ovarioles are built of terminal filaments, vitellaria and ovariole pedicels only; in adult females germaria are absent. The vitellaria contain 10-14 oocytes surrounded by follicular cells. In the large oocyte nuclei the amplification of rDNA takes place. The resulting nucleolar masses undergo fragmentation into multiple polymorphic nucleoli. The presented data are discussed in phylogenetic context. We postulate that Panorpidae, Panorpodidae, Bittacidae and Meropeidae represent a common evolutionary lineage, while Boreidae should be classified into a separate suborder. Our data suggest also a close relationship between boreids and fleas.

Index terms: polytrophic ovaries, panoistic ovaries, amplification, phylogeny.

[3037] OVARIAN FOLLICE DIFERENTIATION IN INSECT OVARIOLES

H. Lin

ABSTRACT NOT RECEIVED

[3038] THE SELF-RENEWING MECHANISM OF GERMILINE STEM CELLS IN DIVERSE ORGANISMS

D. Godt

ABSTRACT NOT RECEIVED

[3039] REGULATION OF OVARIAN MORPHOGENESIS IN *DROSOPHILA*

D. Godt[1], M. Li[1], R. Avancini[2] & U. Tepass [1], 1) Dept. of Zoology, University of Toronto, 25 Harbord St, Toronto, ON M5S3G5, Canada. 2) Dept. of Parasitology, I.B., P.O.Box 6109,UNICAMP, 13083-930 Campinas, Brazil.

The development of organs in multicellular organisms requires the differentiation of distinct cell types and their arrangement into a regular and reproducible spatial pattern. We use the *Drosophila* ovary as a model system to study the genetic regulation of morphogenetic processes during organogenesis. Here, we describe the action of genes that control/mediate interactions between germ cells and somatic cells, which determine the spatial relationship of cells in the ovary, and are critical for normal gonad development and gametogenesis. (1) A regulator of ovarian morphogenesis that we have identified is the gene *traffic jam* (*tj*). It encodes a nuclear protein that belongs to the evolutionary conserved family of large Maf (musculo-aponeurotic fibrosarcoma) factors, a subfamily of basic-leucine zipper transcription factors. Other members of this family are the *v-maf* oncogene and the vertebrate *mafB/kreisler* gene. *tj* is not involved in cell fate decisions but instead controls the behavior of somatic cells in the ovary. Throughout development *tj* is expressed in the gonads, and here specifically in those somatic cells that contact the germ cells. In wild-type larval gonads, the interstitial cells intermingle with the female primordial germ cells, and the cyst cells ensheath individual male germ cell cysts. In *tj* mutants, the normal contact between the somatic cells and the germ cells is disrupted, resulting in segregated cell populations. The arrangement of these two cell populations in *tj* mutants is reminiscent of classic cell sorting phenotypes as the somatic cells form a cell layer that surrounds a large ball of non-differentiating germ cells. These data suggest that the severe disruption of gonad morphogenesis/ gametogenesis in *tj* mutants is caused by defects in the adhesive interactions between soma and germline. (2) We study the role of cell-cell-adhesion receptors of the cadherin superfamily in morphogenesis. Analysis of *D*E-cadherin function in oogenesis suggests that this homophilic adhesion molecule can promote cell sorting and cell migration by mediating adhesive interactions between germ cells and follicle cells. One example is the correct localization of the oocyte in a follicle. In a *Drosophila* follicle the oocyte always occupies a posterior position among a group of sixteen germline cells, a cell arrangement that is crucial for the subsequent formation of the anterior-posterior axis of the embryo. Our analysis indicates that the posterior localization of the oocyte depends on a cell-sorting process that is based on differential adhesion between germline and follicle cells. Differences in the concentration of *D*E-cadherin allow the oocyte to attach specifically to the posterior most follicle cells, thereby assuring its posterior position. *Drosophila melanogaster*, oogenesis, gonadogenesis, germline-soma interaction.

[3040] GERM LINE AND SOMA DIFFERENTIATION IN *BGCN* MUTANT *DROSOPHILA* OVARIES

R. Rübsam[1], R. Cordes[2] & J. Büning[1], [1]Developmental Biology Unit, Inst. of Zoology, Univ of Erlangen, Staudtstr.5, 91058 Erlangen, Germany. E-mail: rruebsam@biologie.uni erlangen.de. [2]present address: MH Hannover, Carl Neuberg Str.1, 30625 Hannover, Germany.

Mutations in the *Drosophila benign gonial cell neoplasm (bgcn)* gene were shown to interfer with germ cell differentiation in both sexes (Gateff (1982) in: *Embryonic Development* (eds M.M. Burger, R. Weber), A.R. Liss: 621-632). We have analyzed cell differentiation in ovarie mutant for three different *bgcn* alleles: $bgcn^1$, $bgcn^{OW34}$ and $bgcn^{052}$. In each allele, germ cel development is arrested at an early stage. Cells, however, continuously undergo mitosis unti they finally degenerate. In contrast to male *bgcn* mutant germ cells which still divide i synchronous groups (Gönczy *et al.*, *Development* 124, 4361-4371; own observations), th majority of female germ cells behave like individual cells. From studying germ cell divisio pattern using the BrdU incorporation technique and immunofluorescent labelling of the mitoti antigen phospho-histone H3 we infer that mitotic synchrony of germ cells is only a rar exception. By electron microscopic examination of ultrathin serial sections of *bgcn* mutan ovaries we learned that cluster formation takes place on a small scale only. Consistent with thes findings, branched polyfusomes are very rare; anti-α-spectrin and anti-hts staining label fusome with dot-or dumbbell-like appearance. Ring canal rims accumulate phosphotyrosine-containin antigens but no F-actin. The *bgcn* mutation also alters the expression pattern of Sex-letha protein: whereas in wild type germaria Sxl protein is drastically downregulated in mitoticall dividing cysts, cytoplasmic Sxl staining remains on high levels in *bgcn* mutant germ cells. Or protein, in wild type cysts first detectable after completion of mitotic divisions, is not expresse in *bgcn* mutant germ cells. Taken together we conclude that germ cell differentiation in *bgc* mutant ovaries is arrested at the onset or even prior to cystocyte cluster formation. Though gerr cells fail to exceed early stages of differentiation, somatic follicle cells follow a surprisingl autonomous developmental program. Follicle formation is impeded to a different extent in eac of the three alleles. In $bgcn^{OW34}$ and especially in $bgcn^{052}$ follicle cells succeed in pinching of small populations of germ cells thereby forming individual follicles. In $bgcn^1$ there is formed single sac, enveloped by somatic cells which establish epithelial polarity only within smal patches of the layer. Epithelial follicle cells in $bgcn^{OW34}$ and $bgcn^{052}$ build up a complet chorion, consisting of vitelline membrane, wax layer, endo- and exochorion. In $bgcn^1$ follicl cells end up with secreting vitelline membrane material. Expression patterns of several differer enhancer trap lines helped us in identifying well-known follicle cell populations like stalk cell and centripetal follicle cells in *bgcn* mutant ovaries.

[3041] FEMALE STERILE MUTATIONS AND EGG CHAMBER DEVELOPMENT IN *DROSOPHILA MELANOGASTER*

S. Gigliotti, A. Manzi, F. Graziani & C. Malva, International Inst of Genetics and Biophysics, C.N.R., via Marconi 10, 80125 Naples, Italy, E-mail: malva@iigbna.iigb.na.cnr.it.

Drosophila oogenesis provides an excellent opportunity to learn the importance of multiple signalling pathways in the regulation of cellular morphogenesis. The oocyte is a member of a 16-sister-cell cluster, the other 15 functioning as nurse cells. Each germline cyst acquires a monolayer of follicle cells and buds from the germarium as a new egg chamber. Reciprocal cross-talks between oocyte and follicle cells mediate the different processes required for egg chamber development. The first visible asymmetry in the egg chamber is positioning of the oocyte posteriorly in the cyst and this early event plays a key role in the establishment of both major body axes. In our laboratory mutations affecting oocyte determination and positioning within the cyst have been identified as well as new genes involved in cyst formation, nurse cell chromosome structure and egg maturation. Among them we have characterized the first mutants in a *Drosophila* homolog of known nucleoporins, the *NUP154* gene. The *NUP154* gene is expressed in all developmental stages but maximal RNA levels are detected in ovaries and early embryos. The characterization of the mutant ovarian phenotype has revealed a major block in early vitellogenic stages, where defects in nurse cell chromatin organization are evident. A number of additional abnormalities such as oocyte displacement, alterations in nurse cell nuclei number and/or distribution, incomplete dumping and defective follicle cell migration processes are also observed in mutant egg chambers. The role of *NUP 154* and of the other genes under study in the early events of oogenesis will be discussed in relation to the ovarian phenotypes induced by their mutations and the kind of proteins produced.

Index terms: oogenesis, cell-cell interaction, nucleoporins

[3042] STAGE SPECIFIC APOPTOTIC PATTERNS DURING *Drosophila* OOGENESIS

I. P. Nezis[a], D. J. Stravopodis[a], L Papassideri[a], M. Robert-Nicoud[b] and L. H. Margaritis[a], [a]Fac. of Biol., Dep.of Cell Biol. & Biophysics, Univ. of Athens, Panepistimopolis, Kouponia, Athens, GR-15784, Greece, e-mail: lmargar@cc.uoa.gr. [b]DyOGen, INSERM U309, Institute Albert Bonniot, Joseph Fourier University, Grenoble, France. This work was supported by a TMR grant N° ERB4061PL970047 to Prof. L.H. Margaritis.

In the present study we demonstrate the existence of two apoptotic patterns in *Drosophila* nurse cells during oogenesis. One is developmentally regulated and normally occurs at stage 12 and the other is stage specific and is sporadically observed at stages 7 and 8 of abnormally developed follicles. The apoptotic manifestation of the first pattern begins at stage 11 and is marked by a perinuclear rearrangement of actin cytoskeleton and the development of extensive lobes and engulfments of the proximal to the oocyte nurse cell nuclei. Consequently, at the late stage 12 (12C), half of the nuclei exhibit condensed chromatin, while at the late stage 13 all the nuclei have fragmented DNA, as it is clearly shown by TUNEL assay. Finally, the apoptotic vesicles that are formed during stage 13, are phagocytosed by the neighboring follicle cells and at stage 14 the nurse cell nuclear remnants can be easily detected within the adjacent follicle cell phagosomes. In the second sporadic apoptotic pattern, all the nurse cell nuclei are highly condensed with fragmented DNA, accompanied by completely disorganised actin cytoskeleton. When we induced apoptosis in *Drosophila* follicles through an etoposide and staurosporine *in vitro* treatment, we observed a similar pattern of stage specific cell death at stages 7 and 8. These observations suggest a possible protective mechanism throughout *Drosophila* oogenesis that results in apoptosis of abnormal, damaged or spontaneously mutated follicles before they reach maturity.

Index terms: apoptosis, Drosophila, etoposide, staurosporine, oogenesis

[3043] DEVELOPMENTAL RESTRICTIONS AND UNUSUAL MECHANISMS IN THE EMBRYOGENESIS OF THE FRUIT FLY *ANASTREPHA*

D. Selivon & A. L. P. Perondini, Dept.de Biologia, Univ.de São Paulo, C.P.11461, São Paulo, SP, 05422-970, Brasil. E-mail dselivon@usp.br; alpperon@usp.br.

Embryos of 7 species of the fruit flies of genus *Anastrepha* show an unusual phenomenon of facultative yolk masses extrusion by their tips. Evidences indicate that this is a regular process and not an occasional random event, although the controlling mechanism is still unknown. Two other genus of fruit flies, *Ceratitis* and *Bactrocera* do not present the yolk extrusion. The eggs of *Anastrepha* show an intraspecific variability in length which is still larger among the species. An "in vivo" analysis of the embryos of *A. fraterculus* showed: (1) egg-cell retraction during intravitelline cleavage stages is positively correlated to egg length; (2) cellular blastoderm does not cover the entire length of the embryos leaving an area at the posterior tip with a disorganized cellular arrangement; (3) the size of this area is variable being correlated to egg length, the longer the egg, the larger this area; (4) cephalic furrow forms at a fixed position from the anterior tip regardless the length of the egg-cell; (5) in small eggs germ band extends by the posterior tip of the embryo while in larger ones it "enters" at some distance from the tip causing separation and extrusion of the posterior portion of the embryo; (6) hence, the extruded masses show different size which is positively correlated to the size of the egg; (7) the final length of the embryo corresponds to the length of the egg-cell after full retraction minus the diameter of the extruded yolk masses. As a consequence, the germ band of embryos derived from eggs of very different size present nonetheless a very similar length. Analysis of other 6 species of *Anastrepha* show that for each one, the same relationships between egg length, extruded yolk and length of the germ band were observed. Comparisons among the species showed that the germ band of all seven species show only a sligth variation in length, although their eggs may vary considerably, from about 1 mm in *A. sororcula* to 2 mm in *A. grandis*. Embryos of *Ceratitis capitata* and *Bactrocera carambolae*, species which do not extrude yolk masses, present a length that is almost equivalent to the size of the eggs. Additionaly, the size of these embryos are similar to those of the seven *Anastrepha* species. In conclusion, the data suggest that although there is an extraordinary variation in egg length (possibly related to different life strategies of the fruit flies species), the extrusion of yolk masses seems be a by-product of the restrictive determining processes of segmentation exhibited by higher diptera which involve a narrow variation in the number of blastodermic cells during the initial steps of determination.

Index terms: blastoderm, germ band, segmentation, *Ceratitis, Bactrocera*

[3044] HORMONES/NEUROHORMONES-INVOLVEMENT IN HOST/PARASITE RELATIONSHIPS IN THE TOBACCO HORNWORM, *MANDUCA SEXTA*

D. B. Gelman & N. A. Beckage, Insect Biocontrol Lab, U.S. Dept. of Agric., Bldg. 306, Rm. 322, BARC East, Beltsville, MD 20705 USA & Dept. of Entomol., Univ. of California, Riverside, CA 92521 USA.

Numerous and intricate host-parasite interactions are responsible for the successful development of insect parasitoids and the accompanying developmental arrest/demise of the host insect. Manipulation of host biochemistry, endocrinology, neurobiology and immunology including dramatic alterations in concentrations of hormones and neurohormones by insect endo and ectoparasitoids are the rule rather than the exception. *Cotesia congregata* (Hymenoptera: Braconidae) is a gregarious endoparasitoid which oviposits in young *M. sexta* (Lepidoptera: Sphingidae) larvae. Eggs hatch, but the parasitoids remain as 1st instars until the host becomes a last instar, at which time the parasitoids molt to the 2nd instar. Several days later parasitoid larvae concomitantly molt to the 3rd instar and emerge from the host. Parasitoid pupation occurs shortly thereafter. The last instar host ceases to feed and neither wanders nor pupates. Juvenile hormone levels are abnormally high, and although a small hemolymph ecdysteroid peak is detected, neither a wandering nor a premolt ecdysteroid peak is observed. Thus, the host is arrested. Interestingly, based on ligation studies and prothoracic gland activity bioassays, it appears that the parasitoid interferes with host stimulatory and inhibitory mechanisms responsible for regulating host hemolymph ecdysteroid levels. In addition, immuno- histochemical studies indicate that the cerebral neurosecretory cells, neurohemal organs and gut endocrine cells of host last instars contain considerably more neuropeptide than do those of unparasitized larvae, suggesting that the release of regulatory neuropeptides is inhibited.

Index terms: *Cotesia congregata,* ecdysteroids, JH, peptides, FMRFamide, PTTH

[3045] ULTRASTRUCTURAL ANALYSIS OF NEUROSECRETORY CELLS IN THE ANTENNAE OF THE MOSQUITO, *CULEX SALINARIUS* (DIPTERA: CULICIDAE).

S. M. MEOLA[1], H. S.-BHATKAR[2] & M. W. PENDLETON[1].
[1]S. Plains Agric. Res. Center, Agric. Res. Service, U. S. Dept. of Agric., 2881 F & B Rd., College Station, TX 77845, USA, E-mail: smeola@acs.tamu.edu; [2]Electron Microscopy Center, Texas A & M Univ., College Station, TX 77843, USA.

An antiserum raised against the peptide, culetachykinin II isolated from the mosquito, *Culex salinarius,* revealed a group of neurosecretory cells in the first flagellar segment of the antennae of both male and female mosquitoes of this species. Processes of these neurosecretory cells extend to specific glomeruli of the antennal lobe where they form neurotransmitter synapses with the interneurons of the antennal lobe. Ultrastructural analysis revealed that these cells contain relatively small (140-220 nm) electron dense elementary neurosecretory granules. This is the first insect species in which neurosecretory cells are found in the flagellae of the antenna, revealing the close interrelationship of the neuroendocrine system with the olfactory sensory system in mosquitoes.

Index terms: sensory neurons, neurohormones, peptide, tachykinin.

[3046] THE STRUCTURE, EXPRESSION, AND FUNCTION OF *DROSOPHILA* MYOSUPPRESSIN

R. Nichols, Dept. of Biological Chemistry, Univ. of Michigan, 830 N. University Ave., Ann Arbor, MI 48109-1048, USA, E-mail nicholsr@umich.edu.

Myosuppressin peptides affect spontaneous contractions of the heart, oviduct, and gut. We have isolated TDVDHVFLRFamide, *Drosophila melanogaster* myosuppressin or dromyosuppressin (DMS). Based on structure similarity, myosuppressin is a member of the FMRFamide-related peptide (FaRP) family. DMS is expressed in the central nervous system during all stages of development, beginning late in embryogenesis. The number of cells expressing DMS immunoreactive material increases during development. The complexity of the arborizations of processes projecting from DMS-stained cells increases as the animal develops, with staining present throughout the brain and ventral nerve cord in the adult. Immunoreactive fibers project from superior protocerebral cells to impinge on the dorsal vessel in larva, pupa, and adult. Immunoreactive fibers project from the adult brain to cover the surface of the crop with an extensive network of processes. Immunoreactive fibers project from adult rectal cells to contact the oviduct and the base of the ovaries. Likewise, in the male, immunoreactive fibers project from adult rectal cells to impinge on the testes and accessory glands. We have established bioassays to analyze the effect of DMS on *D. melanogaster* heart rate, crop motility, and oviduct motility. DMS decreases *in vivo* heart rate in larva, pupa, and adult in a dose dependent manner. DMS also decreases adult crop motility and oviduct motility when tested in semi-isolated tissue preparations. The availability of the structure of the naturally-occurring peptide, peptide-specific antisera, and bioassays in a versatile experimental organism like *D. melanogaster* provides the opportunity to delineate the signaling pathway and confirm the physiological function of myosuppressin, a conserved peptide.

Index terms: *Drosophila melanogaster*, FMRFamide, heart, neuropeptide

[3047] ALLATOSTATINS AND THE REGULATION OF THE CORPORA ALLATA IN A COCKROACH

B. Stay[1], K.K. Chan[1], J.R. Zhang[2], R. Kwok[2], I. Orchard[2] and S.S. Tobe[2], [1]Dept. of Biological Sciences, Univ. of Iowa, Iowa City 52242-1324, USA, E-mail barbara-stay@uiowa.edu; [2]Dept. of Zoology, Univ. of Toronto, Toronto, Canada M5S 1A1

Allatostatins are neuropeptides that inhibit juvenile hormone synthesis by the corpora allata. A family of such peptides, with Tyr-Xxx-Phe-Gly-Leu-amide at the C-terminal end, occurs in the cockroach *Diploptera punctata* as well as other cockroach species. Neurosecretory cells in the pars lateralis of the brain send axons in the NCC II through the corpora cardiaca to the corpora allata. The neurosecretory granules in the terminals and varicosities of these allatostatin containing cells within the corpora allata constitute about 75% of the neurosecretory granules within the corpora allata. In addition to allatostatins, FMRFamide has been detected in nerve terminals in the corpora allata. The quantities of both allatostatin and FMRFamide remain constant throughout a cycle of changing rates of juvenile hormone synthesis suggesting that release of these peptides at the nerve terminals must be regulated. When corpora allata-brain complexes were incubated *in vitro* they produced less juvenile hormone and showed more exocytoses at nerve terminals than did corpora allata incubated alone. Treatment of corpora allata with allatostatin elicited release of FMRFamide. The interactions between FMRFamide and allatostatins in the corpora allata are being studied further.

Index terms: *Diploptera punctata*, juvenile hormone, FMRFamide

[3048] DEVELOPMENTAL REGULATION AND FUNCTIONS FOR FLRFAMIDE PEPTIDES IN *MANDUCA SEXTA*

Y.S. Miao[1], D. Lu[1], K.-Y. Lee[2], F. Horodyski[2], & J. L. Witten[1], [1]Dept. of Biological Sciences, Univ. Wisconsin-Milwaukee, PO Box 413, Milwaukee, WI 53201 USA, E-mail jlw@uwm.edu; [2]Dept. of Biomedical Sciences, 228 Irvine Hall, Ohio University, Athens, OH 45701 USA.

Complex behaviors require the coordination of multiple physiological systems. Peptides functioning as local modulators and circulating hormones can provide this orchestration. Ecdysis requires the precise coordination of the neuroendocrine system, CNS, and their peripheral targets such as skeletal and visceral muscles. We are studying the modulatory roles for the FLRFamide family of neuropeptides in *Manduca sexta* in stage-specific ecdysis behavior. Five FLRFamide peptides that all share the common 5 carboxy terminus, SFLRFamide, have been isolated from the nervous system and gut of this insect (Kingan et al., 1990; 1996, 1997). The developmental profile reveals the three central nervous system neuropeptides, pEDVVHSFLRFamide (F10), GNSFLRFamide (F7G) and DPSFLRFamide (F7D), are regionally regulated and are likely released at ecdysis (Miao et al., 1998). Immunocytochemical analysis localize this family to neurosecretory cells (NSC) within the brain and nerve cord whose axons traverse to neuroendocrine organs, over skeletal muscles, or terminate near the heart and motoneurons. We hypothesize the release of the *Manduca sexta* FLRFamides (MasFLRFamides) from diverse NSCs and motoneurons modulate skeletal and visceral muscle to facilitate stage-specific ecdysis behaviors. To test this hypothesis, we are investigating the physiological actions of the three peptides on skeletal muscles used in ecdysis, the heart, and midgut. The peptides had excitatory actions on the skeletal muscles and heart with the heptapeptides being more potent. F10's excitation of heart rate was surprising since it is structurally similar to the insect myosuppressins and contains the "inhibitory" consensus sequence (Wang et al., 1995). Only the heptapeptides inhibited ion transport in the midgut (Lee et al., 1998). The enhancement of skeletal muscle tension and heart rate and inhibition of digestion are all consistent with facilitating ecdysis. To understand how the MasFLRFamides might interact to modulate stage-specific differences in ecdysis behavior, we are using molecular methods to map their cellular and temporal specific distribution. The cDNA we have isolated and sequenced encodes F10 and the larger gut FLRFamides within the prohormone. *In situ* hybridization analysis confirms the localization of this cDNA to regionally distinct NSCs, in subsets of midgut endocrine cells, likely hindgut motoneurons and revealed their localization to a set of peripheral NSCs the link neurons. The new molecular tools will aid in testing our hypothesis that the spatial and temporal expression and release of the MasFLRFamides modulate peripheral tissues to permit stage-specific ecdysis behavior.

Index terms: tobacco hornworm, ecdysis, neuropeptides

[3049] DEVELOPMENT OF THE ANTENNA

T. A. Keil, Max-Planck-Institut, D-82319 Seewiesen

The insect antenna arises early in embryogenesis as a small bud which contains its own coelomic sac. "Luminal neurons" migrate from the epidermis into the antennal lumen and lay down two pioneer nerves to the CNS (1). Sensilla arise in the epidermis from precursor cells. In hemimetabolan insects, the size of the antenna as well as the number of sensilla increase stepwise with each molt. After embryogenesis, creation of new sensilla as well as olfactory neurons can happen only during a molting cycle. In most hemimetabolans, the antenna has a simple flagellar shape which is similar in larvae and adults and can be easily molted. In holometabolans, the larval antenna differs completely from that of the adult. The former is usually very small and carries a special set of only few larval sensilla, wheras the latter can have a remarkable size and complicated (e.g., feathered) shape, and may carry ten thousands of olfactory sensilla. In preparation for metamorphosis, the anlage of the adult antenna is formed from the basal region of the larval antennal epidermis as the "imaginal disk" (2). In higher evolved flies, the antennal imaginal disk develops independently of the larval olfactory organ. In the prepupa, the antennal anlage increases in size and is stowed inside the anterior end of the larva, until it is inflated and stretched during the pupal molt. Adult development starts with apolysis, after which precursor cells of sensilla arise in special sensillogenic regions of the antennal epidermis. Each precursor cell undergoes a series of differential mitoses, by which the cells of the future olfactory sensillum are created. The sensillum differentiation proceeds as follows: 1., outgrowth of a primary ciliary dendrite and an axon; 2., outgrowth of the hair-forming apical process of the trichogen cell; 3., secretion of cuticle and loss of primary dendrite; 4., retraction of trichogen cell; 5., secondary outgrowth of dendrite; 6., formation of sensillum lymph cavity (3, 4). The outgrowing sensory axons follow the larval antennal nerves which persist through metamorphosis. The olfactory axons are needed for proper differentiation of the deutocerebrum (5).

Index terms: peripher

[3050] ANTENNAL CIRCULATION: VESSELS, HEARTS AND NEUROSECRETION

G. Pass, Department of Evolutionary Biology, Institute of Zoology, University of Vienna, Althanstrasse 14, A-1090 Vienna, Austria. E-mail: Guenther.Pass@univie.ac.at.

Insects possess accessory circulatory organs to ensure the hemolymph supply to the antennae and other elongate body appendages (review: Pass G. 1998. In Harrison F, Locke M eds, Microscopic Anatomy of Invertebrates, Vol 11B Insecta, 621-640). Comparative studies revealed a surprising diversity in the functional morphology of antennal circulatory organs. In primitive insects, hemolymph is supplied to antennae by arteries connected to the dorsal vessel. In higher insects, however, these arteries were decoupled and associated with autonomous pumps. These "antenna-hearts" entered their body plan as evolutionary innovations. The involved muscles were probably recruited from pharynx dilators as indicated by their attachment sites and innervation. The deeper cause for the diversity in the functional morphology of the antenna-hearts is not easy to explain. In general, it seems that the evolution of the antennal circulatory organs has been determined by spatial constraints caused by the evolution of other internal organs of the head rather than by changes in circulatory demands (Pass G. 2000. Annu.Rev.Entomol. 45:493-516). The antennal circulatory organs may have vital functions in addition to that of circulatory pumps. In the cockroach, *Periplaneta americana*, the antenna-hearts contain an extensive neurohemal area. Based on anatomy, it must be concluded that hormones released there are instantly pumped into the antennae and that their target sites must be located somewhere within these appendages. Neuroanatomical and neurochemical investigation revealed in the antenna-heart an extraordinary high concentration of octopamine which is presumed to be the released hormone. The results give rise to the hypothesis of an efferent control of the antennal sensory system by means of a hormonal mechanism originating from the antenna-heart.

Index terms: Morphology, evolution, sensory system, *Periplaneta americana*
al nervous system, morphogenesis

(1) Selzer, R. & Schaller-Selzer, L. (1987) Dev. Biol. 122, 363-372
(2) Svacha, P. (1992) Dev. Biol. 154, 101-117
(3) Keil, T.A. & Steiner, C. (1990) Tissue & Cell 22, 705-720
(4) Keil, T.A. & Steiner, C. (1991) Tissue & Cell 23, 821-851
(5) Boeckh, J. & Tolbert, L.P. (1993) Microsc. Res. Techn. 24, 260-280

[3051] STRUCTURE AND FUNCTION OF THE ADULT INSECT ANTENNA

R.A. Steinbrecht, Max-Planck-Institut für Verhaltensphysiologie, D-82319 Seewiesen, Germany. E-mail: steinbrecht@mpi-seewiesen.mpg.de

Insect antennae show remarkable variation in size and shape and bear sensilla serving all kinds of sensory modalities, except vision. Olfactory sensilla are usually most numerous, as only a large number of olfactory receptor neurons with different specificity can cope with a great variety of different environ-mental odours. Moreover, if maximum sensitivity to a given odour is required as, e.g., for the detection of pheromones, a large number of sensilla with receptor neurons of the same specificity will increase the chance of catching stimulus molecules at very low concentrations. Gustatory sensilla are not always present on insect antennae (e.g. in *Musca*, *Drosophila*) but usually some are found which supplement the more abundant population of contact chemoreceptors on mouth parts, legs and other body regions. Mechanosensitive sensilla are invariably found on insect antennae and predominate on the pedicel. Thermo- and hygrosensitive receptor cells are a further constant component on any insect antenna, usually they occur combined in the same type of sensillum. For each modality we find a characteristic sensillum bauplan with modality-specific structures that are basically similar throughout the different insect orders. Selected examples of highly developed antennae are presented and compared with greatly reduced antennae; possible evolutionary trends and constraints are discussed. Adaptation to different living and environmental conditions obviously had a great influence on sensillar numbers, antennal form and shape. The fundamental bauplan of insect sensilla and modality-specific structures, however, apparently have evolved very early in insect phylogeny and have been passed on in a rather conserved way during insect radiation.

Index terms: sensilla, sensory modalities, evolution.

[3052] HOW TO BUILD A BETTER INSECT ANTENNA: LESSONS FROM THE PHYSICS OF CHEMORECEPTION

P. A. Moore[1], Lab. for Sensory Ecology, Dept. of Biological Sci., Bowling Green State Univ., Bowling Green, OH 43403, USA, E-mail pmoore@bgnet.bgsu.edu.

Insects are renown for their chemosensory abilities. Moths fly great distances to locate mates, bees use chemical signals to forage, and ants follow trails using pheromones. Each of these organism use appendages covered with sensory hairs to perform these chemosensory tasks, yet each has a distinct morphology associated with their chemosensory appendages. Any sensory appendage placed within moving air has a boundary layer surrounding it. This boundary layer is a gradient of fluid velocities that range from stagnant at the antenna surface to full air velocity a great distance away from the surface. Chemical signals are transported from the source (flower or potential mate) to the receiver (antenna) through a combination of fluid flow and molecular diffusion. Because the boundary layer around sensory appendages alters fluid flow, the dynamics of fluid flow and molecular diffusion within a boundary layer will alter the temporal and spatial dynamics of chemicals signals as they arrive at the sensory neurons. Physics predicts that different morphologies or hair structures will have different boundary layer dynamics. What arises from this interaction between morphology and fluid flow is a complex physical filter that can alter or constrain the chemosensory abilities of organisms. By studying the physics of boundary layers around different insect antenna, we can provide some insight into the basis by which natural selection has shaped the design of sensory appendages.

Index terms: *Manduca Sexta*, *Apis mellifera*, chemoreception, antenna morphology.

[3053] ANTENNAL SMOKE DETECTORS COMBINED WITH THORACIC INFRARED PIT ORGANS GUIDE BUPRESTID BEETLES OF THE GENUS *MELANOPHILA* TO FOREST FIRES

H. Schmitz[1] & S. Schütz[2], [1]Institute of Zoology, Univ. of Bonn, Poppelsdorfer Schloss, D-53115 Bonn, Germany, E-mail h.schmitz@uni-bonn.de; [2]Biological and Biotechnical Plant Protection, Institute of Phythopathology and Applied Zoology, Univ. Giessen, Heinrich-Buff-Ring, D-35392 Giessen, Germany, E-mail Stefan.Schuetz@agrar.uni-giessen.de

Jewel beetles (family Buprestidae) of the genus *Melanophila* approach forest fires because their brood can only develop in trees recently killed by a fire. The beetles can detect fires from great distances of many kilometers and use olfactory as well as thermal cues. The antennae are highly sensitive to phenolic compounds. Highest sensitivity of only a few parts per billion (p.p.b.) was found for derivatives of 2-me

[3054] INSECT ANTENNAE AS A BASIS OF EARLY WARNING SYSTEMS IN AGRICULTURE AND INDUSTRY

S. Schütz[1], B. Weißbecker[1], P. Schroth[2] & M.J. Schöning[2, 1] Inst. of Phytopathology and Applied Zoology, Univ. Giessen, Ludwigstr. 21b, D-35390 Giessen, Germany. E-mail: stefan.schuetz@agrar.uni-giessen.de. [2] Inst. of Thin Film Ionics, FZ Juelich GmbH, D-52425 Juelich, Germany.

Insect antenna are morphologically and physiologically highly specialised organs for odour perception. Their sensitivity, selectivity, and response time cannot be matched by any technical method of trace analysis. Utilisation of these unique abilities of insects for trace analytical purposes demands a thorough adaptation of technical devices to the special needs of insect antennae. Former approaches using electroantennogram (EAG) techniques are highly sophisticated yet (Koch et al., 1997), however, insect antenna have to be damaged limiting lifetime of the preparations. Using a field effect transistor directly coupled to an undamaged insect antenna proved to solve some of the problems (Schroth et al., 1999). Therefore, practical applications of biosensors on the basis of intact insect antennae as a sensitive odour detecting device become more feasible. Besides sex pheromones, insect antenna are able to detect a broad range of odours specific to their habitat. The Colorado beetle (*Leptinotarsa decemlineata*) shows a high sensitivity to damage induced volatiles released by potato plants (Schütz et al., 1997), the Steelblue jewel beetle (*Phaenops cyanea*) detects stressed and burned trees, and the Black jewel beetle (*Melanophila acuminata*) shows a very high sensitivity to wood-fire specific volatiles (Schütz et al., 1999). First practical applications of the biosensor in plant protection and stored food protection will be presented and further possible applications in food quality assessment and fire early warning will be discussed. Koch, U.T., Lüder, W., Clemenz, L., & Cichon, I. (1997). Pheromone measurements by field EAG in apple orchards. In: Technology Transfer in Mating Disruption, IOBC wprs Bulletin, 20: 181-190.Schroth, P., Schöning, M.J., Kordos, P., Lüth, H., Schütz, S., Weißbecker, B., & Hummel, H.E. (1999). Insect-based BioFETs with improved signal characteristics. Biosensors & Bioelectronics, 14: 303-308. Schütz, S., Weißbecker, B., Klein, A., & Hummel, H.E. (1997). Host plant selection of the Colorado potato beetle as influenced by damage induced volatiles of the potato plant. Naturwissenschaften, 84: 212-21.Schütz, S., Weißbecker, B., Hummel, H.E., Apel, K.-H., Schmitz, H., & Bleckmann, H. (1999). Insect antennae as a smoke detector. Nature, 398: 298-299. Index terms: *L. decemlineata*, *Ph. cyanea*, thoxyphenol (guaiacol). Absolute sensitivity was 1.1±0.8 pg/ml. Methoxylated phenols are emitted by the incomplete combustion of lignin and therefore are characteristic for smoke of burning wood. *Melanophila* beetles additionally possess two infrared (IR) pit organs next to the coxae of the middle legs. Electrophysiological experiments have shown that the sensilla in the pits are fast and phasic IR receptors which respond within a few milliseconds to IR radiation. Highest sensitivity was found in the wavelength range between 2.8 – 3.5 µm (test range 2.8 – 5 µm). An intensity of 5 mW/cm^2 already evoked single action potentials; saturation of receptor response (i.e. 8 – 9 action potentials) was reached at an intensity of about 250 mW/cm^2. When stimulating the IR receptor with monochromatic radiation of 3.4 µm and 5 µm respectively, it was found that at equal intensities sensitivity (i. e. the amplitude of the generator potential as well as the number of action potentials) was 20 to 40% greater at the shorter wavelength. The results are consistent with our hypothesis that the beetles in a first step become aware of a forest fire by olfactory cues. This may cause the beetles to take off and search for the fire. In flight infrared radiation perceived by the paired thoracic pit organs guides a beetle to the fire by tropotaxis.
Index terms: infrared receptor, smoke receptor, remote sensing.

[3055] FUNCTIONAL MORPHOLOGY OF SPECIES-SPECIFIC GRASPING STRUCTURES IN MALE SEPSID FLIES, AND THE EVOLUTION OF ANIMAL GENITALIA

W. G. Eberhard, Smithsonian Tropical Research Institute, and Escuela de Biologia, Univ. de Costa Rica, Ciudad Universitaria, Costa Rica, E-mail: webe@biologia.ucr.ac.cr

The modified front legs of male sepsid flies, which grasp the female's wings prior to copulation, show a typical genitalia-like pattern of rapid divergent evolution: they are often morphologically elaborate and species-specific in form, and their complexity seems too great to be explained by the apparently relatively simple mechanical function of grasping the female's wings. Because the legs are more easily observed while in use, and are easier to manipulate experimentally than most genitalic structures, they offer an opportunity to test hypotheses regarding the causes of rapid divergent evolution. In five species of *Archisepsis*, the morphological fit between the male's front legs and the veins at the base of the female's wing is very tight. The species-specific forms of male front legs are generally *not* associated, however, with species differences in the morphology of female wings. Instead, the different male designs grasp essentially unvarying female structures in different ways. The distribution of female sense organs in the area of the wing that is grasped by the male is also relatively uniform, and differences in the placement of these organs do not match differences in male front leg designs. Experimental modification of male leg morphology in one species resulted in a sharp decrease in the likelihood that the female would accept copulation after the male mounted, but did not reduce the male's ability to maintain his hold on her wing in the face of female rejection movements. These results are at odds with predictions of both the mechanical lock-and-key and male-female conflict of interests hypotheses, but they are compatible with the sexual selection by cryptic female choice and a relaxed version of sensory lock and key hypotheses for genitalic evolution.
Index terms: sexual selection, genitalic evolution, Sepsidae, contact courtship devices, cryptic female choice

[3056] MATE CHECK: THE LINK BETWEEN NICHE THEORY AND SEXUAL SELECTION

R. Jocqué, Invertebrate Section, Royal Africa Museum, B-3080 Tervuren, Belgium. E-mail: jocque@africamuseum.be

There is a remarkable difference between the views on speciation from students of the niche theory and from those that study sexual selection. Adaptation to, and shifts in ecological niches are paramount for speciation with the former, rapid evolution of sexual characters (SC, including secondary sexual characters), involved in courtship and mating supposedly molded by female choice, with the latter. One of the reasons for these unrelated or even opponent views is that in some speciose taxa the only morphological differences between species appear to be in the SC. This might give the impression that speciation has occurred without the development of adaptive novelties other than improved stimulation of the female. Therefore the cause for speciation is sought in the evolution of these SC alone and female choice is assumed to be the driving force behind speciation. Abstraction is thereby made of behavioral adaptations which may change drastically but often have no bearing on somatic morphology. The mate check hypothesis links these elements and assumes that evolution through behavioral adaptation, allowing exploitation of underexploited resources, is backed up by changes in the SC. The presence of these crucial characters is checked, hence "mate check", during courtship and mating. This line of thinking may explain the large range of complexity of SC in closely related taxa providing that complexity of SC is linked to ecological specialization. Quantifying complexity and similarity of SC is a major problem in this context. The utility of the present methods quantifying complexity by the means of a scoring system using naïve human subjects is questioned. Fourier analysis methods are still unable to cope with complex 3-dimensional structures and cannot really reflect their range of complexity. Therefore a new method is proposed to measure complexity in order to enable comparisons of this parameter in related taxa. It is a scoring system based on the morphological distance between the original state of a structure, most often a simple sclerite, and its configuration after modification for its sexual function. Examples are given of large genera in spiders with very stable somatic morphology and an enormous range of genitalic complexity. These examples, from remote taxa, show that somatic patterns evolved without much variation in SC. In a second phase somatic morphology remained sometimes remarkably stable whereas SC evolved most often very gradually into complex organs.
Index terms: Sexual selection, female choice, mate check, complexity, niche theory.

[3057] SCORPION GENITALIA: WHICH THEORY CAN BEST EXPLAIN THE DIVERSITY?

A. V. Peretti, CONICET, Cátedra de Diversidad Animal I, FCEFyN, Universidad Nacional de Córdoba, Av. Vélez Sarsfield 299 (5000), Córdoba, Argentina, E-mail aperetti@com.uncor.edu

Scorpions use sclerotized spermatophores for sperm transfer. The family Bothriuridae has the most complex spermatophores, with a distinct capsule and lamella. The female genital atrium is soft, elastic and very uniform among different species. This study evaluates the abilities of some hypotheses regarding the evolution of animal genitalia to explain the diversity in scorpion spermatophore. These possibilities are: female choice (internal courtship and mechanical fit), conflict of interests (morphologically forced insemination) and lock-and-key (interspecific mechanical incompatibility) hypotheses. A review of all papers on spermatophore morphology in scorpions was made. Observations of mating sequences of 13 bothriurids and a buthid were recorded. Histology of female atrium was analysed. The data indicate: 1) Internal courtship (sexual stimulation through male genitalia) would be the best explanation for widespread capsule diversity. Indeed females of *Brachistosternus* and other genera have nerve fibres in places of genital atrium that are rubbed by spines, tubercles or capsular lobes of spermatophores. 2) Mechanical fit may be acceptable for some structures of lamella (distal crest and dorsal fold) that fit tightly between female's coxae. 3) Morphological coercion might be admissible only when capsular lobes are very well developed. This occurs in *Bothriurus bonariensis*, females show difficulty in disengaging by themselves the large lobes if they attempt to interrupt the sperm transfer. 4) Observations of matings among species closely related indicate that lock-and-key hypothesis is little acceptable to explain spermatophore diversity. However a slight mechanical incompatibility occurs during interspecific mating between two sister species (*B. bonariensis* and *B. chacoensis*) due to some differences in capsular lobes and post-insemination behavior. 5) These hypotheses might not be directly apply to simple spermatophores of the family Buthidae. In *Zabius fuscus* males are able to perform either behavioral coercion or copulatory courtship during sperm transfer. The implications of all these results and the relation with other arthropods that also have spermatophores will be discussed.
Index terms: Bothriuridae, Buthidae, spermatophore, sperm transfer, sexual selection.

[3058] SELECTION OF MALE GENITALIA IN THE SEEDBUG *LYGAEUS SIMULANS*

A. Tadler, Inst. f. Zoologie u. Limnologie d. Univ. Innsbruck, Technikerstr. 25, Innsbruck, Austria, EU, A-6020, E-mail andreas.tadler@uibk.ac.at

The processus gonopori of lygaeid bugs is a tube like sklerotized extension of the male aedeagus, shaped for the transfer of sperm into the female spermatheca. It gives an impressive example of the rapid and divergent evolution of genitalic structures. Within the family Lygaeidae the length of the processus is highly variable. In some species it consists only of a short spine, whereas it reaches three times the body length in some other species. The most promising hypothesis for an explanation of this evolutionary pattern, the cryptic female choice hypothesis of genitalia, predicts selection of male genitalia during copulation. Here, I demonstrate actual phenotypical selection of processus gonopori length based on insemination success. In a laboratory study, 97 pairs of virgin *Lygaeus simulans* copulated once. The females consisted of six groups of full sisters. All sisters of a group having been raised in the same box. Related females where used in order to lower the variance of female preferences and to thereby increase the chances of detecting selection of male traits by female choice. The males where independent, i.e. each male descended from a unique pair of parents. Multiple regressions of insemination success on linear and nonlinear terms of processus gonopori length and male weight revealed stabilizing selection on processus length. The variances in processus length differed significantly between female families. This suggest that female choice occurred and that female families differed between female families.
Index terms: Lygaeidae, sexual selection, cryptic female choice, insemination

[3059] SPERM TRANSFER, LOCK AND KEY MECHANISMS, AND FUNCTIONAL DEMANDS IN TRACHEATES

O. Kraus. Zool. Inst. & Zool. Mus., Univ. Hamburg, Martin-Luther-King-Platz 3, 20146 Hamburg, Germany

Terrestrialization in arthropods is closely linked with the development of efficient modes of sperm transfer into female genitalic ducts. Indirect transfer *via* spermato-phores is widely distributed among terrestrial arthropods. Due to parallel evolution, this principle seems to have multiple origins. Direct transfer by auxiliary structures in the Diplopoda (gonopods) and other modified appendages in the Arachnida are interpreted as an active transfer by the males of what originally were deposited spermatophores. This mode was even maintained in different groups of the Pterygota, including dipteran subtaxa. The question is why (a) indirect sperm transfer was maintained in so many different groups, and why (b) direct sperm transfer originated independently in many other major taxa. The latter case is frequently correlated with the evolution of complicated lock and key mechanisms. Mutual co-adaptation of male and female genitalia is frequently species-specific (and hence provides reliable taxonomic characters). Could this be due to sexual selection by female choice (EBERHARD 1985, 1996)? Another explanation may be that locking male and female genitalia tightly together may efficiently safeguard sperm transfer under certain conditions (e.g. smooth body surface, flight, and copulation on threads). Interdependencies of this kind, reversals included, are analyzed in order to test the 'sperm safeguard hypothesis' as an alternative to the female choice hypothesis.
Index terms: Genitalia, Functional Morphology, Evolutionary Significance

[3060] THE BIOMECHANICS AND FUNCTIONAL DIVERSITY OF FLIGHT

R. Dudley, Section of Integrative Biology, Univ. of Texas at Austin, Austin, TX 78712, USA, E-mail: r_dudley@utxvms.cc.utexas.edu.

The evolution of wings in the late Paleozoic was a defining event for subsequent hexapod radiations on (and above) the surface of the earth. Equally important to the evolutionary diversification of insects have been repeated events of miniaturization, a process enabled by acquisition of asynchronous flight muscle and elevated wingbeat frequencies during flight. Ordinal-level patterns of wing transformation for non-aerodynamic purposes have similarly been influenced by high flapping frequencies, an effect most clearly evidenced by the elytra of Coleoptera and the halteres of Diptera. Most insects are fairly small and fly in Reynolds number regimes strongly influenced by the viscosity of air. The combined effects of wing flapping and rotation at the ends of half-strokes yield strongly unsteady airflows, leading-edge vortices, and aerodynamic forces well in excess of those associated with steady-state wing translation. Flight has been an essential underpinning to diverse features of insect ecology and behavior, including aerial mating systems, phytophagy, and the pollination of angiosperms. Low flight speeds derived biomechanically from small body sizes, however, indicate that ambient flight trajectories are often dominated by ambient winds. Forces of both natural and sexual selection have contributed synergistically to the evolution of insect flight performance and maneuverability, yielding the wonderfully agile taxa that to this day compete with *Homo sapiens* for dominance of the terrestrial biosphere.
Index terms: biomechanics, flight, miniaturization, wings

[3061] THE STRUCTURE AND MECHANICS OF INSECT WINGS

R.J.Wootton, Sch. of Biological Sciences, Exeter Univ., Hatherly Laboratories, Prince of Wales Road, Exeter, EX4 4PS, UK. E-mail: r.j.wootton@exeter.ac.uk

The primary role of insect wings is flight, and for two decades insect aerodynamics and functional wing morphology have progressed hand in hand. We now know what wings are required to do, and are well-advanced in interpreting much of their form and construction in functional terms. In one respect they are unique. As they have no internal muscles, the changes in shape which they undergo in flight and in folding are largely encoded in their structure - the distribution of elasticity around the wing - under remote, rather simple, active control. This probably makes them the most automatic of any locomotory appendages, involving mechanical principles ripe for technological exploitation. The interaction between basal muscular control and the wings' intrinsic properties has now been explored in many insects, and common principles and parallel adaptations are emerging, despite the obvious diversity of form. Recent work has focussed on the application to wings of advanced structural engineering and materials science methodologies.

[3062] FLIGHT RESPIRATION AND ENERGETICS

J.F. Harrison[1], S.P. Roberts[2] , J.H. Fewell[1], & R. Dudley[3], [1]Dept. of Biology, Arizona State University, 85287-1501, USA, E-mail:j.harrison@asu.edu; [2]Dept. of Biological Sciences, Univ. of Nevada, Las Vegas, NV, 89154-4004, USA, [3]Dept. of Zoology, Univ. of Texas, Austin, TX 78712, USA.

Flight ability is a key trait, responsible for many of the ecological successes of insects. One important mechanism responsible for flight ability in insects is high aerobic metabolic rate (V_{O2}). Available data suggest that flying insects have metabolic rates and mechanical power outputs approximately 30-fold greater than running insects; a difference much greater than between flying and running mammals or birds. The large flight-running V_{O2} difference in insects seems to be partially due to: a) a general trend across animals toward decreased efficiency (power output/power input) at the small body sizes characteristic of insects, and b) insectan thermal biology. Many insect fliers (like birds and mammals) have flight muscle temperatures above ambient, while this is rarely true for insect runners. Metabolic rates during flight are affected by a variety of environmental factors. At least in some endothermic bees, flight metabolic rate and wingbeat frequency are inversely correlated with air temperature, apparently in order to achieve thermal stability. In honey bees, this pattern may depend on season. Winter bees have lower flight metabolic rates and fly at lower air and body temperatures than summer bees. Therefore, for winter honey bees, thorax temperature, air temperature, and metabolic rates are positively correlated. In carpenter bees, decreasing air density increases power output and metabolic rate, to values about 30% above those in normobaric conditions. This increase is size dependent, with smaller bees having greater aerobic and mechanical scopes. Intra-specific genetic variation can also have striking effects on flight metabolic rates. African honey bees have higher flight metabolic rates than European honey bees, and this difference persists when reared in common hive environments. Interesting, the strain-based differences in flight metabolic rates are not found in juvenile bees, but only appear in foraging-age bees. Differences in flight metabolic rates are correlated with differences in foraging effort in these strains, which may partially explain the higher colony growth rates of African honey bees.

Index terms: metabolism, honey bee, *Apis mellifera*, temperature, body size

[3063] ASYNCHRONOUS FLIGHT MUSCLE: MECHANISM AND PERFORMANCE

R.K. Josephson, Department of Ecology and Evolutionary Biology, Univ. of California, Irvine, CA 92697, USA, E-mail rkjoseph@uci.edu.

Insect flight muscles can be divided into synchronous muscles and asynchronous muscles on the basis of the neural control of their contraction. During activity of synchronous muscles there is a 1:1 relationship between muscle action potentials and contractions, in asynchronous muscles there is not. Asynchronous muscles are turned on by neural impulses and resulting muscle action potentials, and when turned on they can contact in an oscillatory fashion if they are attached to an appropriate, resonant load, as is offered in life by an insect's wings and thorax. In addition to a lack of synchrony between muscle electrical and mechanical events, asynchronous muscles are characterized by having muscle fibers with large diameter myofibrils and poorly developed sarcoplasmic reticulum; and by having slow time course of isometric contraction, high passive stiffness, and delayed shortening deactivation and delayed stretch activation. It is delayed shortening deactivation and stretch activation that allow an asynchronous muscle to contract in an oscillatory manner. Because of delayed shortening deactivation and stretch activation, during cyclic length change at appropriate frequency the muscle force is greater during shortening than during lengthening. More work is done by the muscle during shortening than is required to re-lengthen it, and there is net work output over a cycle. The maximum mechanical power output from an asynchronous flight muscle of the beetle *Cotinus mutabilis* under conditions mimicking those of flight was found to be about 150 W/kg, which is about twice the power output obtained in earlier studies using synchronous flight muscles of locusts and of a moth. The high power output of the beetle muscle supports the hypothesis that asynchronous muscle has evolved independently in several different insect lines because it gives greater power output than does synchronous muscle at the high operating frequencies of insect flight.

Index terms: *Cotinus mutabilis*, flight muscle, asynchronous muscle, power.

[3064] THE AERODYNAMICS AND NEUROBIOLOGY OF FLIGHT CONTROL

M. H. Dickinson, Dept. of Integrative Biology, Univ. of California, Berkeley, CA 94720, USA, E-mail flymanmd@socrates.berkeley.edu

As the mechanisms that explain how insects stay in the air become better understood, it grows easier to study how insects manipulate aerodynamic forces to generate elaborate aerial maneuvers. At the center of flight control behavior is a continuous feedback loop by which sensory information modifies motor patterns that in turn alter wing kinematics and force production. We are currently attempting to dissect the flight control system of the fruit fly, *Drosophila melanogaster*, using a variety of techniques. Studies of free flight behavior in an automated tracking arena indicate that the flight paths of fruit flies consist of straight sequences interspersed with rapid saccadic turns. Each saccade consists of a stereotyped sequence of three body rotations. The fly begins the saccade with a slow 'head up' pitch movement, which is followed by a rapid combined roll-yaw, and is completed by a second 'head up' pitch movement that returns the animal to the equilibrium condition. The entire sequence lasts approximately 1.5 seconds or 320 wingbeat cycles, which is much longer than predicted from tethered flight studies. The frequency and spatial distribution of saccades depends upon the arrangement of visual objects and chemical odors within the environment. By tracking the flies within a structured arena it is possible to reconstruct what the fly 'sees' as it moves in search of food and oviposition sites. Flies track sharp contrast edges (=fixation) during the straight portions of their flight trajectories, whereas asymmetrically looming objects elicit saccades. The net result is that animals fly slowly and saccade frequently within dense clusters of objects, and fly rapidly and saccade less frequently within open landscapes. Attractive chemical odors appear to raise the threshold for collision avoidance responses and lower the threshold for landing responses. Using a virtual reality tethered flight arena it is possible to measure changes in wing stroke kinematics while reconstructing or manipulating the sensory stimuli that the animals experience under free-flight conditions. The aerodynamic consequences of these alterations are measured using a large dynamically scaled model of a flapping fly. Flies generate pitching moments, like those that occur at the start and end of each saccade, by bilaterally increasing the ventral excursion of the stroke amplitude, whereas bilateral differences in amplitude are responsible for the combined roll-yaw moment in the middle of each saccade. These force moments are augmented by changes in the timing of wing rotation, angle of attack, and deviations of the wing from the stroke plane. We are currently using data gathered from free-flight, tethered flight, electrophysiological preparations, and the mechanical insect to construct a comprehensive mathematical control model of the flight system. The goal is to develop a rigorous analytical framework with which we can test and modify increasingly complex models of flight control behavior.

Index terms: vision, steering, maneuverability, halteres, wings

[3065] INSECT WINGS AND MICRO-HELICOPTER DESIGN

C. P. Ellington, Dept. of Zoology, Univ. of Cambridge, Downing Street, Cambridge CB2 3EJ, UK, E-mail c.ellington@zoo.cam.ac.uk.

In order to support their body weight, flapping insect wings must typically produce 2-3 times more lift than can be explained by conventional aerodynamics. A leading-edge vortex (LEV) created by dynamic stall is responsible for most of the enhanced lift production. A strong spanwise flow is also generated by the pressure gradients on the flapping wing, stabilising the LEV and causing it to spiral out to the wingtip. At the laminar Reynolds numbers (*Re*) appropriate to large insects, less than about 5000, we have discovered that the spiral LEV can be maintained indefinitely on rotary wings (i.e. propellers and rotors) that are modelled on insect wings. Rotary and flapping-wing Micro-Air Vehicles (MAVs) with a useful payload capacity must operate at *Re* an order of magnitude higher, where the separated flow from the sharp leading-edge is likely to become turbulent. Can lift-enhancement by the spiral LEV still be achieved? Lift and drag characteristics will be presented for a variety of rotary wing designs over a wide range of Re for comparison with flapping wings.

Index terms: Flapping flight, micro-air vehicles, aerodynamics

[3066] EVOLUTION OF ANTEROPOSTERIOR AXIS FORMATION IN INSECTS: THE ROLE OF *HUNCHBACK* AND *NANOS* IN THE GRASSHOPPER

S. Lall[1], M. Z. Ludwig [1,2] & N. H. Patel[1], [1] Dept Org Bio and Anatomy, Univ. of Chicago, MC1028, N-101, 5841 S. Maryland Ave., Chicago USA [2] Dept of Ecology and Evolution, University of Chicago, 1101 E. 57th St., Chicago USA

Maternally provided *hunchback* (*hb*) and *nanos* have been shown to play an important role in the formation of the anteroposterior axis of *Drosophila melanogaster*. In the syncytial *Drosophila* embryo, maternally provided and posteriorly localized results in the translational repression of uniformly deposited *hb*. Interaction of nanos with the 3' untranslated region of *hb* transcript is mediated by a third factor, pumilio. We are interested in the potential conservation of this mechanism of axis formation during the early embryogenesis of the short germ insect *Schistocerca americana*. In particular, we are interested in whether a localized maternal factor such as *nanos* can be involved in axis formation in a cellular environment, when compared with the early syncytial embryogenesis of *Drosophila melanogaster*. In order to address this issue, we have cloned *hunchback*, *nanos* and *pumilio* from the grasshopper *Schistocerca americana*. Both hb and nanos accumulate to high levels during grasshopper oogenesis, suggesting maternal contribution. Furthermore, during early embryogenesis the expression patterns of hb and nanos are consistent with a role in anteroposterior axis formation.
We propose a model where the *hunchback*/ nanos/ pumilio interaction is a conserved mechanism for generating polarity along the anteroposterior axis.
Index terms: *Schistocerca americana, Drosophila melanogaster*

[3067] CLEAVAGE AND BLASTODERMFORMATION IN SHORT GERM BAND INSECTS

M. Akam

ABSTRACT NOT RECEIVED

[3068] REGULATION OF CASTE FATE IN POLYEMBRYONIC WASPS

L. Corley, J. A. Harvey & M. R. Strand[1], [1]Dept. of Entomology, Univ. Wisconsin, Madison, WI, USA.

Polyphenism refers to the ability of a single genotype to produce alternative phenotypes. Distinct morphological castes are commonly seen in eusocial insects like ants and termites. However, castes have also evolved in a few other insect groups including polyembryonic wasps in the family Encyrtidae. Each egg laid by polyembryonic wasps divides clonally to produce a brood of genetically identical siblings that feed together inside the host. In the case of *Copidosoma floridanum*, each egg laid into a host proliferates to form more than 1000 embryos. Most embryos give rise to reproductive larvae that develop into adult wasps. Some embryos, however, develop into precocious larvae that have soldier functions. In this study, we discuss the proximate mechanisms that regulate embryo proliferation and caste formation in *C. floridanum*. Transplantation and lineaging experiments together indicate that proliferation and caste determination are affected by both host environment and intrinsic regulatory factors in embryos. Factors that have favored the evolution of distinct castes in polyembryonic wasps are also discussed.

[3069] SHIFTS IN THE LIFE HISTORY OF PARASITIC WASPS CORRELATE WITH ALTERATIONS IN EARLY DEVELOPMENT

M. R. Strand[1] & M. Grbic[2], [1]Dept. of Entomology, Univ. of Wisconsin, Madison, WI, USA , [2]Dept of Zoology, Univ. W. Ontario, Ontario, Canada.

In insects, the regulation of embryonic development has been intensively studied in model species like *Drosophila melanogaster*. Previous comparative studies have suggested that the developmental processes documented in *Drosophila* well describe embryogenesis of holometabolous insects generally. However, there have been few attempts to take into account how life history has influenced insect embryogenesis or to characterize early development of species with life histories fundamentally different from flies. Our studies of advanced insects in the order Hymenoptera suggest that punctuated shifts in life history can profoundly influence these events. In particular, alterations associated with the evolution of endoparasitism argue that departures from the fly paradigm may occur commonly among insects that develop under conditions different from typical terrestrial species.

[3070] ZYGOTIC ANTERO-POSTERIOR PATTERNING GENE FUNCTIONS IN THE PARASITOID WASP *NASONIA*

M. A. Pultz[1] & D. S. Leaf[2], [1,2] Biology Dept., Western Washington Univ., Bellingham, WA, USA 98225, E-mail: pultz@biol.wwu.edu, leaf@biol.wwu.edu. Supported by NSF.

Understanding the evolution of developmental regulatory networks requires the comparative study of gene functions as well as the comparative description of gene expression patterns. One approach to understanding gene functions is the classical genetic method of isolating recessive loss-of-function mutations affecting a process of interest. We have chosen the solitary parasitoid wasp *Nasonia vitripennis* for comparison to *Drosophila*. In *Nasonia*, as in other Hymenopterans, fertilized eggs develop as diploid females while unfertilized eggs develop as haploid males. This facilitates the isolation of recessive zygotic loss-of-function mutations identifying genes of interest. *Nasonia* has a long germ band mode of embryonic development, morphologically similar to that of *Drosophila*. In a screen for EMS-induced recessive zygotic mutations affecting antero-posterior patterning, we have identified representative gap and pair-rule genes, as well as other classes of antero-posterior patterning genes. Interestingly, three mutations (identifying three genes) affect larger regions of the anterior-posterior axis than are affected by corresponding zygotic loss-of-function mutant phenotypes in *Drosophila*. We have focused on two of these, *head only* and *headless*. *head only* mutant embryos have posterior defects resembling those of *Drosophila* embryos lacking both maternal and zygotic *caudal* function. The mutant phenotype of *headless* mutant embryos, with anterior and posterior gaps, resembles that of embryos lacking both maternal and zygotic *hunchback*. These results suggested that some zygotic genes in *Nasonia* control functions that are covered jointly in *Drosophila* by both maternal and zygotic gene products. To test the hypotheses that *head only* is *Nasonia caudal* and that *headless* is *Nasonia hunchback*, we have begun by cloning *Nasonia caudal* and *Nasonia hunchback*, then carrying out meiotic mapping experiments. These experiments have yielded results consistent with each of the above hypotheses. We are now sequencing the mutant alleles and analyzing the expression of these genes in wild-type and mutant embryos. We have also been analyzing *Nasonia hunchback* cDNA clones isolated by RACE-PCR from *Nasonia* embryonic RNA. Surprisingly, although flies are more closely related to wasps than to beetles, the *Nasonia hunchback* sequences that we have characterized do not share all of the features that are held in common between *Drosophila hunchback* and *Tribolium hunchback*. Our analysis of the structure of the *Nasonia hunchback* gene will also be presented in detail in a poster by D. S. Leaf et al.

Index: Hymenoptera, embryogenesis, A-P axis

[3071] MATERNAL VS ZYGOTIC CONTRIBUTIONS TO PATTERNING THE SHORT GERM EMBRYO OF *TRIBOLIUM CASTANEUM*

S. J. Brown, Jennifer Brisson & Robin Denell. Division of Biology, Kansas State University, Manhattan, KS 66506-1234, USA, E-mail sjbrown@ksu.edu

Most insect species display short or intermediate germ development in which a germ rudiment forms containing the embryonic termini and a few body segments, the additional segments are added sequentially. In contrast, insects with long germ development segment along the entire anterior-posterior axis virtually simultaneously. This behavior, thought to be derived, is due in part to increased maternal contributions of materials and patterning information, and presumably offers the selective advantage of rapid early development. It has been suggested that regulatory changes occurred via a shift of some embryonic patterning functions from zygotic to maternal regulation. In the long germ insect *Drosophila melanogaster*, the gene *ftz transcription factor 1 (ftz-f1)* is maternally translated and the protien is stored in the embryo. In addition to activating transcription of *ftz*, the Ftz-f1 protein is required in combination with Ftz protein for normal segmentation. In the short germ beetle *Tribolium castaneum*, the ortholog of *ftz-f1* is not maternally regulated, but is expressed in embryonic pair-rule stripes. This apparent shift of *ftz-f1* control from zygotic to maternal may provide a general paradigm for some of the regulatory changes that accompanied the evolution of long germ development in Drosophila.

Index terms: *Tribolium castaneum*, evolution of embryonic development, *ftz*, *ftz-f1*

[3072] EVOLUTION OF THE BICOID GENE IN DIPTERAN INSECTS

U. Schmidt-Ott & M. Stauber, Max-Planck-Institut für biophysikalische Chemie, Abt. Molekulare Entwicklungsbiologie, Am Fassberg 11, D-37077 Göttingen (Germany)

The *Drosophila* gene *bicoid* acts at the beginning of gene cascade which specifies anterior structures in the fruit fly embryo. Embryos lacking maternally expressed *bicoid* fail to develop anterior segments including head and thorax . In wild type eggs, *bicoid* mRNA is localized in the anterior pole region and the *bicoid* protein forms an anterior-to-posterior concentration gradient. *bicoid* activity is required for transcriptional activation of several zygotic segmentation genes and for the translational suppression of uniformly distributed maternal *caudal* mRNA in the anterior region of the embryo. We identified a *bicoid* homolog (*Ma-bcd*) from a basal cyclorrhaphan fly, *Megaselia abdita* (Phoridae, Aschiza). *Ma-bcd* is presently the most basal of the known *bicoid* homologues not only because of the basal position of *Megaselia* within the phylogenetic tree of cyclorrhaphan flies but also because of its sequence. Analysis of the *Ma-bcd* sequence reveals that *bicoid* emerged by duplication of the Hox class 3 gene *zerknüllt*, which specifies extraembryonic tissue in insects. This result implies that Bicoid function underwent dramatic changes in the course of insect evolution. As a first step in analyzing the evolution of Bicoid function we studied the function of *Ma-bcd* in the *Megaselia* embryo by double stranded RNA interference (RNAi). We present evidence that *Ma-bcd* specifies more body segments in Megaselia then does *bicoid* in the *Drosophila* embryo. We propose that *bicoid* function was progressively restricted to more anterior regions of the embryo in the course of dipteran evolution.

[3073] *BICOID* AS A PHYLOGENETIC ADDITION TO THE INSECT BODY PLAN

E. A. Wimmer[1], V. Schaeffer[2], A. Carleton[2], P. Harjes[2], M. Simpson-Brose[2], T. Turner[2] & C. Desplan[2], [1]Lehrstuhl Genetik, Univ. Bayreuth, Universitatsstrasse 30, NW I, 95447 Bayreuth, Germany, E-mail ernst.wimmer@uni-bayreuth.de; [2]Dept. of Biology, New York Univ., 100 Washington Square East, New York, NY 10003, USA.

Both Bicoid (Bcd) and Hunchback (Hb) have been shown to act as morphogens in patterning the *Drosophila* embryo along the anteroposterior axis. *hb* has been identified in a wide variety of arthropods and annelids, whereas *bcd* seems restricted to higher dipterans. Therefore, *bcd* might be a newly acquired gene which serves in head development and gradually replaces the function of the ancient morphogen Hb. The problem in studying the specific roles of the two morphogens lies in the Bcd-dependent activation of *hb*. Thus, whenever *bcd* activity is altered, the *hb* activity is also indirectly changed. To overcome this problem, we have developed an *in vivo* system that allows us to study the two morphogens independently of each other. Using this system we can show that the zygotic, Bcd-dependent *hb* expression is dispensable for embryonic segmentation. This shows that the two morphogenetic systems, Bcd and Hb, do not need to be directly linked, which probably reflects their independent evolutionary origins. Moreover, we can show that the graded distribution of Bcd is in principle unnecessary for patterning along the anteroposterior axis, as long as the Hb gradient is unaltered. Bcd distributed uniformly in the embryo can lead to the development of head, thoracic, abdominal and tail structures. Uniform distribution of Hb, however, is inadmissible to proper development. It is conceivable that Bcd acts as a 'generic' activator which is required for the activation of anterior specific genes, but whose graded distribution is not really necessary, which might be a reflection of its novelty in the regulatory network of embryonic patterning.

Index terms: development, *Drosophila melanogaster*, *hunchback*, morphogen, pattern formation

[3074] DORSOVENTRAL PATTERNING IN *TRIBOLIUM CASTANEUM*

S. Roth[1], K. Handel[2] & G. Chen[2], [1]Institut für Entwicklungsbiologie, Gyrhofstr. 17, 50923 Köln, Germany. [2]Max-Planck-Institut für Entwicklungsbiolgie, Spemannstr. 35, 72076 Tübingen, Germany

In *Drosophila* the nuclear gradient of the maternal transcription factor Dorsal determines cell fates along the dorsoventral axis of the embryo by acting as a transcriptional activator or repressor of zygotic target genes. The target genes for mesoderm specification are *twist* and *snail*. We have identified the *dorsal* and *twist* genes from *Tribolium castaneum* (*Tc-dl* and *Tc-twi*) and raised antibodies against their proteins. Like *Drosophila dorsal* (*Dm-dl*), *Tc-dl* is maternally expressed and the protein forms a nuclear gradient, which shows peak levels, centred on the ventral midline. The early gradient forms evenly along the entire anteriorposterior axis despite the fact that the embryo proper develops only from a posteriorly located germ rudiment. In contrast to *Drosophila*, the shape of the gradient changes during blastoderm stages. A shallow nuclear concentration gradient occupying 40-50 % of the egg circumference is followed by a steep gradient restricted to a narrow stripe along the ventral midline. The overlap with the presumed zygotic target gene *Tc-twi* is only transient. When *Tc-twi* expression is well detectable the Tc-Dl gradient has disappeared. No nuclear Tc-Dl is found in the growth zone where *Tc-twi* expression is initiated in each newly forming segment. Thus, here *Tc-twi* cannot be activated by Tc-Dl. We have isolated the promoter of *Tc-twi* and have shown that it is activated ventrally in *Drosophila* embryos. However, *Drosophila snail* appears to act as repressor of *Tc-twi* suggesting an evolutionary change of *snail* function in mesoderm specification. We have also generated *Drosophila* embryos, which express *Tc-dl* instead of endogenous *Dm-dl*. They show dorsoventral polarity, but frequently lack the mesoderm. We try to use transgenic techniques to reconstitute some aspects of *Tribolium* dorsoventral pattern formation in *Drosophila* embryos.

[3075] MOLECULAR MECHANISMSM OF PATIEN FORMATION IN THE INSECT GUT

R. Reuter

ABSTRACT NOT RECEIVED

[3076] PROXIMAL-DISTAL PATTERNING IN *TRIBOLIUM CASTANEUM*, AN INSECT WITH EMBRYONIC LIMB FORMATION

B. Wigand[1], N. Prpic[2], J. Scholten[1], W.G.M. Damen[2] & M. Klingler[1], [1] Zoologisches Institut, Universität München, Luisenstrasse 14, 80333 München, Germany (Email: klingler@zi.biologie.uni-muenchen.de); [2] Institut für Genetik, Universität zu Köln, Weyertal 121, D-50931 Köln (Email: damen@uni-koeln.de).

The current understanding of insect development is primarily based on genetic analysis of *Drosophila*. But embryogenesis in this model system differs in many aspects from that of other insects. One derived character of dipterans is the lack of larval limbs, i.e. the formation of adult appendages from imaginal disks. We study development of the flour beetle *Tribolium*, a species amenable to molecular as well as genetic analysis. In *Tribolium*, the appendages arise during embryogenesis, and one of our goals is to see if pattern formation in embryonic limbs differs from that in imaginal disks. We have cloned *Tribolium* homologues of the limb genes *homothorax* (*hth*), *extradenticle* (*exd*), *dachshund* (*dac*), *apterous* (*ap*) and *pdm*. While *exd* and *dac* are expressed as expected, the remaining genes, especially *hth*, differ somewhat from the respective patterns in *Drosophila*. We will also discuss expression in the head appendages and the larval wing primordia, as well as misexpression in certain limb mutations. In addition to *Tribolium*, we also identified limb genes from the spider *Cupiennius salei*. Expression aspects common to *Tribolium* and *Cupiennius* clearly indicate that subdivision of limbs in *hth/exd*, *dac* and *Dll* expressing domains is a basal character of all arthropods, and therefore typical for all insects. Modifications of these domains in different limbs in some cases can explain morphological specializations. In addition, the expression patterns suggest diverse regulatory mechanisms in the specification of these domains.
Index terms: appendage formation, leg genes, leg mutants, evolution of development

[3077] THE DEVELOPMENT AND EVOLUTION OF BRISTLE PATTERNS IN DIPTERA

C. Wülbeck, D. Pistillo, N. Skaer & P. Simpson, Institut de Génétique et de Biologie Moléculaire et Cellulaire, CNRS/INSERM/ULP, BP 163, 67404 ILLKIRCH Cedex, C.U. de STRASBOURG, FRANCE. E-mail: psimpson@IGBMC.u-strasbg.fr.

The stereotyped positioning of sensory bristles in *Drosophila* has been shown to result from complex spatio-temporal regulation of the proneural *achaete-scute* genes, whose products direct development of the nervous system. Their expression at the sites of each future bristle precursor relies on an array of *cis*-regulatory elements and spatially restricted transcriptional activators. The *achaete-scute* complex of *Drosophila* comprises four closely related, functionally redundant, genes. The isolation of *ac-sc* homologues in three other species of Diptera suggests that the duplication event(s) leading to these four copies preceded the separation of the two families Drosophilidae and Tephritidae, whose common ancestor goes back more than 100 million years, but probably occurred after the, much older, split between the Nematocera and the Brachycera. The complex temporal and spatial regulation in species with stereotyped bristle patterns may have been made possible through gene duplication. Divergence of bristle patterns could arise from changes in the expression pattern of proneural genes, resulting from evolution of the *cis*-regulatory sequences and/or altered expression patterns of transcriptional regulators. The expression patterns of *achaete-scute* homologues in *Ceratitis capitata*, whose bristle pattern differs slightly from that of *Drosophila*, provide evidence for conservation of many *cis*-regulatory elements as well as a common origin for the stereotyped patterns seen on the scutum of many Schizophora. Some aspects of the transcriptional regulation have changed, however, and correlate in the notum with differences in the bristle pattern.
Index terms: *Drosophila melanogaster, Ceratitis capitata, Anopheles gambiae, achaete-scute*, bristles

[3078] HOW HAVE INSECTS PARTITIONED THEIR FOOD RESOURCE WORLD DURING THE PAST 420 MILLION YEARS?

Conrad C. Labandeira, Department of Paleobiology, National Museum of Natural History, Smithsonian Institution, Washington, DC, USA 20560-0121

Modern insects possess an amazing variety of mouthparts and associated head structures, reflected in their consumption of virtually any nutritionally-rewarding substance in terrestrial and aquatic ecosystems. A phenetic analysis of modern insect mouthparts reveals that this immense structural variety is categorized into 34 basic types, arranged into seven larger groupings. These 34 and two additional fossil mouthpart classes were mapped onto their constituent clades, and times of origin were inferred based on fossil occurrences, supplemented by evidence from the direct fossil records of insect mouthparts and insect-mediated plant-damage. A distinct pattern of Late Paleozoic to mid-Mesozoic morphological saturation is evident, indicting that almost all the fundamental ways that insects consume food was completed by the Early Cretaceous at 145 million years ago. Additionally, there is evidence for convergent and iterative origin of most of the 36 mouthpart classes both between the Paleozoic Insect Fauna and the Mesozoic + Cenozoic Modern Insect Fauna, and within each of these evolutionary faunas. This demonstrates that multiple, unrelated clades have evolved repeatedly similar mouthpart types to feed on the same types of plant, fungal and animal tissues in time and space, recognizing that the taxonomic affinity of prey or host food has changed considerably through geologic time. Almost all of these fundamental morphologies originated within the first 65 percent of insect history, and were associated principally with the diversification of pteridiphytic and seed plants during the Late Carboniferous to Late Jurassic, the expansion of freshwater ecosystems during the Permian and Triassic, and the Jurassic radiation of parasitoid clades. The expansion of angiosperms during the Middle Cretaceous resulted in the addition of two new mouthpart types. An alternative geochronology of mouthpart-related activity resides in the undervalued but extensive fossil record of insect-mediated plant damage. From this record, two important categories can be extracted: functional feeding group and dietary guild. Functional feeding groups are characterized by *how* insects obtain their food, and is inferred by modification of a food substrate by a particular mouthpart type. Dietary guild refers to *what* is consumed, and is determined by the assignment of consumed food items to a particular organ or tissue type. These two categories of ancillary fossil data are best documented for plants, and are degraded considerably for single-celled organisms, fungi, and animals. Nevertheless, integration of the insect fossil history of mouthpart type, functional feeding group, and dietary guild can reveal how the ecological partitioning of food resources occurred during the past by the most successful clade of macroscopic organisms.

Key words: mouthparts, functional-feeding-groups, dietary guilds, fossil-history, resource partitioning

[3079] MYRIAPOD AND HEXAPOD MOUTHPARTS: FUNCTIONAL MORPHOLOGY AND PHYLOGENETIC IMPLICATIONS

M. Koch & O. Kraus, Zool. Inst. & Zool. Mus., Univ. Hamburg, Martin-Luther-King-Platz 3, 20146 Hamburg, Germany, E-mail: Markus_Koch@zoologie.uni-hamburg.de.

Chilopoda, Progoneata and Hexapoda are traditionally united in the Tracheata (=Atelocerata), but in recent years the monophyly of this taxon has been repeatedly questioned. In order to contribute further arguments, general aspects of mouthpart differentiation within this major taxon will be discussed, including the presumed ground patterns of the high-rank subtaxa. There are different pathways of transformation and functional adaptation. This especially concerns constructional solutions as to how the preoral cavity is bordered: mandibles, 1st and 2nd maxillae are differently involved. Within the Progoneata, the formation of a gnathochilarium (fused 1st and 2nd maxillae) is only characteristic in one diplopod subtaxon, the Chilognatha. However, comparable structures ("maxillo-labial complexes") also occur in some pterygotes (e.g. certain coleopteran and lepidopteran larvae). Entognathous conditions apparently originated several times independently: not only in the Chilopoda, Pauropoda and some Diplopoda, but also in the Ellipura (Collembola + Protura) and Diplura (previously united as "Entognatha" within the Hexapoda). Mandibles primarily show a common basic plan in being tripartite and provided with an independently movable gnathal lobe. New data support the view that this is probably also true for the hexapod ancestor. Accordingly, previous concepts on early mandible evolution within the Hexapoda are modified; particularly, the traditional distinction between mono- and dicondylic mandibles is abandoned. The diversity of "technical constructions" functionally correlated with the mechanism of food uptake permits conclusions on phylogenetic relationships.

Index terms: Tracheata, feeding mechanisms, mandible evolution

[3080] PROBOSCIS MORPHOLOGY AND SPECIALIZED FEEDING HABITS IN NYMPHALID BUTTERFLIES

H. W. Krenn, Inst. of Zoology, Univ. Vienna, Althanstr. 14, A-1090, Vienna, Austria. E-mail: Harald.Krenn@univie.ac.at.

The proboscis of butterflies is primarily adapted for localizing and sucking nectar out of floral tubes. Among the Nymphalidae (sensu lato), however, various feeding habits have been reported in many species. For example, the neotropical *Heliconius* species use their proboscis for collecting and processing pollen aside from nectar-feeding. Furthermore, there are representatives from different nymphalid subfamilies that virtually never visit flowers for feeding nectar, instead they normally feed on rotting fruits, tree sap or decaying organic matter. In order to interpret their mouthpart morphology in context with food preferences, proboscis length parameters and features of the sensilla equipment (i.e. number, shape and distribution) have been analyzed in representatives with known feeding habits from all major subfamilies of Nymphalidae. Morphological comparisons suggest that specific types of proboscises exist among Nymphalidae. Nectar-feeding species tend to have a long, slender proboscis with short tip region which is equipped with few and rather short sensilla. Nectar plus pollen-feeding Heliconiinae have longer and more numerous bristle-shaped sensilla on their proximal proboscis and shorter labial palpi than related non-pollen-feeding Heliconiinae. Among "non-flower-visiting" Nymphalidae, two types of proboscises have been found. (1) The investigated species of Apaturinae, Limenitidinae, Morphinae, Brassolinae and the non-flower-visiting species among Satyrinae and Nymphalinae have a long tip region in relation to the total proboscis length and the proboscis sensilla are extraordinarily numerous and long. Near the tip, club-shaped sensilla are densely arranged forming a flat brush which enables these butterflies to mop up fluid from wet surfaces. Preliminary results suggest that this "brush-tip" proboscis is more efficient in taking up fluid from rotting fruit than the proboscis of flower-visiting species. A brush-like arrangement of long club-shaped sensilla near the tip evolved several times convergently among Nymphalidae in context with the derived fruit-feeding behavior. (2) The second proboscis type was found in fruit-feeding Charaxinae. Their stout proboscis is equipped with only one row of short and slender sensilla in the tip region. Observations of the feeding behavior in Charaxinae indicate that these butterflies are able to bore holes into decaying fruits. These data suggest that proboscis types correspond rather with certain feeding habits than with phylogenetic relatedness. It can be argued that food preferences are predictable from mouthpart morphology in Nymphalidae.

Index terms: Nymphalidae, mouthparts, food up-take, adaptation, ecomorphology

[3081] BEHAVIORAL ADAPTATIONS TO POLLEN-FEEDING IN *HELICONIUS* BUTTERFLIES

C. Penz[1] & H. Krenn, [1]Invertebrate Zoology, Milwaukee Public, Museum 800 West Wells St. Milwaukee , WI 53233, FAX:(414) 278-6100

Species of *Heliconius* and the closely related monotypic genus Laparus have the unique ability among butterflies to feed on pollen as adults. Physiological studies have demonstrated that nutrients acquired from pollen are used for continuous egg production, prolonged life, and increased chemical defense. This suggests that pollen-feeding has a strong influence on butterfly fitness. Morphological studies on the proboscis showed that although there are no special structures that assist in pollen-feeding, structures ubiquitous to butterflies have been modified in *Heliconius* and Laparus to facilitate pollen-feeding. A well supported morphological phylogeny indicated that the genus Laparus, in combination with Eueides and Neruda, form a sister group to Heliconius, therefore suggesting that pollen-feeding has evolved multiple times within this group. We examined four flower-handling characters in nine heliconiine species in the genera Agraulis, Dione, Dryadula, Dryas, Philaethria, Eueides, Laparus and Heliconius, and the nymphaline Anartia fatima. Analysis of four behavioral characters showed that pollen-feeding species manipulate Lantana flowers faster and more thoroughly as compared to non-pollen-feeding relatives. Although this suggests that pollen-feeding species are potentially more efficient in harvesting pollen, every butterfly tested successfully removed pollen from Lantana and non-pollen-feeding butterflies generally extracted larger amounts of pollen than Heliconius and Laparus. Our results, in concert with those of previous morphological analysis, indicate that behavioral and structural attributes associated with pollen-feeding in Heliconius and Laparus are subtle modifications of widespread butterfly characteristics, and raise the question of why other butterflies do not use pollen in their diet.

[3082] FLIES THAT TAP CONCEALED NECTAR: MORPHOLOGICAL INNOVATIONS OF THE PROBOSCIS IN BOMBYLIIDAE (DIPTERA)

N. U. Szucsich & H. W. Krenn, Inst. of Zoology, Univ. Vienna, Althanstr. 14, 1090 Vienna, Austria e-mail: a8708777@unet.univie.ac.at

Among flower visiting insects elongated mouthparts are a widely distributed feature that evolved as adaptation to floral morphology. Few attempts have yet been made at identifying morphological details that evolved when concealed nectar sources are tapped. All adult Bombyliidae are regular flower visitors. Of these *Hemipenthes morio* possesses a 1.5-3 mm long proboscis which while at rest is totally withdrawn into the oral cavity. To take up food it is unfolded vertically. Despite the same body size, the proboscis of *Bombylius major* is 10-13 mm long and projects horizontally over the edge of the oral cavity. In addition to the unfolded feeding position, this species can feed with a horizontal proboscis posture, allowing food uptake while hovering in front of blossoms. The morphological comparison of heads and mouthparts of these two species revealed (1) an additional feeding position, (2) a novel feeding mode, and (3) modifications in feeding pumps and sealing structure in *B. major* that can be discussed in context with feeding nectar out of blossoms that (1) open to the side, (2) have narrow and (3) deep corolla tubes, respectively. Regardless of its length, the principle morphology of the proboscis is similar in both species, comprising the basal fulcrum, the central proboscis unit that can be flexed against the fulcrum, and the labella as the location of food uptake. Although *B. major* can take up food while the proboscis is in a horizontal posture, both species share the same kinematical mechanisms of the proboscis. The additional feeding position is enabled by an enhanced moveability of the central proboscis unit against the fulcrum. While sucking up fluids *H. morio* spreads its labella to feed in the "sponging feeding mode". Feeding out of narrow corolla requires a proboscis which functions as a "drinking straw". In *B. major*, this is realized by narrow labella which show only few longitudinal pseudotracheae, while the labella of *H. morio* are broad, with a comblike arrangement of numerous pseudotracheae. It can be hypothesized that the evolution of highly elongated proboscides has led to increased demands in both pumping mechanisms and sealing structures. In *B. major* a prolongation of the proboscis is accompanied by a lengthening of the labro-epipharyngeal pump, thus achieving an increased pumping force. In this species lateral protrusions of the labrum enhance the efficiency of sealing the single components of the haustellum fluid-tight. We may assume that similar morphological and functional modifications also occur in other groups of nectar feeding insects.
Index terms: functional morphology, flower visitors, evolution

[3083] FUNCTIONAL MORPHOLOGY AND ECOLOGICAL IMPLICATIONS OF THE ADHESION-CAPTURE APPARATUS OF *STENUS* SPECIES (COLEOPTERA, STAPHYLINIDAE)

O. Betz, Zoologisches Institut der Universität Kiel, Ökologie, Olshausenstr. 40, D-24098 Kiel, Germany, Email: obetz@fmnh.org

Among insects, the modified labium of *Stenus* species is one of the most specialized prey-capture structures. Structure and function of this labium have been reinvestigated by using light microscopy, scanning electron microscopy, transmission electron microscopy, high speed cinematography, and video recordings. These investigations ended in the construction of a functional model of the capture mechanism which includes the mode of protrusion of the elongated labium and the expansion and concurrent erection of both sticky cushions which are situated on the apex of the labium. The comparison of the outer morphology showed that, on the species level, the labium has been modified with respect to its length and the morphology of its sticky cushions. It has been shown experimentally that larger sticky cushions together with higher numbers of adhesive contacts improve adhesion and thus lead to enhanced capture success. Since most species make use of the mandibles as an alternative capture technique, within-species comparisons of the performance abilities of both capture techniques (i.e. velocity, mode of prey seizure, range, rate of occurrence, and capture success) could be carried out. These experiments led to the conclusion that the specialized labial apparatus of *Stenus* beetles provides an ecological advantage in that it permits these predators, in spite of the limited reaction ability and agility of many *Stenus* species, to catch prey that are capable of rapid escape responses.
Index terms: mouthparts, labium, prey-capture, predation, ecomorphology

[3084] SETAE ON HEAD AND MOUTHPARTS: ADAPTATIONS TO PREY CAPTURE

T. Bauer, Zoologisches Institut der Universität Kiel, Ökologie, Olshausenstr. 40, D - 24098 Kiel, Germany, e-mail:thbauer@zoologie.uni-kiel.de

Setae of different size and length which are situated in variable numbers on head, antennae and mouthparts of predatory insects normally serve as sensilla for detecting mechanical and chemical cues during predation. In any species single setae have more or less special functions, depending on their position. The particular function is indicated by the construction of the setae. Examples are the long and thin mechanosensilla of ground beetle larvae, that serve to detect the exact position of prey animals in total darkness without stimulating their flight and very short, highly specialized mechanosensilla on the head tip which strike the prey during attack and trigger closing of the mandibles. Setae that help to fix the prey during attack, especially when the prey is fast and difficult to catch, are normally long and strong and equipped with sockets of special shape which allow the setae to be bent in one direction but maintain them in an upright position if they are pushed in the opposite direction. Examples are found in the Carabid genera *Nebria*, *Leistus* and *Loricera* and even in spiders, e.g. in the Linyphiid *Drapetisca socialis*. Among predacious water insects mechanosensilla may act as detectors of waves generated by their prey. This is reflected by their position and shape, as shown, for example, in the larva of *Hyphydrus ovatus*.

[3085] BODY SIZE AND TRACHEAL FUNCTION IN GRASSHOPPERS

J.F. Harrison, J.J. Lafreniere, K.J. Greenlee, S.D. Kirkton & M. Frazier, Dept. of Biology, Arizona State University, Tempe, AZ 85287-1501, email: j.harrison@asu.edu.

Theoretical studies have suggested that body size should have major effects on the respiratory physiology of insects, and that these allometric effects may affect many aspects of insect structure and function; however, empirical studies have been lacking. The primary goal of these experiments has been to examine the effect of body size on tracheal structure and function during the growth of the grasshopper, *Schistocerca americana*, the American locust. In the first set of studies, we examined the effect of body size on the morphology, and diffusive and convective conductances of the primary transverse tracheae which supply the gut of *S. americana*. Tracheal diffusive conductances (calculated as: (tracheal area * Krogh's diffusion constant for oxygen) / tracheal length) increased with size, but with a lower slope than the increase in resting oxygen consumption with size. In contrast, flow conductance (calculated as tracheal area squared / (tracheal length * 8 * pi * air dynamic viscosity)) increased in parallel with the rise in whole animal oxygen consumption with size. The calculated pressures necessary to drive convection through the trachea remain constant with size, while the partial pressure gradient necessary if all gas exchange occurred by diffusion increased strongly with size. These data are consistent with the hypothesis that convection is necessary for insects to achieve large size. In a second project we determined the effect of atmospheric oxygen levels on the ventilation rate and critical P_{O2} for carbon dioxide emission (M_{CO2}, µmol/h) of resting *S. americana* of different sizes (ages). Adult grasshoppers exhibited exponentially increasing ventilation rates as atmospheric P_{O2} decreased and constant M_{CO2} down to critical P_{O2}'s in the range of 2-3 kPa. In contrast, the M_{CO2} of small grasshoppers was depressed in a graded fashion by hypoxia. First instar grasshoppers (10 mg) had ventilation rates similar to adults in 21 kPa P_{O2} atmospheres but did not increase ventilation rates in response to hypoxia. Development of chemosensitivity may cause the size-related variation in oxygen-sensitivity. In a third project, grasshoppers of the various instars were forced to jump until fatigued in normobaric atmospheres at six P_{O2}'s ranging from 5 to 40 kPa. Adult but not juvenile jumping performance was strongly stimulated by hyperoxia, suggesting that the oxygen delivery capacity to the leg muscle decreases relative to metabolic needs in larger animals. Finally, studies of the effect of atmospheric oxygen levels (10, 21, 40 kPa) on development suggest that atmospheric oxygen has minimal effects on body size and growth rate of this grasshopper, but may increase tracheal diameters.
Index terms: respiration, *Schistocerca americana*, hypoxia, ventilation

[3086] ACTOGRAPHIC RESPIROMETRY REVEALS THE STRATEGIES OF SPIRACULAR CONTROL OF GAS EXCHANGE IN INSECTS

P. Kestler[1], S.T. Persijn[2], F.J.M. Harren[2] & J. Reuss[2], [1]Dept. of Biology; Physiological Ecology and Entomology, Univ. of Osnabrück, D-49069 Osnabrück, Germany, E-mail: kestler@uos.de; [2]Dept. of Molecular and Laser Physics, Univ. of Nijmegen, Toernooiveld 1, NL-6525 ED Nijmegen, the Netherlands.

Actographic flow through respirometry (FTR) was introduced by Kestler (1971). Specific patterns of CO_2 release from a differential infra-red gas analyzer (DIRGA) were calibrated for the first time by simultaneous event recordings of microscopic observations of behavior, pumping movements and spiracles in adult *Periplaneta americana* which were free to move. Independent of temperature *Periplaneta, Blaberus discoidalis, Schistocerca gregaria* and *Carabus problematicus* showed only at rest eupnoic (C)FV cycles similar to the (C)FO cycles known from diapausing pupae only (Schneiderman 1960). This showed for the first time that many resting adult insects use active cyclic ventilation and not only diffusion control. The nice CO_2 patterns due to single pumping movements or spiracle openings must have been so convincing that later behavioral calibration by simultaneous observations were only seldom made in the numerous forthcoming continuous recordings with FTR or closed system respirometry (CSR). Lacking behavioral calibration, low time resolution and species differences have lead to many uncertainties. To avoid them we combine in a running EC project a DIRGA for CO_2 and a most sensitive CO laser-photo-acoustic (LPA) spectrometer for H_2O or CH_4 with simultaneous microscopical video recordings under changing ambient conditions. We can specify different behavior during activity and separate during rest cuticular from oral, anal or tracheal losses. Within tracheal losses we can separate not only C and F behavior of the spiracles but also the diffusive from the convective part during active ventilation. Molar ratios of spiracular release of CO_2 or CH_4 and H_2O allow actual calculations of tracheal CO_2 or CH_4 partial pressures and experimental testing of the four combined water retention strategies: minimization of opening, separation of in- and e-fluxes by co- or anti-current diffusion, interburst maximization of CO_2 over H_2O partial pressure and replacement of diffusion by convection in the burst. We analyze further cyclic H_2O losses of all cockroach larval stages and of thripses. In future MS, balance or CSR recordings of CO_2 release or O_2 uptake must be added to LPA in those cases where DIRGA's are at their limit of resolution. Simultaneous recordings of as many additional parameters as possible including myograms have to be added too.

Index terms: *Periplaneta americana*, respiration, cyclic ventilation, spiracles, burst

[3087] RECORDING OF SPIRACULAR FUNCTIONS BY ARTIFICIALLY GENERATED PRESSURE PULSES

K. Sláma, Inst. of Entomology, Czech Academy of Sciences, Drnovská 507, 16100 Praha 6, Czech Republic; slama@entu.cas.cz.

After invention of special methods for recording changes in haemocoelic pressure in 1976, I also attempted to record endotracheal pressures through the spiracles. Unfortunately, these recordings never produced practically useful results. The obstacle was due to mutual interconnections of all spiracles. The cannulated spiracle became soon recognized by the nervous system and it was opened within some 10-15 min. Since then, the barographs recorded only the trivial changes in overall haemocoelic pressure. In 1984, I invented a new, micro-anemometric technique for simultaneous recording of inspirations from multiple spiracles. The advantage of this method was that it permitted recording of air passage through absolutely unrestrained spiracles. It also enabled recording of coordinated pulsations of different spiracular valves during the extracardiac haemocoelic pulsations. These results indicated that insects could actively regulated breathing by means of an autonomic, cholinergic nervous system (coelopulse) localized in thoracic ganglia of the ventral nerve cord. In contrast to the perfectly synchronised pulsation of spiracular valves during extracardiac pulsations, spiracular behaviour during the resting period remains still rather obscure. The results of previous anemometric recordings suggested that spiracles might be during this period closed, with exception of one or a few alternating valves that were incompletely constricted or flashed briefly once in a few min. (passive suction inspiration). In order to obtain more informations in this respect, I tried to develop another method, which was based on physical proportions between the volume, internal pressure and external surface of insect body. I knew from some earlier observations that a relatively small abdominal compression could cause a large positive peak in haemocoelic pressure, provided that all spiracles had been tightly closed. Alternatively, when certain spiracles were open, the same abdominal compression produced only a bulk flow of air through the spiracles without profound impact on haemocoelic (internal) pressure of the body (effect as of a punctured ball). The described isometric-anisobaric physical principle has been now used for recording of spiracular openings. Artificially generated pressure pulse has been externally applied to insect body, whose abdominal movements were monitored by a strain-gauge sensor positioned at the tip of abdomen. The closure, constriction or opening of spiracles could be easily discerned on the records by sudden appearance, modulation or disappearance of the pulse, respectively. The results of these recordings will be presented, with special emphasis on functions of the spiracular valves during the passive suction inspiration, extracardiac haemocoelic pulsation, or during spiracular outpuffs of CO_2. The measurements were mainly performed on pupae of several species of Coleoptera, Lepidoptera and Diptera. Index: Spiracular functions, Spiracular pulsations, CO_2 outpuffs.

[3088] COMPARATIVE MORPHOLOGY OF THE SPIRACLES OF THE PAPILIONIDAE, SPHINGIDAE, AND SATURNIIDAE (INSECTA: LEPIDOPTERA)

A. Schmitz[1], L. T. Wasserthal[2], [1]Inst. of Zoology, Univ. of Bonn, Poppelsdorfer Schloss, 53115 Bonn, GERMANY, E-mail ankeschmitz@uni-bonn.de; [2]Inst. of Zoology I, Univ. of Erlangen, Staudtstr. 5, 91058 Erlangen, GERMANY, E-mail ltwthal@biologie.uni-erlangen.de

The morphology, ultrastructure, and innervation of the spiracles of the instars and adults of representatives of three lepidopteran families were examined: *Ornithoptera priamus poseidon* and *Pachliopta aristolochiae* (Papilionidae), *Attacus atlas* (Saturniidae), and *Acherontia atropos* (Sphingidae). Adults possess 2 thoracic (pro- and metathoracic) and 7 abdominal pairs of spiracles, while larvae and pupae have 1 thoracic (prothoracic), and 8 abdominal pairs of spiracles. Although the first abdominal spiracle in pupae develops a closing apparatus, it is not open to the atmosphere. In the last pupal spiracle, a closing apparatus is lacking and the peritreme is fused. The metathoracic spiracles of the adults are external closing systems; all other spiracles have internal valves. Peritreme and atrium show stage- and family-specific structures for protecting the internal valve apparatus. The gross morphology of the cuticular valve mechanism is uniform within the three families, consisting of a rigid bow and a movable bar with a lever. In all stages, the lever is oriented caudally in the abdominal spiracles and cranially in all thoracic spiracles. An opener extends from the tip of the lever toward the segmental boundary, where it is attached to the body wall. Bow and bar are connected ventrally and dorsally by thinner and weakly sclerotized cuticular parts. The closing muscle, which is innervated only by motor neurons, inserts between the tip of the lever and the ventral atrium. The elasticity of the cuticular system and the opener are the antagonists to the closing muscle. In adult Papilionidae, all cuticular parts (bow, bar and lever) of the valve are innervated by multipolar dendrites. The opener of the adult Papilionidae and of all instars of the moths is a non-innervated elastic ligament. The opener of the larval and pupal spiracles of the Papilionidae, however, is a single thickened muscle fiber surrounded by an elastic sheath of connective tissue. As it contains motor and multipolar sensory neurons, we assume that it may function as a stretch receptor for controlling the spiracular opening state. Internal or external cuticular chemo- or hygroreceptors, which could participate in the regulation of respiration, could not be detected in any stage.

Index terms: insect respiration, tracheal system, spiracular valve apparatus.

[3089] SPIRACULAR CONTROL OF ENDOTRACHEAL OXYGEN PARTIAL PRESSURE IN MOTH PUPAE

S.K. Hetz, Department of Animal Physiology, Humboldt-Universität zu Berlin, Philippstrasse 13, 10115 Berlin, Germany; e-mail: Stefan.K.Hetz@rz.hu-berlin.de

Diapausing butterfly pupae are known to release carbon dioxide discontinuously during a so-called "burst". Oxygen uptake is more or less continuously by repeated brief openings, the so-called flutter behaviour of the spiracles. Diffusional oxygen uptake is driven by oxygen partial pressure differences between the endotracheal space while hydrostatic pressure gradients allow gas exchange by convection. The convection part of the oxygen uptake is considered to counteract respiratory water loss by minimizing anticurrent diffusion of water. The present work aimed on studying the control mechanisms in oxygen uptake in diapausing pupae of *Attacus atlas*. The experiments were performed by recording spiracular activity (carbon dioxide release and endotracheal pressure) and endotracheal oxygen partial pressure simultaneously while changing ambient oxygen partial pressure in a flow- through system. Normoxic, hyperoxic and hypoxic gas mixtures were applied for at least two complete respiratory cycles, followed by two cycles under normoxic conditions. The results indicate that spiracular activity is controlled according to ambient oxygen partial pressure. At high external oxygen levels, the duration of constriction depended linearly on the amount of oxygen taken up into the tracheal system. Minimum endotracheal hydrostatic pressure falls below -2500 Pa. Mean hydrostatic endotracheal pressures, flutter frequencies and mean carbon dioxide release rates during flutter periods were lower than under normoxic conditions. Under slightly hypoxic conditions, the duration of the constriction period decreased, whereas the duration of the whole flutter period increased. Severe hypoxia (oxygen partial pressures about 5 kPa) caused the spiracles to flutter instantaneously at a high frequency since the time necessary to obtain a certain amount of oxygen increased, leading to more frequent spiracle openings. So, during constriction and fluttering spiracular activity is adapted to a certain endotracheal oxygen partial pressure, aiming at an adjustment of the endotracheal oxygen partial pressure to meet the metabolic demands of the tissues.

Index terms: respiration, discontinuous carbon dioxide release, oxygen, *Attacus*

[[3090] INSECT LUNGS

M. Locke, Department of Zoology, University of Western Ontario, London, Ontario, Canada, N6A 5B7, e-mail mlocke@juliam.uwo.ca

Insects have been known to respire by air filled tubes since the time of Swammerdam in the mid 17th century. Numerous studies since then have confirmed his observations, showing that since insect blood usually lacks oxygen-carrying pigments, diffusion in the gas-filled lumen of their tracheal systems meets their respiratory needs. Outside air enters the tracheal system through segmentally arranged spiracles, diffuses along tubes of cuticle secreted by tracheal epithelia and then to tracheoles, thin walled cuticle tubes that penetrate in or between the cells of all tissues. The only recognized exceptions have been blood cells (hemocytes), which are not tracheated because they float freely in the hemolymph or are only superficially attached to tissues. In caterpillars, anoxia causes hemocytes to be released from the tissues and to pass with the hemolymph through tufts of thin walled tracheae near entrances to the heart opposite the 8th (last) pair of abdominal spiracles. The tufts of thin walled tracheae are positioned to aerate both hemolymph and hemocytes. Hemocytes changed in their structure due to anoxia revert to their normal aerated form near the tufts. Thin walled tracheae occur in a second location at the tip of the abdomen in the more slowly moving hemolymph of the tokus compartment, where they are adorned with hemocytes. These two specializations of tracheae in the 8th segment and tokus may therefore form lungs for hemocytes and hemolymph, a novel concept in insect physiology.

[3091] THE CENTRIOLE IN INSECT SPERMATOZOA

R. Dallai[1], **B.A. Afzelius**[2] **& G. Callaini**[1], [1]Dept. of Evolutionary Biology, Univ. of Siena, via P. A. Mattioli 4, I-53100 Siena, Italy, E-mail dallai@unisi.it; [2]Arrhenius Laboratories F3, Stockholm Univ. S-106 91 Stockholm, Sweden.

Insect spermatozoa are usually characterized by one basal body only, derived from the single centriole present in the spermatid. Evidence given by Friedländer and Warman (1971) on the lack of centriole replication at the second meiotic division of spermatogenesis could thus be confirmed with fluorescence microscopy using an antibody raised against centrin. In most insect orders the centrioles consist of 9 microtubular doublets, often also a third microtubule namely the accessory tubule, immersed in an electron dense material (Dallai and Afzelius, 1990; Dallai *et al.*, 1995, 1996). These doublets are devoid of dynein arms and sometimes conserve a cartwheel array of the centriole units. In *Drosophila* and related brachyceran species, however, the sperm centriole has a classical centriole, thus consisting of microtubular triplets (Dallai and Afzelius, 1991). After fertilization, the centriolar structure is the site for organization of the sperm aster of the first zygotic spindle (Riparbelli *et al.*, 1997). Fluorescence microscopy and blot analysis (using CP 190 and γ-tubulin) indicate that in *Drosophila* centrosomal material was undetectable in mature spermatozoa, but soon after the sperm entry, maternal material was recruited around the basal body to form the functional centrosome (Callaini *et al.*, 1999).

References:
Callaini G, Riparbelli M.G., Dallai R. 1999. Biol. Cell 91: 355-366.
Dallai R., Afzelius B.A 1990. Biol. Cell 70: 19-26.
Dallai R., Afzelius B.A. 1991. Int. J. Insect Embryol. 20(45): 215-222.
Dallai R., Lupetti P., Afzelius .A., Mamaev B.M. 1995. Zoomorphology 115: 213- 219.
Dallai R., Lupetti P., Frati F., Mamaev B.M., Afzelius B.A. 1996. Zoomorphology 116: 85-94.
Friedländer M., Warman J. 1971. J. Morphol. 134: 383-398.
Riparbelli M.G., Whitfield W.G.F., Dallai R., Callaini G. 1997. Mech. Dev. 65: 135-144.
Index terms: *Drosophila melanogaster*, centrosome, fertilization.

[3092] TESTIS DIFFERENTIATION - ROLE OF APICAL COMPLEX

A. Dorn, E. D. Schmidt, S. Balles & U. Maas, Institute of Zoology, University of Mainz, D-55099 Mainz, Germany.

The apices of insect testis follicles contain, as a rule, one or more conspicuous somatic cells which are termed apical cell (if they occur singular), apical complex *sensu stricto* (if they consist of a small cluster) or apical tissue (if cells amass to a tissue-like formation). Several hypotheses were put forward as to their role during testis differentiation: Apical complexes may have a trophic function; they may remove degenerating spermatogonia and thereby help to provide space for developing spermatogonia; they may prevent neighboring stem cells from entering the spermatogonial pathway. In a unique case among insects, the glow worm *Lampyris noctiluca*, the apical testis tissue is believed to produce a true androgenic hormone which determines the primary and secondary sexual characters in this coleopteran (NAISSE, 1966). We studied 3 species, including *Lampyris noctiluca*, representing the 3 types of apical complex organization and 3 insect orders. In orthopterans (*e.g. Schistocerca gregaria*) each testis follicle contains one large star-like apical cell which changes little from first larval stage to death. Its cellular extensions penetrate the intercellular spaces between the surrounding stem cells. The most prominent feature of the apical cell is the abundance of smooth ER. In the heteropteran *Oncopeltus fasciatus* about 12 cells form an apical complex *sensu stricto* per follicle. Also in this hemimetabolan insect the apical complex shows its typical appearance throughout the whole postembryonic life cycle. The cells exhibit a very scant, electron dense cytoplasm which offers no clue as to the functional significance of the cells. The surrounding stem cells, however, form numerous branching cell projections towards the apical complex. The terminals of the projections are closely packed around the apical complex and contain numerous lysosomal bodies and autophageous vacuoles. In the holometabolan *Lampyris noctiluca* testis differentiation and sperm maturation take place during a relatively short period of the life cycle, namely during the last larval and the pupal stage. The apical tissue is a very transient formation that develops to envelope cells of spermatocysts. Whereas the apical tissue reveals no specialized subcellular organization, the cells become packed with smooth ER after their transformation to cyst envelope cells. The findings are discussed in connection with the reproductive strategies of the 3 species. In *Schistocerca gregaria* and *Oncopeltus fasciatus* our observations are in support of the hypothesis that by direct local interaction of stem cells with the apical complex, the stem cells may be prevented from enterering the spermatogonian pathway.

Index terms: Testis, apical complex, *Oncopeltus fasciatus, Lampyris noctiluca, Schistocerca gregaria.*

[3093] ORGANELLE MODIFICATION DURING INSECT SPERMIOGENESIS

H. Dolder, Dept. of Cell Biology, I.B., UNICAMP, C.Postal 6109, 13083-970 Campinas, São Paulo, Brasil.

Spermatogenesis is a very interesting process where a rapid differentiation process can be observed in which a newly divided cell is transformed into a very specific cell type. Cell modification is accelerated after meiosis so that the resulting spermatids form structures that are unique to this cell lineage by morphofunctionally altering the organelles that they retain and by eliminating the cytological elements that sperm cells will no longer need. This developmental stage, known as spermiogenesis, can furnish important data on morphological aspects of cell differentiation. The process has been extensively studied in vertebrates, but it is in invertebrates that a large structural variation can be found, providing a fascinating challenge for research in this area. In some insects, distinguishing characteristics can be identified that are restricted to Families and even a particular Genus. This specificity has proved to be an interesting contribution toward taxonomic identification and to phylogenetic studies. Initial modification of the spermatid shows a very well developed Golgi complex principally involved in forming the acrosome. This vesicle grows with the fusion of smaller Golgian vesicles, attaches itself to the membrane of a still rounded nucleus and is directed toward the anterior nuclear region. Acrosomic maturation leads to a compacting of its enzymatic content, often revealing a well organized pattern. Nuclear condensation, and elongation, although common to most insects, with the chromatin being wound into thick ropes, can be very distinct in their aggregation mechanisms. Perhaps the most strongly modified organelles are the mitochondria which aggregate and fuse progressively until they form two entwined structures which elongate to accompany the flagellar axoneme. In the final stages of development, they are undergo such a complete transformation that their ultrastructure is not easily recognized. Highly organized rows of microtubules are present in all elongation events. They are disorganized after completing their functions, leaving only the axoneme with the typical 9+9+2 arrangement, common to most of the insects. Illustrations can be taken from the spermiogenesis of an hemipteran, *Triatoma infestans*, the coleopterans, *Cosmopolites sordidus* and *Demetrius ates*, a dipteran, *Ceratitis capitata*, some hymenopterans and a lepidopteran, *Euptoieta hegesia.*

[3094] ULTRASTRUCTURE OF DIMORPHIC SPERMATOZOA AND THEIR FERTILIZATION IN CICADIDAE (HEMIPTERA)

M. Kubo-Irie *, M. Irie [2], T. Nakazawa[1], & H. Mohri [3], [1]Biol. Lab., Univ. of the Air, Chiba, 261-8586, Japan, E-mail miyoko_kubo_irie@hotmail.com; [2]Dept. E.E.C.E. Waseda Univ., Tokyo 169-8555, Japan; [3] Nat. Inst. for Basic Biol., Okazaki 444-8585, Japan

Sperm polymorphism in many invertebrates has demonstrated gross morphological variations of the nucleus and cytoplasm as well as simple size differences. Two different sized spermatozoa were observed microscopically in the Japanese cicada, *Graptopsaltria nigrofuscata* (Kato 1956). Although cicada sperm ultrastructure has been investigated, (Folliot and Maillet 1970, Jamieson 1987), no report has been made regarding the effects of sperm polymorphism on fertilization. In this paper, spermiogenesis and fertilization were observed in Japanese cicada, *G. nigrofuscata* under either electron microscope or fluorescent microscope. The sperm nuclear length was determined by supravital staining technique with a fluorescent dye and computer analysis. In early stage of spermiogenesis two kinds of spermatids with different nuclear volumes were present in the testis. There was no differences in the organization of the acrosome and flagellum. Both kinds of spermatozoa were transferred from the vesicular seminalis to the female spermatheca, and subsequently were released from spermatodesm. They were demembraned in the spermathca separating the nucleus, axoneme and mitochondrial derivatives. The ratio of two kinds of sperm was the same in the vesicula seminalis (male) and in the spermatheca (female). To determine potential differences for fertilization, spermatozoa were observed within the fertilized egg. The result indicated that the sperm with a longer nucleus effectively fertilized eggs.

Index terms: Cicadidae, sperm dimorphism, fertilization.

[3095] ULTRASTRUCTURES AND MOVEMENTS IN THE SPERMATOZOON OF STAG BEETLES

M. Irie [1], M. Kubo-Irie [1], S. Ishijima [2], H. Mohri, [3], [1] Dept. E.E.C.E. Waseda Univ. Shinjuku, Tokyo, 169-8555, Japan; [2] Bio. Lab, Fac. Biosci. and Biotec., Tokyo Institute of Technology Tokyo, 152-8551, Japan; [3] Nat. Inst. for Basic. Biol. Myodaijicho, Okazaki, 444—8585, Japan.

The insect spermatozoa are filiform and typically composed of an acrosome, a condensed nucleus, elongated mitochondrial derivatives and a long flagellum. Some insects have a centriole adjunct, a dense cylinder surrounding the centriolar region, in the sperm tail. The correlation between this ultrastructure in the spermatozoa and the movement of sperm is not well understood. To address this issue, mature sperm of the Japanese stag beetles, *Dorcus cavidens binodulus* were examined. Individual spermatozoa freed from the testicular cysts were obtained directly from the vesicular seminalis. Samples for electron microscopy were treated with the routine methods and the centriole adjunct of the sperm tail was observed longitudinally. To clarify the position of nucleus, samples were stained with Hoechst 33342. Sperm movement was monitored under a fluorescent microscope. Movement of the spermatozoa was divided into sinusoidal components with Fast Fourier Transformation to examine the effects of centriole adjunct. The sperm tail consisted of a 9+9+2 type of axoneme, a pair of mitochondrial derivatives and a centriole adjunct. In the stag beetle, the centriole adjunct extended about half the length of the whole flagellum and partly covered the outside of two mitochondrial derivatives. The three dimensional movement of the sperm was reduced into two helical wave components with independent amplitudes and frequencies originating from the zone around the centriole adjunct that links the nucleus with the flagellum..In the stag beetle, the centriole adjunct, characterized by its unusual position in mature spermatozoa, affects the movement of their extremely long flagellum.

index terms: stag beetle, sperm

[3096] PHYLOGENETIC RELATIONSHIP ON SPERM ULTRASTRUCTURE OF THE STAG BEETLES (COLEOPTERA-LUCANIDAE)

M. Kubo-Irie [1], I. Miura [1], T. Nakazawa [1], M. Irie [2], & H. Mohri [3], [1]Biol. Lab., Univ. of the Air, Chiba 261-8586, Japan, E-mail miyoko_kubo_irie@hotmail.com; [2] Dept. E.E.C.E., Waseda Univ. Tokyo 169-8555, Japan; [3] Natl. Inst. for Basic Biol., Okazaki, 444-8585, Japan.

The phylogeny and evolution of insects has been investigated on the basis of sperm morphology. Jamieson (I987) coined the term "spermiocladistics" for usage of sperm ultrastructure as the basis of phylogenetic analysis. In the family Lucanidae (Coleoptera), various hypotheses concerning the generic and species level relationships were based on morphological characteristics. Opinions about subgeneric and species level classification differ (Kurosawa 1985, Kikuta 1986). Recently, the phylogenetic relationships among the 12 genera of Japanese stag beetles were analyzed by comparing partial nucleotide sequences of the mitochondrial cytochrome b gene (Miura et al., 1998). However, there has been no report concerning sperm ultrastructure in the family Lucanidae to determine if sperm ultrastructure and molecular phylogeny correlate. In this study, sperm ultrastructures of all genera of the Lucanidae family available in Japan were examined by electron microscopy. We gave special attention to the centriole adjunct, a unique structure in the sperm tail. Centriole adjuncts were classified into three patterns: fan, crescent or compound shape in the sperm tail cross section. The fan pattern was found in *Aesalini* and *Platycerini*. The crescent pattern was in *Figulini* and *Nigidiini*. The compound pattern was found in the remaining genera. The ratios of the nuclear length to the whole sperm length were also compared. No correlation was found between genera in this regard. In conclusion, classification of Lucanidae family based on the centriole adjunct pattern appears to correlate with the molecular phylogenetic tree.

Index terms: Sperm ultrastructure, phylogeny, stag beetle ultrastructure, movement

[3097] ABERRANT SPERMATOGENESIS AND POST ZYGOTIC SEX-DETERMINATION IN COLLEMBOLA

R. Dallai, F. Frati & P. P. Fanciulli, Dept. of Evolutionary Biology, Univ. of Siena, Via P.A. Mattioli 4, I-53100 Siena, Italy, E-mail dallai@unisi.it.

Chromosomal and electron microscopy evidences have been obtained to describe the peculiar spermatogenesis in some species belonging to Sminthuridae and Dicyrtomidae. In these species, the two sexes differ for the lack of two chromosomes (the sex-chromosomes) in males. While oogenesis seems to proceed normally with evident chiasmata between bivalents of the oocytes, spermatogenesis is peculiar because chromosomes of spermatocytes do not pair and the two daughter cells at the end of the first meiotic division have different chromosome numbers. Cells receiving fewer chromosomes degenerate, while those with a normal haploid set of chromosomes complete the second meiotic division and produce homogametic spermatozoa. At fertilization, sexually indifferentiated zygotes are formed: while female embryos will retain the complete diploid set of chromosomes, male embryos lose 2 sex chromosomes during the first mitosis. The sex-chromosomes system of these species can be identified as $X_1X_1X_2X_2$:X_1X_20. The finding of the same peculiar spermatogenesis and sex-determination in 6 genera from 2 different families of Symphypleona suggests that this mechanism may be common to the whole suborder. Conversely such system has not been observed in the studied species of Arthropleona. This peculiar sex-determining mechanism (post zygotic sex-determination) could allow females to control the sex-ratio of the progeny, thus having an important adaptive significance for the species.

Index terms: Symphypleona, chromosome elimination, aberrant meiosis, spermatogenesis

[3098] THE GIANT SPERM AXONEME OF THE GALL-MIDGE FLY *ASPHONDYLIA RUEBSAAMENI* KERTESZ: FINE STRUCTURE AND DEVELOPMENT

P. Lupetti, C. Mencarelli, & R. Dallai, Dept. of Evolutionary Biology, Univ. of Siena, via P.A. Mattioli 4, I-53100 Siena, Italy, E-mail lupetti@unisi.it.

The giant sperm axoneme of the cecidomyiid fly *Asphondylia ruebsaameni* consists of a great number of microtubular doublets (up to 2500) arranged in a double spiral wrapping around an axial cluster of mitochondria. Each microtubular doublet is provided with an outer dynein arm only. In the perinuclear region of the early spermatid a large system of curved multi-layered filamentous material has been observed in close association with membranous cisternae. Such a system extends throughout the cytoplasm to contact the plasma membrane. The filamentous material appears to act as a nucleating centre for the assembly of the microtubular doublets, which initially have a submembranous location and later are distributed in the interior of the cell. After their assembly, microtubular doublets are associated pairwise and are arranged in a single microtubular row with a zig-zag configuration. Later on, during spermiogenesis, microtubular doublets pairs rotate and the excess cytoplasm is eliminated compacting the axonemal complex. This process leads to the formation of a double parallel spiral of microtubular doublets. Quick-freeze, deep-etching EM of demembranated spermatozoa revealed the presence of a globular component located in the foot region of outer dynein arms. This domain was not observed in similar preparations of spermatozoa from the related species *Monarthropalpus flavus* (Lupetti et al. 1998) which belongs to a different supertribe. This observation, together with the differences we have noticed in the sperm axonemal model corroborate the hypothesis of a relationship between the supertribes Asphondyliidi and Cecidomyiidi (Dallai et al. 1996) which, however, would belong to two separate lineages

[3099] TRYPSIN-INDUCED MOTILITY IN *MANDUCA SEXTA* SPERMATOZOA *IN VITRO*

M. Friedländer[1], A. Jeshtadi[2] & S. E. Reynolds[2], [1]Dept. of Life Sciences, Ben Gurion Univ., Beer-Sheva 84105, Israel, E-mail frdln@bgumail.bgu.ac.il; [2]Dept. Biology & Biochemistry, Bath Univ., Bath, BA2 7AY, UK.

Males of *Manduca sexta*, like those of other lepidopterans, produce nucleate (eupyrene) and anucleate (apyrene) sperms; the eupyrene ones fertilize the eggs while the apyrene sperm, of unknown function, remain in the spermatheca and eventually lyse. In the male seminal vesicle, (a) the cyst cells that cover the intra-testicular sperm bundles are not longer present; (b) the apyrene bundles disperse; (c) the eupyrene bundles remain unbroken, held together by an electron-opaque matrix that accumulates between the spermatozoa; (d) each eupyrene and apyrene spermatozoon is individually wrapped by extracellular envelopes. Both kinds of spermatozoa become motile within the spermatophore through a process involving proteases from the male genital duct. *In vitro*, exogenous trypsin induces immotile sperm, taken from seminal vesicles, to become motile. We found *in vitro* (a) that trypsin induces ultrastructural modifications of the spermatozoa mimicking closely those the spermatozoa undergo while attaining intrinsic motility *in vivo* and (b) that these changes are time- and dose-dependent. They comprise, successively, (1) disappearance of the extra-cellular matrix maintaining integrity of the eupyrene bundles, (2) dispersion of the eupyrene bundles, (3) intermingling of eupyrene and apyrene spermatozoa and (4) "hatching" of the eupyrene spermatozoa from the individual envelopes. Acquisition of motility by eupyrene spermatozoa may be related to the dispersion of the eupyrene bundles following the disappearance of the electron-opaque matrix. But "hatching" of eupyrene spermatozoa from the envelopes is apparently unrelated to acquisition of motility since these spermatozoa become motile before "hatching" and apyrene spermatozoa become likewise motile, although they never "hatch". "Hatching" may be related to capacitation of spermatozoa to either leave the spermatheca or fertilize the eggs as *in vivo*, neither apyrene spermatozoa, nor eupyrene spermatozoa that fail to "hatch", leave the spermatheca.

[3100] CYTOCHEMICAL LOCALIZATION OF ENZYMES DURING SPERMIOGENESIS IN INSECT

S.N. Báo, Lab. Microscopia Eletrônica, Depto. Biologia Celular, IB, UnB 70919-970 Brasília - DF, Brasil. e-mail: snbao@unb.br. Supported by CNPq, CAPES and FAPDF

Insect spermatozoa are specialized cells, representing a valuable model for ultrastructural and cytochemical studies. These cells result from a complex process of cell differentiation, during which morphological, biochemical and physiological changes take place. During spermiogenesis parts of the nuclear and cytoplasmic contents, including some organelles are eliminated, and changes occur in the cellular surface. This phenomenon involves the participation of several enzymes. For enzyme cytochemistry the fixed-washed testes were incubated for 1 h at 37 °C in the adequate media to the acid phosphatase, thiamine pyrophosphatase, glucose-6-phosphatase and cytochrome c oxidase activities. The onset of spermatid differentiation is first visible as a change in nuclear shape and size, acrosome development, and the outgrowth of the flagellum. Usually the spermatid showed acid phosphatase activity in association with several cisternae of the Golgi complex, but mainly with those in the trans-most region. However, in the proacrosomal granule and acrosome occasionally may be observed reaction product. The glucose-6-phosphatase and thiamine pyrophospharase activities were seen in association with the endoplasmic reticulum and in several cisternae of the Golgi complex principally in the trans Golgi network. The presence of enzyme reaction products in endoplasmic reticulum and Golgi complex suggest that these membrane systems may be involved in the segregation of hydrolases required for the spermatid differentiation. For the phosphatase enzymes an intense deposition of reaction product was localized in the spermatozoon axoneme, particularly in the electron-dense fibres or radial spokes that extend from the central microtubules towards the microtubule doublets, as well as in the electron-dense fibres connecting the accessory microtubules. Phosphatases might be involved in the metabolism of phosphate compounds important to flagellar motility. The cytochrome c oxidase activity was mainly evidenced in mitochondria cristae of early spermatids. However, only a very light labeling may be observed in the last stages of sperm maturation process. Thus, ours results confirm the involvement of enzymes in spermatid remodeling, as well as in the chemical changes which occur during spermiogenesis.

Index words: cytochemistry; insects; spermatozoon, ultrastructure

[3101] WASPS *ET AL.* (HYMENOPTERA) AND THEIR SPERM: THERE ARE PHYLOGENETIC CHARACTERS AFTER ALL

D. L. J. Quicke, Center for Population Biology, Imperial College at Silwood Park, Ascot, Berkshire, SL5 7PY, UK; Unit of Parasitoid Systematics, CABI Bioscience UK Centre (Ascot), Dept. of Biology, Imperial College at Silwood Park, Ascot, Berkshire, SL5 7PY, and Dept. of Entomology, The Natural History Museum, London SW7 5BD, UK, E-mail d.quicke@ic.ac.uk.

The Hymenoptera are a vast and diverse group of insects and by analogy to other insect orders it would seem a prime target for using information from sperm to help elucidae infraordinal relationships. However, patchy early studies seemed to reveal few potentially informative characters: all sperm appeared to be of a fairly typical form, a few taxa were found to have spirlly twisted axonemes and nuclei but while these were considered from a functional point of view, no phylogenetic interpretations were made. The situation has only changed a little in terms of firm phylogenetic conclusions in terms of higher level relationships within the order, but within superfamilies, there appears to be more potential. Major features will be illustrated including arrangement of sperm into spermatodesmata in sawflies, different arrangements between the nucleus, mitochondrial derivatives and centriolar adjunct in basal groups, reduced flagellae in some braconids, and complex acrosomal caps in some ichneumonidae and aculeata. The potential of spermatology to help unravel hymenopteran phylogeny at various levels will be discussed.

Index terms: Spermatozoa, phylogenetics, spermatodesmata, sawflies.

[3102] COMPARATIVE SPERMATOLOGY IN PLECOPTERA

A.M. Fausto[1], M. Belardinelli[1], J.M. Tierno de Figueroa[2], R. Fochetti[1] & M. Mazzini[1], [1]Dept. Environmental Sciences, Tuscia University, 01100 Viterbo, Italy, E-mail fausto@unitus.it; [2]Dept. Animal Biology and Ecology, Granada University, 18071, Granada, Spain.

Plecoptera are a very interesting and enigmatic group from the systematic and phylogenetic point of view. Although it is not possible to establish their position among the Insecta with certainty, they are considered a key group. Comparative spermatology, could help to clarify the position of stoneflies. The aim of the present study was to provide details of the ultrastructure of spermatozoa in several Plecopteran species. The morphology and ultrastructure of spermatozoa of at least one species of each of the European Plecoptera families (Taeniopterygidae, Nemouridae, Capniidae, Leuctridae, Perlodidae, Perlidae, Chloroperlidae) were investigated by means of light microscopy, scanning and transmission electron microscopy and immunofluorescence microscopy. The spermatozoa of all the species examined are filiform and flagellate. Their ultrastructure shows a degree of heterogeneity between the families, with different "sperm models". In particular, there are differences in nuclear and acrosome shape and disposition, and tail organization. In the Taeniopterygidae species, the apical portion of the spermatozoon is complex in structure with a dense cup-like acrosome and a large extra-acrosomal granular layer; the nucleus is a long cylindrical body which lies between the two mitochondrial derivatives for most of the tail length. In the other families the spermatozoon has the simple classic organization of head and tail. The ultrastructure of the head consists of a peculiar acrosomal complex, a nucleus that varies in size and shape between the families and, in some species, rod-like bodies. The tail has components which run lengthwise and parallel: an axoneme flanked by one or two accessory bodies (derived from the centriolar adjunct), two mitochondrial derivatives and two flat membranous cisterns interposed between axoneme and mitochondrial derivatives. Comparison of the different sperm models among Plecoptera and with other insect groups revealed characters useful for clarifying Plecoptera systematics and phylogeny. Spermatologycal data suggest close phylogenetic affinity between Plecoptera and Polyneoptera.

Index terms: Spermatozoa, ultrastructure, stoneflies, electron microscopy.

[3103] PRACTICAL APPLICATION OF A CLASSIFICATION FUNCTION TO DETERMINE WING MORPHOLOGY DIFFERENCES BETWEEN WILD AND STERILE MALES OF *CERATITIS CAPITATA* (DIPTERA: TEPHRITIDAE)

A. Alemany, M.A. Miranda & L. Gállego, Univ. of Balearic Islands. Cra. Valldemossa km 7,5, CP: 07017, Palma de Mallorca, Spain, E- mail: analem@uib.es.

In previous works we have found significant differences in the biometric wing study of different species of Tephritidae, as well as between males and females of *Ceratitis capitata*, on applying a classification function (Gállego *et al.* 1993). The aim of the present study is to check whether this methodology enables us to find appreciable differences between the biometric data corresponding to the wings of wild and sterile males of the Mediterranean fruit fly. Wing images were digitalized and analysed using a video camera and image analyser software. Wing parameters were measured and the programme calculated a series of indices, out of which the most adequate were selected. Since such differences must necessarily have an effect on wing functionality, including flight capacity and male wing fanning for releasing the sexual pheromone, the usefulness of this biometric technique as a complementary quality control test in mass-rearing sterile insects is discussed.

Index terms: *Ceratitis capitata*, wings, biometry

[3104] ULTRAMORPHOLOGY OF THE MIDGUT OF *SOLENOPSIS SAEVISSIMA* (FORMICIDAE: MYRMICINAE)

A. Arab[1] & F. H. Caetano[1], [1]Dept. of Biology, Univ. Estadual Paulista, P.O. Box 199, Rio Claro, São Paulo 13506-900, Brazil, E-mail: ajao@ms.rc.unesp.br. Supported by CAPES and FAPESP

The midgut epithelium of insects consists of two or three types of cells, surrounded by a basal lamina and a discontinuous mass of circular and longitudinal muscles. Columnar epithelial cells are predominant in the insect midgut. The basal plasma membrane of these cells is usually highly and irregularly infolded, whereas the apical plasma membrane is covered in microvilli. Both show a high concentration of mitochondria. Regenerative, endocrine and goblet cells are also present in the insect midgut. In ants, the midgut ultrastructure is uniform between species but variations according to the diet are frequent. *Solenopsis saevissima* is located on the southeast of Brazil and its omnivorous diet led us to examine the major ultrastructural features of the midgut epithelium. Digestive tracts were removed from workers and fixed in Karnovsky modified solution, rinsed in phosphate buffer, postfixed in osmium tetroxide 1% in the same buffer, dehydrated in acetone, and embedded in Epon resin. Ultra-thin sections of the midgut were stained with uranyl acetate and lead citrate. The samples were analyzed using a Transmission Electron Microscope Phillips CM-100. *S. saevissima* presents a midgut composed of three types of cells: the columnar cells, the regenerative cells and the goblets cells. The midgut epithelium was covered by a basal lamina composed of banded fibrils. Outside the basal lamina, a layer of inner circular and outer longitudinal muscles was present. Columnar cells showed a basal plasma membrane containing numerous infoldings, mitochondria and the nucleus. Rough endoplasmic reticule, Golgi bodies, membrane bounded vacuoles, and spherocrystals were also found in this region. The apical plasma membrane was constituted by microvilli that contained fibrous material and sometimes a network of smooth endoplasmic reticule. The apical plasma membrane lied above a region rich in mitochondria. The high concentration of mitochondria in those regions supports an active transport role in the midgut epithelium. Regenerative cells were found in groups lying with the basal lamellae and showed a clear cytoplasm lacking the elaborations of the apical and basal plasma membrane described in the columnar cells. Goblet cells are typical of ephemenopteran and lepidopteran midguts and are associated with the ion transporting mechanism between the haemolymph and midgut epithelium. These cells were observed lying by the midgut lumen and showed large microvilli in their cavity; the cytoplasm features were similar to the columnar cells.

Index terms: *Solenopsis saevissima*, columnar cells, goblet cells.

[3105] BUTTERFLIES STRUCTURES AND OPTICAL TECHNOLOGY

S. Berthier, Laboratoire d'Optique des Solides, Univ. P. et M. Curie, case 80, 4 place Jussieu, F75252 Paris cedex 05, France. E-mail: berthier@ccr.jussieu.fr

Butterflies are wildly tributary of light. It is not surprising that they use many physical concepts developed by the actual optical technology in very similar contexts. Our aim in this paper is to present a succinct overview of some of the structures encountered in the Lepidoptera, and compare them with the artificial structures actually used in optical technology. We will first present the well known multilayered membrane of the *Uranidae* scales, responsible of their iridescent colours, whose principle is actually used in the realisation of dielectric mirrors - or Bragg mirrors - in many domains, running from laser mirrors to lamp reflectors, and for antireflection coatings or pigment-less coloured fibres. The structure of the *Morpidae* scales is more complex. The multilayer lies in the ridges themselves so that the diffraction effect from the ridges is superimposed with the previous interference effect. Modelisation and realisation of such structures are accurate problems. Multilevel gratings are used as antireflection structure or for the separation of the polarisation modes for optical devices. Sheer brightness is very likely to serve its main purpose in long-range communication between insects. The viewing angle over which they are visible is a fundamental parameter and the angular spread of light reflected from the wing has to be as large as possible. Interferences do not disperse light and the scales of *Urania* type are generally strongly convex to permit some part to be in position to reflect through considerable variation in the inclination of the wing. On the contrary, most of the scales of *Morpho* type are practically plane and dispersion of light is assumed by diffraction from the ridges and diffusion of the reflected light by the cover scales. In both cases, the reflecting power is high but differs in the polarisation state of the reflected light. It could introduce an additional element in the subject of *Morpho* visibility. We will then focus our attention on the subwavelength-structured surfaces acting as antireflection structures on certain night-flying moths. This moth-eye nanometric structure is adapted for effecting the maximum transmittance with the minimum diffraction and scatter losses on the spectral range visible for most of the insects. Identical structures at micrometric scales are wildly used as antireflection-structured and for applications such as space optics for which adhesion and thermal expansion are critical and imperative parameters. At last, we will consider the thermo-optical properties of the wings of certain black butterflies whose thermoregulation is partially exothermic. The solar absorptivity is assumed by both the pigment and the dendritic structure of the scale. The absorptivity over the solar spectrum can be as high as 98% when the thermal emissivity in the near infrared range is relatively low. This spectral selectivity enhances the thermodynamic efficiency. Such structured materials are used for the realisation of solar absorbers, but also for furtivity devices for military applications. Index terms: *Morpho, Prepona,*

[3106] SPECTRAL SELECTIVITY PROPERTIES OF *ARCHAEOPREPONA DEMOPHON*

S. Berthier, Laboratoire d'Optique des Solides, Univ. P. et M. Curie, case 80, 4 place Jussieu, F75252 Paris cedex 05, France. E-mail: berthier@ccr.jussieu.fr,

To achieve the body temperature (30° – 40°C) needed for flight, endothermic insects elevate their temperature by endogenous heat production. However, most of the butterflies are heterothermic, some of them are even purely exothermic insects. In these cases, the photothermal properties of the body and of the basal area of the wings, which assumed the major part of the solar absorption, are important parameters in the energy balance. In this paper, we will focus our attention on the optical and radiative properties of the black basal wings of the Charaxinae *Archaeoprepona demophon* supposed to absorb most of the solar energy. Whatever the absorber, only one fraction of the incoming energy is transferred. A part of the incident radiation is lost by reflection (or transmission) : this constitutes the optical losses. An other part is lost by convection, conduction and radiation : this constitutes the thermal losses. Convection and conduction are approximately proportional to the temperature whereas radiative losses vary like the forth power of the temperature (Stephan-Boltzmann's law). If convection and conduction phenomena are limited by the insulating properties of the scales, optical and radiative losses are the two main parameters of the energy balance. The conversion efficiency, at a given temperature, can be increased if the absorption coefficient α of the surface is close to unity on the solar spectral range, and if the emissivity $\varepsilon(T)$ in the infrared (IR) range is weak, that is, according to the Kirchhoff's law, if the absorptivity is weak. An ideal solar absorber is therefore totally absorbent or "black" at wavelengths below a cut-off wavelength λ_c depending of temperature and totally reflecting and/or transmitting for wavelengths above λ_c. Material with high visible absorptivity and low IR emissivity are known as selective absorbers and are wildly used for heliothermic conversion devices. Such selective properties can be realised from many processes and *Archaeoprepona* developed a very particular and efficient one. Spectral reflectivity and transmittivity measurements have been performed in the UV-visible and near IR range with a Cary 5 spectrophotometer (UV/visible) and a Fourier Transform Spectrometer (IR range) both equipped with integral sphere, on the basal area of the wings. The visible absorptivity is partly (and classically) obtained by pigmentary absorption, partly by optical trapping in surface roughness perfectly adapted in size and spacing to the visible wavelengths. The absorption is of the order of 98% on the visible range. In the thermal IR region, running from 2µm to 15 µm according to the wing temperature when exposed to the solar radiation, the wavelengths are much more larger than the dendrite spacing. The surface appears fairly smooth, with reflection (R) and transmission (T) coefficients such than R+T ~ 1, i.e. Absorption (A) coefficient ~ 0, acting as a poor radiator of energy.

[3107] MORPHOLOGY AND BIOLOGY OF THE IMMATURE STAGES OF *CITHERONIA (CITHERONIA) BRISSOTII BRISSOTII* (BOISDUVAL, 1868) (LEPIDOPTERA, SATURNIIDADE, CERATOCAMPINAE)

J. F. Bianconcini[1], O. H. H. Mielke[2] & M. M. Casagrande[3], [1]Av. Brasil, 566, Cx. P. 64, Iguaraçú, Paraná 86750-000, Brazil, E-mail jeanfabio@engineer.com; [2]Dept. de Zoologia, Univ. Federal do Paraná, Cx. P. 19020, Curitiba, Paraná 81531-990, Brazil, E-mail omhesp@bio.ufpr.br; [3]Dept. de Zoologia, Univ. Federal do Paraná, Cx. P. 19020, Curitiba, Paraná 81531-990, Brazil, E-mail mibras@bio.ufpr.br.

Citheronia (Citheronia) brissotii with his two subespecies: *C. (C.) brissotii brissotii* e *C. (C.) brissotii meridionalis*, were redescribed by Lemaire (1988). The first subspecies occurs in Espírito Santo, Rio de Janeiro, São Paulo, Paraná, Santa Catarina, and Mato Grosso, Brazil and the second in north-east of Argentina (Entre Ríos province). The moth flies between September and March. The work was developed in Curitiba, Paraná, Brazil, where all specimens were observed, colected and reared. The larvae feeds on *Ligustrum japonicum* (Oleaceae), *Prunus brasiliensis* (Rosaceae), *Schinus terebinthifolius*, (Anacardiaceae), *Ilex paraguariensis* (Aquifoliaceae), *Phrygylanthus acutifolius* (Loranthaceae), *Ricinus communis* (Euphorbiaceae), *Escallonia* sp. (Escalloniaceae) and *Sapium glandulatum* (Euphorbiaceae), but doesn't is an economic pest. The biology is described, including the morphology and chaetotaxy of the larvae. The female lays one or two eggs on each leaf (totality of eggs by female: 85-166) and the embrionary period duration is 11 to 13 days. The eggs are initially yellow, after darking until the color and shape of 1st instar larvae appear through the corion. They are elliptical in superior view and flat in their vertical axis, the micropylar axis is horizontal and the egg's lenghts are 4mm X 3,2mm, and 2,3mm height. The larvae borns with 6mm and reaches 12-14 mm during its 5-8 days at the end of 1st instar. They will be solitary for all the larval stage. 1st instar larvae is black, with an yellow area on the dorsal part of 3rd and 4th abdominal segments, and has long scoli on all body; dorsal scoli of toracic segments and 8th abdominal segment are longer than others. 2nd instar larvae reaches 15-22mm in 4-6 days; is black with a brown area on 3rd and 4th abdominal segments, and has lateral wavy bands with the same color; dorsal scoli of 2nd and 3rd toracic and 8th abdominal segments are proportionaly longer than the others, they will be more and more prominent to the others in the next instars. 3rd, 4th and 5th instar larvae predominantly gray, with white wavy lateral bands and pink scoli; their length and instar duration are respectively: 21-32mm, 4-8 days; 38-52mm, 5-12 days; 80-100mm, 9-15 days. When stage of pre-pupa starts, 6-7 days before the stage of pupa, the larvae leaves the host plant and bury herself on subsoil, from where will emerge a new moth after 30 to 40 days.

Index terms: biodiversity, neotropical, ecology

[3108] THE OVARIES OF CHAULIODIDS, AS THOSE OF CORYDALIDS, ARE PANOISTIC (SECONDARY PANOISTIC)

S. M. Biliński[1], B. Szymańska[1] & J. Kubrakiewicz[2], [1]Inst.of Zoology, Jagiellonian Univ., R. Ingardena 6, PL 30-060 Kraków, Poland, E-mail sbili@zuk.iz.uj.edu.pl; [2]Zoological Inst., **Univ. of Wroc law, Sienkiewicza 21, PL 50-335, Poland.**

The structure of the ovaries of two representatives of Chauliodidae (*Chauliodes pectinicornis*, *Nigronia fasciata*) and one of Corydalidae (*Corydalus peruvianus*) was studied. In all 3 investigated species the ovaries are panoistic (secondary panoistic, = neopanoistic) and consist of numerous (more than a hundred) ovarioles that are differentiated into 3 well defined regions: the terminal filament, the germarium and the vitellarium. The germaria are relatively small and contain few oogonia and degenerating germ cells. The vitellaria are composed of 12 – 15 developing ovarian follicles (= oocytes surrounded by follicular cells) in a linear arrangement. In adult females these follicles can be classified into early previtellogenic, late previtellogenic, vitellogenic and choriogenic ones. Early previtellogenic oocytes are located in the anterior (apical) part of the vitellarium. Their nuclei (= germinal vesicles) are voluminous and contain few dense nucleolar masses as well as several DAPI-positive (DNA-containing) accumulations of variable sizes. During subsequent phases of a previtellogenic growth nucleolar masses gradually break down into multiple nucleoli. Simultaneously, the DAPI-positive accumulations disperse and become less conspicuous. The multiple nucleoli are roughly spherical and consist of electron-dense, fine granular material. Germinal vesicles of vitellogenic oocytes are considerably larger. At that stage the number of multiple nucleoli increases while their size is reduced. The ooplasm is differentiated into 2 clearly recognisable zones: more transparent (perinuclear) and opaque (peripheral). Ultrastructural investigations revealed that the former region contains ribosomes only, whereas the latter comprises also mitochondria, Golgi complexes and vesicular bodies. During vitellogenesis the ooplasm becomes filled with irregular yolk spheres and large lipid droplets. After termination of yolk accumulation, follicular cells start to synthesise precursors of egg envelopes. Fully developed egg is covered by a vitelline envelope and a relatively thin and flexible chorion. The vitelline envelope is uniformly studded with characteristic, regularly spaced granules. The chorion consists of flattened, tabular elements. The anterior pole of the oocyte is equipped with a mushroom-like micropylar apparatus.

Index terms: Megaloptera, oogenesis, multiple nucleoli, egg envelopes.

[3109] MORPHOLOGY OF *PESSONIA CATENARIA* (LEPIDOPTERA: NYMPHALIDAE: MORPHINAE)

L. G. Bilotta[1], [1]Sector of Biological and Health Sciences/Sector of Agrarian Sciences, Univ. Tuiuti of Paraná, Curitiba, Brazil, E-mail lgbilotta@uol.com.br.

The main objective of this paper is to make a more detailed study of the morphology of *Pessonia catenaria* providing data for a taxonomic survey of the Morphinae sub-family. It was considered the characteristics of the genitals and veins of both male and female adult specie. *Pessonia catenaria* can be found in the states of São Paulo, Paraná, Santa Catarina and Rio Grande do Sul. The structures used in this research were prepared with KOH at 10% and for the wings were cleared up.

[3110] INCIDENCE AND MORPHOLOGIC ASPECTS OF *LONOMIA OBLIQUA* (LEPIDOPTERA: SATURNIIDAE)

I. G. Bilotta[1], S. E. Geraldi[2], G. C. Melo[2], M. Przybysz[2], J. Z. Braga[2] & R. Garcia[2], [1]Sector of Biological and Health Sciences/Sector of Agrarian Sciences, Univ. Tuiuti of Paraná, Curitiba, Brazil, E-mail igbilotta@uol.com.br, [2]Sector of Biological and Health Sciences, Univ. Tuiuti of Paraná, Curitiba, Brazil.

The caterpillars measure about 6 to 7 cm. Their bodies are covered by ramified thorns, brown-greenish or brown-yellowish colored, with a small irregular spot on the dorsum of the third thoracic segment. They are gregarious and eat leaves like cedar, wild fig tree, lentisk, plum tree, pear tree, peach tree and avocado tree, during the night. The period of pupa may last about three months. The *Lonomia obliqua* adult appears in the hottest months, november to march. The female presents a dark gray coloring and the male a yellow orangish one. In Brazil, the first registration of hemorrhagic accident trough contact with *Lonomia obliqua* occurred in Minas Gerais in 1914. In 1989/90 there was significant increase in the states of Rio Grande do Sul and Santa Catarina. In 1989, there were indications of it in Nova Cantu town, in the state of Paraná. In 1996, it reached the metropolitan area of the capital city, Curitiba.

[3111] EFFECT OF TWO PLANT EXTRACTS ON *CERAEOCHRYSA CINCTA* AND *C. CUBANA* (NEUROPTERA: CHRYSOPIDAE)

G. Bissolli[1], L. Vieira[1], P. Fortes[1], J. E. Miranda[1], S. A. De Bortoli[1] & A. T. Murata[2], [1]Dept. de Fitossanidade, Univ. Estadual Paulista, CEP 14884.900, Jaboticabal, SP, Brasil.; [2]Dept. de Biologia, Univ. de São Paulo, CEP 14040-901, Ribeirão Preto, SP, Brasil (FAPESP Fellowship), E-mail: murataat@asbyte.com.br.

The crisopids are important predators found in several crop fields, feeding aphids, whiteflies, caterpillars and eggs. They are important components in the biological control. In contrast, they seem be highly susceptible to the chemical used in the fields. Extracts *Azadirachta indica* and *Bougainvillea spectabilis* have presented great potential insecticide and, because of their natural source, should be innocuous or present less effect on the predators. In this way, this work was made to study the effect of the aqueous extract of these plants 2 crisopids species. The rehearsal was conducted in the Laboratory of Insect Biology, Jaboticabal, SP, Brasil, under controlled conditions (25±2°C, 70±10%RH and 12 H photophase). The delineament used consisted of 6 treatments (eggs of *Ceraeochrysa cubana* and *C. cincta* sprayed with *B. spectabilis*, *A. indica* and control [water]) and 20 replications. The larvae were individualized in glass tubes (9cm height and 2cm diameter) and fed with eggs of *Diatraea saccharalis* sprayed with different treatments. The works were accomplished with 3th instar larvae and appraised after 24 hours. It was observed that the consumption of treated eggs was much smaller than no treated eggs, being consumed 10.4 and 21.92 eggs sprayed with *B. spectabilis* extract by *C. cubana* and *C. cincta*, respectively; 9.0 and 15.3 eggs sprayed with *A. indica* by *C. cubana* and *C. cincta*, respectively; 130.93 and 120.0 eggs sprayed with water by *C. cubana* and *C. cincta*, respectively. The mortality of *C. cubana* fed on eggs treated with *B. spectabilis* and *A. indica* were 5 and 10%, respectively. For *C. cincta* there was no mortality. The length of the 3th instar of the larvae submitted to the natural extracts was largest when compared to the control, being verified largest delay for the specie *C. Cubana*. It was concluded that the tested substances affected the egg consumption and the larval development.

Index terms: *Ceraeochrysa cubana, Ceraeochrysa cincta, Azadirachta indica, Bougainvillea spectabilis.*

[3112] SCANNING AND TRANSMISSION ELECTRON MICROSCOPY OF THE MANDIBULAR GLAND IN THE SUGARCANE BORER *DIATRAEA SACCHARALIS* (LEPIDOPTERA: PYRALIDAE)

A. R. Borges & E. A. Gregório, Centro de Microscopia Eletrônica, Inst. Biociências, UNESP, Campus de Botucatu. CP. 510, CEP. 18618-000, Botucatu, S.P., BR, E-mail borges_alex@hotmail.com

The mandibular gland of the Lepidoptera larvae presumably functions in the secretion of the saliva in conjunction with food ingestion. *Diatraea saccharalis*, the common borer, is considered the most important pest of the sugarcane. In this report we describe the ultrastructure of the mandibular gland of the *D. saccharalis*, in the last larval instar. The insects were reared in laboratory on artificial diet; the mandibular glands were conventionally prepared for scanning (SEM) and transmission (TEM) electron microscopy. SEM shows that the short duct is larger than the secretory regions, exhibiting smooth surface with irregular undulations. At TEM the duct cells are flattened compared with the ones of the secretor regions. They show many microtubules, free ribosomes and discrete amount of either plasma membrane infoldings at the basal region or microvilli at the apical one. The cuticle is thick with many dense projections. SEM analysis of the secretory region shows three differentiate portions: anterior, media and posterior; there is ampoule between the duct and the anterior secretory region. The posterior secretory region is very thin and long, with smooth surface at SEM. Their long microvilli are attached to the cuticle by dense material; the basal plasmatic membrane infoldings are numerous and deep and the cytoplasm presents few organelles. The media secretory region has regular surface at SEM. The cytoplasm exhibit great amount of smooth endoplasmic reticulum and sparse mitochondria; short microvilli and few basal plasma membrane infoldings are observed. The anterior secretory region is short, with regular surface protuberances at SEM. In the apical surface the microvilli are long; they are also visualized between adjacent cells, constituting a canaliculi like-structure. Mitochondria and smooth endoplasmic reticulum are uniformly distributed all over the cytoplasm. The ampoule is not pronounced, with the cells protruding to the surface at SEM. The cuticle facing the lumen is thick, with dense projections both to the lumen and to the apical cytoplasm. The apical cell region present short microvilli; the cytoplasm shows scarce rough endoplasmic reticulum and great amount of smooth endoplasmic reticulum. Few and large canaliculus are detected in the basal cytoplasm, containing microvilli and myelin-like bodies. Our results show that the *D. saccharalis* mandibular gland, at least in the last larval instar, is mainly producing lipid instead of protein secretion. The meaning of the structurally differentiated region will be discussed. (Supported by FAPESP-Proc. 99/02883-8)
Index terms: *Diatraea saccharalis*, mandibular gland, ultrastructure, secretion

[3113] ELYTRA-TO-BODY BINDING MECHANISM IN COELOMETOPINE TENEBRIONID BEETLES (INSECTA: COLEOPTERA): ADAPTATIONS TO FLIGHTLESSNESS AND TAXONOMIC IMPLICATIONS

P. Bouchard[1] & S.N. Gorb[2], [1] Dept. Zoology and Entomology, Univ. Queensland, Brisbane, QLD 4068, Australia. E-mail: p.bouchard@ento.uq.edu.au; [2] MPI für Entwicklungsbiologie, Spemannstr. 35, D-72076 Tübingen, Germany.

The ability to fly in insects was certainly one of the most important factors that stimulated their great radiation in the Carboniferous. This new innovation enabled insects to locate mate and food better, escape from predators and disperse into new environments. It is a striking fact therefore, that the secondary loss of flight has occurred in nearly all winged orders, many times in most orders, and probably thousands of times within the Coleoptera. The elytra of beetles usually possess structures that enable them to join together (in the midline) and with the body at rest. These structures include binding patches of microtrichiae (usually present as well defined co-opted fields under the elytra and on the thorax and abdomen) and mechanical joints (between the elytra and along the sides of the thorax and abdomen). The binding mechanisms are temporary in winged beetles, because the elytra need to open and close every time the hind wings are used during flight. In flightless species, however, the connections between the two elytra and between the elytra and the body can become permanent. The tribe Coelometopini (Coleoptera: Tenebrionidae: Coelometopinae) contains several hundred species worldwide, being especially species-rich in subtropical to tropical forests. Based on characteristic features of their female genital tube, defensive reservoirs as well as their ovipositor, members of this tribe form a natural assemblage of both winged and flightless beetles. Within the Australo-Papuan fauna, flightlessness has evolved several times in these beetles. It is the opinion of the authors that the structures involved in the elytra-to-body mechanisms have adapted differently to the loss of flight in unrelated genera and could be used as important taxonomic characters. This hypothesis is explored in an attempt to understand the relationship of the beetles in the morphologically diverse tribe Coelometopini (also see abstract in SESSION 21 of this conference).

Index terms: phylogeny, darkling, Australia, functional, morphology

[3114] THE ULTRAMORPHOLOGY OF THE RECTAL PADS OF MALE OF THE ANTS *ATTA SEXDENS RUBROPILOSA*: A UNUSUAL FEATURE

F.H. Caetano, Dept. of Biology, IB, UNESP, P.O. Box 199, 13506-900, Rio Claro, SP, Brazil, E-mail: fcaetano@rc.unesp.br, Supported by FAPESP.

The rectal pads are present in the rectal wall and their function were associated to the remotion of the water and ions from the feces. These structures are present in majority groups of insects and usually they are in even number 2, 4 or 6. The Formicidae family presents a great variations in its subfamilies. So the subfamilies Ponerinae, Cerapachyinae, Myrmeciinae, Pseudomyrmecinae and Formicinae possess six; Dolichoderinae and majority of Myrmicinae genus this number is three and in Ecitoninae and *Pheidole* genus of Myrmicinae subfamily there are two. Frequently they have oval or round shape. Caetano (1984) showed in *Atta sexdens rubropilosa* three rectal pads with long elliptical shape in female and cylindrical shape in male. In bees and wasps there are six elliptical. The digestive tract of male of *A. s. rubropilosa* was removed and fixed in Karnovsky modified solution, dehydrated in acetone series and covered of gold coat according routine technique for scanning electron microscopy (SEM). The samples were examined in the Jeol P15 SEM. There are four rectal pads in male of *A. s. rubropilosa* male in the proximal region of the rectum. Two of them have elliptical shape and the others are round which are arranged side by side like a elliptical subdivided. *Atta capiguara* males have three or four rectal pads with elliptical shape (Caetano, 1984). The rectal pads lateral wall is smooth and constituted by a dense cuticle. Its absorbing surface is rugous (rich in folders) where the feces are deposited, similar to that founded in *Myrmecia* genus (Caetano et al., 1991). The shape of rectal pads observed in male of the *A. s. rubropilosa* is similar to that founded in other Hymenoptera such as bees, social and solitary wasps, like Mutillidae. Its ultramorphology features are similar to that described for others ants. Nevertheless I could not explain the shape variations present in male and female of this species. This seemingly to be a non derivative character.

Index terms: *Atta*, rectal pads, ultramorphology, digestive tract, Formicidae

[3115] *RHYNCOPHORUS PALMARUM* A MORPHOLOGICAL AND ULTRASTRUCTURAL STUDY OF FEMALE REPRODUCTOR SYSTEM (COLEOPTERA)

M.I.Camargo-Mathias[1], F.H.Caetano[2] & P.Sanchez[3], [1, 2]Depto de Biologia, IB-UNESP, CP 199, 13506-900 Rio Claro, SP, Brasil. E-mail micm@rc.unesp.br. [3] FONAIAP – Estado Miranda, Venezuela.

Rhyncophorus palmarum is a coleopteran considered to be a pest of economic importance since it attacks plants of the Palmae family that are highly useful at the tropical populations. The records suggest that this beetle maintains an intimate relationship with the nematode *Bursaphelencus coccophilus* , the major causative agent of the red ring disease of palm trees, which uses *R.palmarum* as its major vector. Some morphology studies have demonstrated that in *R.palmarum* females these nematodes migrate to the ovipositor, which they leave at the time of oviposition. The objetive of this investigation was to perform a morphological and ultrastructural study of the reproductive apparatus of *R.palmarum* females using morphological, histological and ultrastructural techniques. *R.palmarum* females have paired ovaries with two ovarioles each, which in turn contain approximately 50 oocytes in different stages of maturation (Camargo-Mathias, 1992). In its proximal region each ovariole has an ellipsoid dilatation which, in histological study, was found to be a pouch externally enveloped by muscles and internally harboring three mature oocytes. The pouch is internally lined with a single epithelium with columnar cells that probably have a secretory function since a large amount of RER and ribosomes was detected in the cytoplasm, as well as, the Golgi apparatus. Large amounts of small and elongated structures bacillus shape was found in the between spaces this epithelium and the oocytes, distributed at random in all directions. The structures presented a negative histochemical reaction to all tests applied. MET study demonstrated that these structures do not have a membrane, are of quite homogeneous aspect and are found in the proximal region of all ovaries. Sometimes two of them may be found fused. Their function, however, is still totally unknown, since we do not know their nature. We may speculate that they serve as a neutralizing agent of plant resistance.

Index terms: *Rhyncophorus palmarum*, palmae trees, pest, insects, reproduction.

[3116] FLUCTUATING ASYMMETRY, MATING SUCCESS, BODY SIZE AND HETEROZYGOSITY IN MALES OF *COENAGRION SCITULUM* (ODONATA: COENAGRIONIDAE)

G. Carchini[1], F. Chiarotti[2], M. Di Domenico[1], M. Mattoccia[1] & G. Paganotti[1], [1] Dip. di Biologia, Univ. "Tor Vergata", Via della Ricerca Scientifica, 00133, Roma, Italy, E-mail carchini@uniroma2.it; [2] Ist. Superiore di Sanità, Lab. Fisiopatologia di Organo e di Sistema, Viale Regina Elena, 299, 00161, Roma, Italy, E-mail chiarott@iss.it.

Fluctuating asymmetry (FA), subtle and random deviations from the perfect symmetry, has been considered as a good descriptor of the developmental stability for decades. Correlation have been shown between FA and several fitness components, including individual mating success and heterozygosity level. Recently, however, some doubts have been expressed about the generalisation of these results, and a bias towards positive results and a poor critical approach was presumed in the first phase of the FA studies (Simmons et al. 1999). The studies are scarce in the Odonata and concentrated on the Coenagrionidae family. Nevertheless, contrasting results have been shown on the relationships between FA and mating success, size and other fitness components (Carchini et al. 2000). We investigate the relationships among FA assessed by (R – L) wing measurements, body size (BS) assessed by (R + L)/2 wing measurements, heterozygosity (HE) assessed by electrophoretic analyses of gene-enzyme systems and daily mating success (DMS) assessed by the status (mated or not) of the males at the moment of the collection. 260 male specimens were collected from a single breeding population in three subsequent days. The data were analysed both by univariate and multivariate statistical methods. After excluding a correlation between FA and BS for the sampled population, the presence of a true FA was checked using tests for normality, directional asymmetry, antisymmetry and difference with the inter-individual variations. In addition, the FA measurement error was calculated from 26 individuals measured twice, and found to be 4.4 % for the signed (R – L) and 12.7% when considering the absolute |R – L| differences. The results showed no correlation between FA (either signed or absolute) and HE, BS and DMS, while HE was clearly positively correlate with BS, and intriguingly with DMS. In fact, our data showed an effect of the presence of some particular alleles on DMS, instead of an effect of the number of polymorphic loci for each individual. Finally, no correlation was found between BS and DMS. These result are discussed regarding both previous results on Odonata and general relations between FA and the other characteristics, and the value of FA as an indicator of a good individual genetic quality is still not supported.

Index terms: developmental stability, genetic structure, reproduction, fitness

[3117] COMPARISON OF PRESERVATION METHODS OF *ATTA* SPP. (HYMENOPTERA; FORMICIDAE) FOR DNA STUDIES

A. O. R. Carvalho[1] & L. G. E. Vieira[1], [1]Área de Proteção de Plantas, Instituto Agronômico do Paraná, C. Postal 481, 86.001-970, Londrina-PR, Brasil, E-mail: alcarva@pr.gov.br

High quality DNA for molecular markers research is easily extracted from freshly killed specimens. However, live samples are difficult to be kept for long periods thus making its preservation a serious problem, specially when they are collected and transported from long distances. In order to establish an efficient method to preserve *Atta* spp. (leaf-cutting ants) for DNA extraction, to be used in PCR-RAPD analysis, six different methods were examined: 1) direct storage at -70°C; 2) ethanol 95% at -20°C; 3) ethanol 95% at 4°C; 4) ethanol 95% at room temperature; 5) silica gel at room temperature; and 6) buffer {0,25 M EDTA, 2,5% SDS (w/v), 05, M Tris-HCl, pH 9,2} at room temperature. DNA from the samples were extracted (Cheung *et al.*, 1993 - modified) and examined after 90, 210 and 360 days after storage. Freshly killed specimens were used as control. Total DNA was measured with a minifluorometer. The DNA quality was determined in a 0.8% agarose gel stained with ethidium bromide. Photographs of the gel (Polaroid 667 film) were scanned in a densitometer and the integral of the scan was calculated for size ≥ 9.4 kb, after adjusting for background fluorescence of the photograph. Data were analysed using a randomised split-plot design with four replicates. In order to determine the feasibility of the preservation method, the extracted DNA was used for PCR-RAPD analysis. All the methods above were efficient to preserve *Atta* spp. up to 210 days. At 360 days, DNA was degraded only in the method 4 (ethanol 95% at room temperature) with unacceptable results after PCR-RAPD (missing bands). Although preservation at low temperatures is useful for large periods, the methods using silica gel and buffer can be satisfactory alternatives when refrigeration and transportation are limiting factors.

Index terms: PCR-RAPD, leaf-cutting ants, storage conditions.

[3118] ANTENNAL SENSILLA OF *COPITARSIA CONSUETA* (LEPIDOPTERA: NOCTUIDAE)

V. R. Castrejón[1], J. Valdéz[2], J. Cibrián [2], R. Osorio[2] & M. Camino[1], [1] Centro de Desarrollo de Productos Bióticos del I.P.N. Carretera Yautepec-Jojutla km. 8.5, Yautepec, Morelos, México. C.P. 62730. A.P. 24. Tel. (739) 4-18-96. e-mail: vcastrej@hotmail.com. [2] Instituto de Fitosanidad, Colegio de Posgraduados. 56230 Montecillo, Estado de México, México. This research was supported by I.P.N. grant (CGPI 980052).

The antennae of 15 males and 15 females were separately placed in a solution of 70 % ethanol and 2 % formaldehyde for 24 hours. Then they were dehydrated in 80 %, 90 %, and 100 % ethanol for 8 hr each. Afterwards they were dried at the critical point and finally gold coated (70 nm) to observe them in a JEOL 35-C microscope at 5 and 10 kV. The average length and basal diameter of the external part of each sensillum was calculated according to 15 measurements taken in photomicrographs. Five types of sensilla were found on the antennae of adult *Copitarsia consueta* by scanning electron microscopy and light microscopy. Those sensilla were trichoidea, coeloconica, styloconica, basiconica and squamiformia. Two types of sexually dimorphic sensilla trichodea were found; type I is in the border of the sensory field of the flagellar segments and present only on male antennae this suggests that the sensillum may contain the receptor sites for the female sex pheromone. Type II is located within the ventro-medial sensillar field where it is arranged without apparent pattern. Other six types of sensilla trichoidea were found around antennal segments, and were particularly abundant on the apical antennal segment. One sensillum styloconicum was identified per segment, except for the apical segment; this sensillum varies in number, and each sensillum consists of a base, a stalk and a cone. Each flagellar segment bears several sensilla coeloconica on the ventral surface, situated on or near distal edge; each sensillum consists of a depression surrounded by 15 to 17 "teeth" and one peg. Two types of sensilla basiconica were identified, type I is more curved and broader than type II. The squamiform sensilla positioned on the dorsal part of the antenna among the scales, were shorter and finer than the scales.

[3119] MORPHOLOGICAL SPECIALIZATION OF THE SENSORY ORGANS IN HEMATOPHAGOUS INSECTS

S. Yu. Chaika, Dept. of Entomology, Fac. of Biology, Moscow State Univ., 119899 Moscow, Russia, E-mail chaika@SChaika.home.bio.msu.ru.

The structure of sensory organs of hematophagous insects (Diptera, Siphonaptera, Hemiptera, Anoplura) reflects adaptive character of evolution of these insects. Analyzing the visual organs we find out a rich spectrum of modifications of their structure and ultrastructures within the framework of constructive features of particular eye type. The visual organs of the bloodsuckers are submitted by compound photopical (dipterans, bugs) and simple (fleas, lice) eyes. The compound eyes of the dipterans and bugs are made of many ommatidia of the apposition type. The simple eyes of the lice and fleas lacks the crystal cone and special pigment cells. In eye of the lice the pigment granules are located only in the photoreceptor cells. Thus in the range of parasitism types from free-living bloodsuckers to permanent ectoparasites is observed either the gradual reduction of an compound eye, or formation of simple visual organs. The reduction of the functional importance of visual organs in insects, connected with the formation of ectoparasitism, is accompanied also by reduction of a surface, occupied by microvilli. Similarly, the ecological rapprochement of bloodsucking insects with their hosts is reflected by development of their olfactory organs. In free-living dipterans (mosquitoes, sandflies, midges) the dependence of number of olfactory sensilla from features of behaviour of insects is discovered. In particular, the catch-species had the minimal number of sensilla, the hunter for the large gregarious host had the mean number, and the hunter for the small, dispersed host had the maximal number of sensilla. Extremely small number of olfactory sensilla in ectoparasites, as well as in close to it hem bloodsuckers is a result of maintenance of close contact with host. Absence in some hematophagous insects such behavioural acts as active dispersion, repeated and active search of host or sources of carbohydrate food, search of places for oviposition has resulted to essential to grate morphofunctional reorganization of sensory systems in obligatory hematophagous insects. In connection with morphological isolation of sensilla as elementary sensory organs the weakening of function of certain sensory system expresses in reduction of sensilla number and is not accompanied by degeneration of their separate elements. The ultrastructural level of evolution of sensory organs is characterized by significant conservatism of organization of sensory cells. This study was supported by RFBR (Grant number 98-04-48419).
Index terms: Diptera, Siphonaptera, Hemiptera, Anoplura, ultrastructure.

[3120] SENSORY ORGANS OF THE LABIUM AND ANTENNAE IN TERRESTRIAL AND WATER BUGS (HEMIPTERA)

S. Yu. Chaika & E. E. Sinitsina, Dept. of Entomology, Fac. of Biology, Moscow State Univ., 119899 Moscow, Russia, E-mail chaika@SChaika.home.bio.msu.ru.

The electron-microscopical investigation of terrestrial bug species from families Miridae, Reduviidae, Nabidae, Tingidae, Aradidae, Coreidae, Rhopalidae, Scutelleridae, Acanthosomatidae, Pentatomidae has shown that chemosensory organs of the rostrum are represented by 6-12 basiconic sensillae, which are arranged in the local sensory field of the each lateral lobe (paraglosses). A sensilla is equipped with 2-6 sensory neurons. Dimensions of the basiconic sensillae, their orientation about the rostrum axis, development of subsidiary structures (basal cylinder in Rhopalidae and Coreidae, microtrichii and long trichoid sensillae in Pentatomidae) have not only adaptive significance, but are correlated with phylogenetic position of bug families in the order Hemiptera. The degree of developing the chitinized and membranized parts of the apical plate in bugs is related to the type and peculiarities of feeding. The labial chemosensory apparatus of water bugs of the families Corixidae, Naucoridae, Notonectidae and Nepidae is quite similar to that of terrestrial bugs in the number of sensory cells in the sensillum, its ultrastructural organization, and innervation. Scanning electron microscope examination of antennae in terrestrial bugs revealed 16 types of sensory organs: sensilla chaetica Ch1-Ch3, trichoid T1-T5, basiconic B1-B3, styloconic, coeloconic, coelospheric, campaniform sensilla, trichobothria as well as pore organs. A generalized set of sensory organs in bugs includes different types of chaetica, trichoid and basiconic sensilla. Increasing the variety of sensory organs from primitive (Saldidae) to advanced (Acanthosomatidae, Pentatomidae) families of bugs is revealed. The greatest number of less common sensilla types in bugs is characteristic of the family Pentatomidae. Rare sensilla types are found in species of the Reduviidae and Coreidae families. Trophic specialization did not influence essentially the formation of the sensory apparatus antennae in terrestrial bugs. The antennal sensilla undergo the greatest changes related to the aquatic habitats. Even though the abundance and variety of antennal chemosensory organs are considerably less as compared with terrestrial bugs. The peculiarities of the habitat and mode of life of different species of water bugs led to significant modifications in several types of their sensilla. This study was supported by RFBR (Grant number 98-04-48419).
Index terms: sensilla, morphology, ultrastructure.

[3121] MORPHOLOGY OF THE MOUTH PARTS IN ADULTS OF *PHYLLOPHAGA (SENSU LATO)*

M. Coca-Abia, Museo Nacional de Ciencias Naturales (CSIC), Dpto. Biodiversidad y Biología Evolutiva, José Gutiérrez Abascal, 2 28006 Madrid (Sapain), E-mail: mcnc171@mncn.csic.es

Phyllophaga (s. lato) is one of the most diverse genus of Melolonthini across the Nearctic and Neotropical Regions and one of the most serious pest of crops in North America. The adaptation of the adult to feed on leaves and stem of plants has been accompanied by considerable development of the mouth parts. However, in spite of the adult of *Phyllophaga* is a large pest, the structure of the mouth parts have atracted little attention of morphologists and there are no publication concerning exclusively the mouth parts morphology. The aim of this work is to show the morphology of the mouth parts in representatives of main subgenera included into the genus *Phyllophaga*, and reveal structures related to trophic pecualiarities of this genus. The material studied included specimens from collections keep at National Museum of Natural History (Smithsonian Institution), Washington D.C. The mouth of adults of *Phyllophaga (s. lato)* is formed by six parts: mentum, two maxiles, two mandibles and labrum. The mentum or prelabium is the distal part of the labium with two lateral segmented palpi with senorial receptors and spurs on the dorsal wall. The maxiles are two pices implanted just behind the mandibles. They are constituted by cardo, stipes, lacinea and galea. Lateraly from the galea arises the palpus or telopodite with senorial receptors. The mandibles in the genus *Phyllophaga* are strong appendages with a broad triangular base and a single point of articulation. Each mandible has its mesal surface differentiated into a distal incisor lobe and a proximal molar lobe which shape and striations degree varies. The labrum is gently depresed in the middle with sensorial receptors very developed. Although the oral system of *Phyllophaga* is of the bits type, the morphology of the mouth parts varies intraspecificaly and could reveal structures related to trophic pecualiarities. Except the mandibles, all parts of the mouth show sensorial structures which seem to be similar to some described in other groups of insects. These sensorial structures could be chemical receptors packed together which would allow insects to select the food.
Key words: feed, structures, sensorial, receptors.

[3122] HIGH RESOLUTION EXTENDED DEPTH OF FOCUS IMAGES FOR ENTOMOLOGY

M. Coca-Abia[1], D. Marshall [2] & A. G. Valdecasas[3], (1,3) Museo Nacional Ciencias Naturales. C/Jose Gutierrez Abascal, 2. 28006-Madrid (Spain). (2) Department of Computer Science, Cardiff Univ. PO Box 916, CARDIFF CF24 3XF, Wales (UK). E-mail: mcnc171@mncn.cisc.es

Depth of focus is a traditional problem in macro and micro photography that only recent advances in cameras and digitising equipment have made digital image processing techniques offer practical solutions to such problems. In particular, these advances have made practical the treatment of successive optical slices such that parts that are determined to be in focus can be extracted from the respective slides. The in-focus portions of respective slides can then be combined to yield a composite data structure that can be more effectively processed and stored in a variety of biological applications. The main weakness of this procedure lies at the input of the system: digital cameras. Despite their increasing popularity, their resolution is well behind traditional analogic photography. The system we propose here is: 1) To take several optical slices of the specimen under study (e.g. Insect), which will cover the focus of the whole organism. 2) To transfer this optical slices to digital format via a slide scanner. 3) To process the set of digital optical slices with extended depth of focus algorithm computer program. 4) A final 2-D totally focussed image is obtained. Important technical problems in this system are: 1) implementation of fiducial marks to correctly align the set of images prior to extended depth of focus processing, and 2) the algorithm to be used in the extraction of focus portion of each optical slide. In the present study we show examples of the application of this system to insects Scarabaeidae belonging to the tribe Melolonthini, where two or three images can portray the whole external information of the animal.
Key words: photography, digital, camara, structure, taxonomy.

[3123] GOBLET CELLS IN THE MIDGUT OF TRICHOPTERAN LARVAE

C. Corallini, Dipartimento di Biologia Animale ed Ecologia, Università di Perugia, via Elce di Sotto 06123 Perugia ITALY, E-mail drusinae@unipg.it

The ultrastructural organisation of the goblet cells is highlighted in some species of Trichoptera. So far, goblet cells have been identified in Philopotamidae, Polycentropodidae and Psychomyidae (Shinoda, 1927; Gibbs, 1965; Corallini *et al.*, 1998). The fine morphology of the goblet cells is here described in Ecnomidae, Leptoceridae and Sericostomatidae. Goblet cells have an elongated shape and their enlarged apical part communicates with the midgut lumen by an apical valve of short and broad interdigitating microvilli. The goblet cavity is delimited by numerous microvilli, similar to those of the brush border of the columnar midgut cells, and show a fairly regular arrangement. Only in *Wormaldia mediana* McLachlan are the finger-like microvilli arranged less regularly. Mitochondria of these cells are numerous and disposed around the cavity. They do not penetrate into the microvilli. Fibrous matrix, electron-dense material and small vesicles have been observed between the microvilli and in the cavity. The cytoplasm includes free ribosomes, vesicles, electron-dense bodies, myelinic bodies and a marked RER development. The nucleus is usually located under the goblet cavity or laterally to it as in *Ecnomus tenellus* Rambur. The goblet cells are scattered among the columnar midgut cells. The occurrence of the goblet cells is not linked to a particular larval diet because they are found in detritivores, vegetarians, omnivores and carnivores.

[3124] MORPHOMETRICS VARIATIONS IN SOLDIERS OF *TERMES SALTANS* (ISOPTERA, TERMITIDAE, TERMITINAE)

J. M. Coronel[1] & E. Porcel[1], [1] Fac. de Cs. Exactas y Nat. y Agrim. Univ. Nacional del Nordeste. 9 de Julio 1449. 3400 Corrientes – Argentina.

The taxonomy of isoptera is thoroughly based on characteristics of the soldier caste and mandibles of workers and imagoes. Although in the last decades other less conventional characters have been incorporated, such as the coiling pattern of the alimentary canal, architecture of the nests, ethological, biomolecular and genetic aspects, the morphology of soldiers and its variations frequently present within a species, continue playing an important role in the identification of termites. Due to workers show convergent interspecific characters and the imagoes can be obtained only in the swarming time, it is necessary to know and to document the variations of soldiers, enlarging the size of the samples considerably. The present work was carried out with the purpose of contributing to a better taxonomic knowledge of *Termes saltans*, by means of the statistical analysis of different morphometric characters and their intrasocial and intersocial variations in the soldier caste. With the purpose of selecting the most variable morphometric characters in soldiers of this specie a previous study was carried out on a sample of 100 soldiers obtained from one nest, in which twenty – one morphomertic characters were measured. To investigate the intracolonial and intercolonial variability, samples from twelve nests situated at three localities from the Corrientes Province, Argentina, were taken. In each locality four nests were sampled, and each sample were integrated by 30 soldiers. The data were analyzed by multivariated analysis of variance, principal component analysis, analysis of variance and test of Scheffé. The results indicate that the biggest variability affects mainly the pronotum and the labrum. The intercolonial variabilty is manifested among the different localities and among the nests within each area, and the intracolonial variability affects each colony in distinct way. These results indicate that, at least in the populations studied, regional and local variations affect in diverse ways the morphology of the soldiers of *Termes saltans*.
Index terms: Termite, regional variation, Argentina

[3125] DESCRIPTION OF THE PREIMAGINAL INSTARS OF *PARAVELIA CORRENTINA* IGLESIAS & CRESPO 1999 (HETEROPTERA: VELIIDAE)

F. A. Crespo[1] & M. S. Iglesias[2], [1 & 2] Facultad de Cs. Exactas y Naturales, Depto. de Cs. Biológicas, 4° piso Pab. II , UBA. CP: (1428) Buenos Aires, Argentina. E-mail: iglesias@bg.fcen.uba.ar.

Three species of the genus *Paravelia* were described from Argentina, *P. platensis*, from the province of Buenos Aires, *P. paxila*, from San Lorenzo, province of Salta and *P. correntina*, from San Cayetano, province of Corrientes; but their larvae had never been described. Species of related genera of the family are poorly known. With the aim of increasing the knowledge of *P. correntina* the five preimaginal instars are here described. The specimens described as well as some adults, were collected from the foam of the stream El Riachuelo, located in San Cayetano, Province of Corrientes (Argentina), with an insect water net of fine mesh. Morphological characters that allow to identify sexes from larva III onwards are recorded. Allometric growth is determined for segment development of antennae. A key for larval instars is provided based on the following characters: shape of the frontal arms of the ecdisial line and last abdominal segment; localization of the lateral muscular impressions and spiracles; length of wing pads. Scanning electron micrographs and illustrations are supplied. All the specimens collected during the fieldwork, when the heavy rains began after the dry season, were winged adults and larvae with wing pads. Possibly as Spangler 1989 suggests based upon the species *Paravelia biae*, veliids disperse from areas of dense population to new habitats with less competition for food. Perhaps breeding begins after the onset of the rainy season when new habitats become available and the dispersal of the adults occurs. This work was funded by the Secretaría de Ciencia y Técnica, Universidad de Buenos Aires (01-TX24).
Keywords: Systematics, *P. paxila*, *P. platensis*, larvae, nymphs, water striders, development, Argentina

[3126] LIFE HISTORY AND MORPHOLOGY OF THE IMMATURE STAGES OF THE HAIRSTREAK BUTTERFLY *"THECLA" CISSUSA* (HEWITSON, 1877) (LEPIDOPTERA, LYCAENIDAE, THECLINAE)

M. Duarte[1], M. M. Casagrande[1], O. H. H. Mielke[1]& R. K. Robbins[2], [1]Dept. de Zoologia, Univ. Federal do Paraná, C.P. 19020, 81531-990, Curitiba, PR, BRASIL, E-mail lycaenidae@ig.com.br. [2] Dept. of Entomology, National Museum of Natural History, Smithsonian Institution, Washington, D.C. USA, E-mail robbins.robert@nmnh.si.edu.

The taxonomy of many lycaenids still remains unclear due to the difficulty of associating males and females, and because little or nothing is known about their immature stages which also provide meaningful characters for a better understanding of the systematic relationships. To solve some taxonomic uncertainties regarding Neotropical fauna of hairstreak butterflies, we have tried to rear in laboratory as many species as possible following a methodology similar to that used by JOHNSON (1985) in order to obtain eggs from females collected in the field. The complete ontogenetic development of *"Thecla" cisssusa* with an ultrastructural examination of the immature stages using scanning electron microscopy is presented. *"Thecla" cissusa* is a common South American hairstreak butterfly, generally well represented in the collections. Like it has been observed in *Calycopis cecrops, Calycopis isobeon* and *Calycopis caulonia, T. cissusa* lays its eggs on dead materials on the ground. The eggs of *T. cissusa* were obtained from females collected in Jacarepaguá, Rio de Janeiro, Brazil (22°56' S, 43°51' W, the locality is characterized by a mountain base forest), and the larvae were fed on a similar artificial diet to that proposed by TROETSCHLER *et al.* (1985) to raise *Pieris rapae* (Pieridae). All the immature stages were maintained in laboratory under natural conditions of temperature, humidity and photoperiod. In the laboratory oviposition was observed to occur mostly in the late afternoon to early-night (1600-1900). The incubation period lasted in average 10 days. The total period of development from larval emergence to adult eclosion ranged 43-49 days (mean=46.15, standard error= 1.73). The results show that females complete the life cycle earlier than males (egg to female adult= 55 days; egg to male adult= 57 days), contrary to the phenomenon of protandry (males emerging before females) commonly observed in the majority of moths and butterflies. The four-instar larval period averaged 32 days and the pupal period 13 days. Average duration of each larval instar was 8, 4, 7 and 13 days respectively. The detailed morphology of *T. cissusa* immature stages will provide useful data for future comparative studies.

Index terms: Lycaenidae, *"Thecla" cissusa*, immature stages, life history, morphology

[3127] DUNG BEETLE SPIRACLES: DIFFERENT APPROACHES TO THE SAME PROBLEM

F. D. Duncan[1], M. J. Byrne[2] & E. D. Green[3], [1]Dept. of Physiology, Faculty of Health Sciences, Univ. of the Witwatersrand, 7 York Road, Parktown 2193, South Africa, E-mail: 127fra@chiron.wits.ac.za; [2]Animal, Plant and Environmental Sciences Dept., Ecophysiological Studies Research Programme, Univ. of the Witwatersrand, Johannesburg, Wits 2050, South Africa; [3]Dept. of Anatomy, Medical University of South Afrcia, Box 232, MEDUNSA 0204, South Africa.

The respiratory physiology, and spiracle structure were examined in four species of scarabaeid ball-rolling beetles. The beetles were chosen from a variety of habitats that would be expected to exert different amounts of water stress. Breathing patterns were determined using flow-through respirometry. The spiracle structure of the beetles was examined using light and electron microscopy. All four beetle species exhibited distinct patterns of external gas exchange, referred to as a discontinuous gas exchange cycle. Each species showed differences in spiracle structure that could be related to life history and or phylogeny. *Sisyphus fasciculatus*, a woodland species, does not have strict spiracular control during its discontinuous gas exchange cycle. *Anachalcous convexus* and *Scarabaeus rusticus* are mesic species, and both exhibit a distinct discontinuous gas exchange cycle. *Circellium bacchus*, an arid species, has the most unusual form of discontinuous gas exchange cycle, with marked spiracular fluttering during the burst phase. All the beetles examined have six pairs of abdominal spiracles opening into a subelytral cavity. In all the species, except *S. fasciculatus*, the spiracles are heavily sclerotised. *C. bacchus* appears unique in that the first two pairs of abdominal spiracles are markedly larger than the others and are covered by a vestigial wing. The external appearance of the spiracles in this species is also notably different, as the filter apparatus is not apparent. The ratio of spiracle opening area to body mass is lower than expected in this species. We propose that this is a result of this primitive beetle (Canthonini) being flightless and adapted to an arid habitat. However the more derived, flightless, arid-adapted scarabs (Scarabaeini) do not show these adaptations.

Index terms: scarabaeidae, respiration, spiracle structure, SEM

[3128] COMPARATIVE STUDY OF MALE'S GENITALS STRUCTURES IN *PSEUDOCENTRON* SPECIES (HYMENOPTERA: MEGACHILIDAE)

S.P. Durante & N.B. Díaz, Depto. Cient. Entomología. Museo de La Plata, Paseo del Bosque s/n, 1900, La Plata, Argentina, Email sdurante@museo.fcnym.unlp.edu.ar

Pseudocentron was considered as a taxon of generic level by Mitchell in 1980 and its ninety two described species were included in seven subgenera *P.(Pseudocentron), P.(Acentron), P.(Grafella), P.(Leptorachina), P.(Leptorachis), P.(Melanosarus)* y *P.(Moureana)*. The subgeneric delimitation is based on characters from the clipeo, mandibles, genae, first and second pair of legs and male's genital morphology. In spite of the last one, the contributions are scarce and the majority of these are referred to isolated taxa. The main objetive of this contribution is to carry out the compared study of the male genital structures at generic, subgeneric and specific level. For this analysis twenty two representative species of seven subgenera were revised and the specimens studied are housed in the entomological collections of the Museo de La Plata, Argentina and British Museum (NH), England. Systematic tratement was carried out according to Mitchell and the nomenclature used for the descriptions is the proposal by Fischer. At generic level the most important characters are referred to the apex of the gonoforceps, specially in the species of *P. (Pseudocentron), P.(Acentron), P. (Leptorachina)* y *P. (Melanosarus)* that constitute the 70% of those nominaded for this taxon. At subgeneric level , the discriminatory characters are related with the general form of the gonoforceps, their long regarding the *aedeagus*, the pilosity and the number of apical lobes; characters referred to the dispotition and pilosity of the *pennis* valves and the form of the *volsella* are also important at this level. At specific level only the morphology variation of the apical loves of gonoforceps is the most important feature. The subgeneric level is the taxonomic category in which the characters of the male's genitalia together with those of external morphology are the best for the identification practice.

Index terms: genitalia, male, Hymenoptera, Megachilidae, Pseudocentron.

[3129] ULTRAMORPHOLOGY OF THE HYPOPHARYNGEAL GLANDS OF *POLISTES VERSICOLOR* (HYMENOPTERA; VESPIDAE)

F. B. Britto, R. L. M. Silva de Moraes & F. H. Caetano, Depto. de Biologia, I. B. Unesp, P.O. Box 199, 13506-900 - Rio Claro - SP, Brazil, E-mail: fbbritto@rs.rc.unesp.br. Supported by FAPESP.

This study describes morphological and morphometric aspects of the hypopharyngeal glands of *Polistes versicolor*, an important genus considered by Evans (1958) as the "key genus" for understanding the evolution of social insects, due to the slight difference between castes, as well as to the fact of their colonies being found worldwide and frequently abundance, both in tropical and temperate regions. In the biology of the social insects, a work program develops together with important age-related physiological changes, and these changes also occur jointly with functional alterations in exocrine glands. Accordingly, the study of these structures, practically non-existent for wasps, provides an excellent contribution for understanding the biology of these social insects. The ultramorphological analyses of hypopharyngeal glands from pre-emergent and post-emergent *Polistes versicolor* carrying out different activities in the colony have led to establishing the location, organization and characteristics of their secretory cells. The hypopharyngeal glands consist of a group of cells situated under the hypopharyngeal plate, on each side of the head. Each secretory cell, called acini, is directly linked by a canal to the hypopharyngeal plate, sieved by pores which are the canal openin. Morphometric analyses supported the ultramorphological results, differentiating the glands of pre-emergent wasps. These individuals present completely formed hypopharyngeal glands, albeit not yet functioning. Consequently, they have small acini, that become larger after emergence. During this period acini maintain the same degree of development, regardless the wasp's activity in the colony. No difference has been noted between hypopharyngeal glands of wasps founder (responsible for the formation of the colony and for the posture) and subordinates wasps.

Index terms: Scanning-electron microscopy, morphometry, wasps

[3130] THE SUBOESOPHAGEAL GANGLION MODULATES THE OUTPUT INFORMATION IN THE MOTHS OLFACTORY CONDITIONIG

R.-J. Fan & B. S. Hansson, Dept. of Ecology, Lunds Univ., S-223 62 Lund, Sweden. E-mail:.Ruey-Jane.Fan@ekol.lu.se.

The moth, *Spodoptera littoralis,* could learn a CS-US (conditioned - unconditioned stimulus) association by means of proboscis extension conditioning. The neural mechanism underlying olfactory conditioning in moths did however remain unknown. The suboesophageal ganglion (SOG) is involved in controlling the movement of the mouthparts and neck muscles for feeding behavior in many insects. The SOG contains neurons projecting to the thoracic ganglion and the brain including the antennal lobes, protocerebrum and mushroom bodies. From studies in honeybees it is known that the SOG is an important area for olfactory conditioning. The aim of the present study is to investigate the function of the SOG in moths. Neural activity was recorded intracellularly before, during and after training. After the recording, neurons were stained with Alexa 568. Confocal microscopy was used to reconstruct morphology. The CS was 100µg geraniol and the US was a toothpick moistened with 40% sucrose solution. A toothpick without sucrose was used as control stimulus. The inter-stimulus interval was 1 s and the inter-trial interval was 30 s. In the discrimination assay, the rewarded conditioned stimulus was 100µg geraniol and the unrewarded stimulus was 10 µg phenylacetaldehyde (PAA). Two types of responses to the sucrose stimulus were observed before training. The first type was a long lasting excitation for 10-30 seconds. The second type was a biphasic response. After three trials of CS-US pairing, the first type of neurons did not respond to the CS (100µg geraniol), but the second type did. In the discrimination experiment, the second type of neuron only responded to the rewarded CS but not to the unrewarded one. The results corresponded to behavioral observation, indicating that the second type of neurons plays a modulation role in olfactory conditioning. The research was supported by a grant from the Swedish Agricultural and Forest Research Council (SJFR).
Index terms:, *Spodoptera littoralis,* learning, proboscis extension reflex, conditioned stimulus, unconditioned stimulus.

[3131] DETECTION OF CALCIUM AND CALMODULIN DURING SPERMIOGENESIS IN PHYTOPHAGOUS BUGS (HEMIPTERA: PENTATOMIDAE)

[1,2]A.P. Fernandes & [1]S.N. Báo, [1] Lab. de Microscopia Eletrônica, Dept. Biol. Cel. IB, UnB, Brasília-DF 70919-970. [2] Dept. Biol. Cel. IB, Unicamp, C.P. 6109, Campinas-SP, 13083-970. e-mail: snbao@unb.br. Supported by CAPES and CNPq

The phytophagous pentatomids are major pets of economically important crops throughout the world. The characterization of spermiogenesis is very important to programmes directed towards the biochemical control of insect pests. The testes of *Acrosternum aseadum, Euchistus heros, Nezara viridula* and *Piezodorus guildini* were removed and fixed in 2,5% glutaraldehyde and 5% sucrose buffered with 0,1M sodium cacodylate buffer, at pH 7,2; the specimens were rinsed in 0,1M potassium phosphate buffer, at pH 7,2 and postfixed in 1% OsO_4, 5% pyroantimonate in the same buffer. The material was dehydrate in acetone and embedded in Spurr. Ultrathin sections were stained with uranyl acetate and lead citrate and observed in an transmission electron microscopy. For the detection of calmodulin the testes were fixed in 0,5% glutaraldehyde, 4% paraformaldehyde, 0,2% picric acid and 5% sucrose, buffered in sodium cacodylate 0,1M, pH 7,2; the free-aldehydes were quenched with NH_4Cl; the specimens were dehydrate in acetone and embedded in LRGold. Ultrathin sections were incubated in PBS-BSA for 1h, and incubated in a primary antibody against calmodulin (Sigma) at a dilution 1:30, and after incubated in a secondary antibody α-mouse (Sigma) at a dilution 1:20. The grids were stained with uranyl acetate and lead citrate and observed in a transmission electron microscopy. The presence of calcium was observed as a reaction product, which shows an electron dense precipitated, in some specific regions. The cis region of Golgi complex shows the reaction product in all the studied species, indicating that this region could be responsible for the calcium sequestration during spermiogenesis of these insects. Indeed the reaction product can be observed on the axonemal microtubules, in small pits scattered in the cytoplasm and near to the paracrystalline region in the mitochondrial derivatives. Moreover, the calmodulin - a calcium binding-protein - detected in the mitochondrial derivatives, in axonemal regions, in pits scattered in the cytoplasm, indicated that this protein and the calcium ions could be involved in several process of cellular differentiation, acting as modulators of flagellar motility, cytoskeleton regulation and sperm capacitation.
Index words: Immunocytochemistry; Insects; Ultrastructure; Spermatozoa;

[3132] FUNCTIONAL MORPHOLOGY OF TREE WETA MANDIBULAR WEAPONS

L. H. Field[1] & N. A. Deans[2], 1Dept. of Zoology, Univ. of Canterbury, PB 4800, Christchurch, N. Z.; 2Fish and Game Council, Nelson, N. Z.

The wetas and king crickets of NZ, Aust, Africa are gryllacridoid ensiferan orthopterans which excel in weapons developed via sexual selection. In NZ, tree wetas, (*Hemideina*: Anostostomatidae), show enlarged male heads (megacephaly) and enlarged, greatly-elongated mandibles used as weapons in male rivalry battles. This study focussed on the structure, mechanical properties and forces developed by these secondary sexual characters. In all species, male mandibles show allometric growth while female mandibles show isometric growth. The left mandible overlaps the right, causing thigosis of the distal incisor cusps which act like scissors to cut leaves, while the molar cusps crush leaves. Cranial modifications related to the extremely long mandibles include elongation of gena and frons which are heavily reinforced and darkly tanned, and widening of the head to accommodate the more massive articulations. Each mandible is reinforced with a frontolateral carina and a large ventral molar process. Two types of mandibles are found. In the *crassidens* type the male head is up to 3.5X longer than that of females, the cranium houses a muscle mass 3-4X the volume of the female head, and the male head reaches up to 43% of total body length. In the *femorata* type the mandibles are less elongated but have a huge carina and articulation area. In the *crassidens* type, structure governs the degree to which mandibles can gape apart, while in the *femorata* type, structure supports very large force development during biting. A cross-sectional study of the two types indicated maximum reinforcement at areas of high tensile stress (stretch along inner margin) and high compression (along outer margin), and confirmed that the carina and molariform process are reinforcement structures. Thicker cuticle and larger carina in the *femorata* type suggest that stronger forces are involved, as shown in tests where a) breaking strength of cuticle samples was roughly an exponential function of thickness and b) whole mandible maximum fracture strength was higher in the *femorata* type. Maximum biting force for *H. crassidens* at tips = 8.7N and at molars = 11.7N, while maximum force for *H. maori* at tips = 11.8N (4058 lbs/sq inch!) and at molars = 18.6N.The conclusion is that sexual selection has driven the *crassidens* type evolve a large gape, by having long mandibles, and that the *femorata* type has evolved to deliver high bite forces. In video studies of weta battles, the mandibles serve two functions. First, in both species groups, the mandibles provide a low-level threat display when gaped. Second, in high-level battles between *crassidens* type males, the greatest mandible gape allows winning by outgripping the opponent's mandibles.

[3133] INTERACTION OF OXYGEN TENSION AND TEMPERATURE ON INSECT DEVELOPMENT

M.R. Frazier, J.F. Harrison & H.A. Woods, Dept. of Biology, Univ. of Arizona, Tempe, AZ 85281-1501, USA, E-mail fraz5@asu.edu.

As temperature rises, the metabolic rates of insects increase more rapidly than the diffusion rate of oxygen. This has led us to hypothesize that at higher temperatures, oxygen delivering capacity may decrease relative to oxygen demands, and this effect may help explain why insects are smaller when reared at higher temperatures. We made two predictions to test our hypothesis: 1. At higher rearing temperatures, insects will be more sensitive to low oxygen concentrations than they will be at lower rearing temperatures, and 2. high atmospheric oxygen levels will increase insect size at high but not low rearing temperatures. To test our hypothesis, *Drosophila melanogaster* were reared from eggs to adult in either 10%, 21%, or 40% oxygen and at 15°C, 25 °C, or 30 °C. Final adult size was measured as thorax length. In support of our hypothesis, there was a strong interaction between rearing oxygen and temperature on thorax length. At high temperatures, insects were much smaller in 10% oxygen than in 21% oxygen, while at lower temperatures, there was no significant difference between flies reared in 10 and 21% oxygen. In addition, females reared at 30 °C and 40% oxygen were larger than those reared at 21% oxygen. This suggests that normal atmospheric oxygen levels of 21% may limit growth in some conditions and is consistent with our hypothesis that the effects of temperature on insect size are mediated by some aspect of oxygen delivery. This research was supported by NSF grant IBN 972844 to JFH and an ASASU grant to MRF.
Index terms: *Drosophila melanogaster*, body size, hypoxia, hyperoxia, growth.

[3134] FINE STRUCTURE OF THE REPRODUCTIVE SYSTEM OF THE CARIBBEAN FRUITFLY

A. H. Fritz[1] & R. F. Turner[2], [1]Dept. of Biology & Center for the Integrative Study of Animal Behavior, Indiana Univ., 1001 E. 3rd St., JH 142, Bloomington, IN 47405 E-mail anfritz@.bio.indiana.edu; [2]Dept. of Biology, Indiana Univ., 1001 E. 3rd St., JH 142, Bloomington, IN 47405.

Female insects with multiple sperm storage organs may control the final destination of spermatozoa and the rate at which it is stored. The Caribbean fruitfly, *Anastrepha suspensa*, has three spermathecae by which it appears to store and utilize sperm differentially. In order to understand the mechanisms responsible for sperm storage and use in *A. suspensa*, fine structure of the female reproductive tract was determined using light microscopy, scanning electron microscopy, and transmission electron microscopy. Structures not previously reported for this species include 1) presence of a ventral receptacle for sperm storage, 2) a conical-shaped "valve" located at the junction between the spermathecal capsules and their ducts, 3) spermathecae with sclerotized, hollow projections that terminate in single glandular cells, and 4) pores through the wall of the sclerotized capsule of the spermathecae. After mating, spermathecae are not filled simultaneously with spermatozoa suggesting that these structures may enable the female to manipulate sperm usage and thereby influence paternity outcomes.
Index terms: *Anastrepha suspensa*, spermathecae, sperm storage.

[3135] INTERSPECIFIC ALLOMETRY IN THE EGG TO BODY SIZE RATIO IN BUTTERFLIES (LEPIDOPTERA): IS THERE A PATTERN?

E. García-Barros[1], Dept. of Biology, Univ. Autónoma de Madrid, 28049 Madrid, Spain, E-mail garcia.barros@uam.es.

The study of the evolutionary relations between egg size and numbers, and adult body size is often limited by the unavailability of accurate data (namely, egg and adult body weights measured from acceptable sample sizes). However, approximate estimates of size can successfully be obtained from some insect taxa for which abundant literature and collection data exist. This kind of approach has recently been attempted using data from butterflies, and the results suggested an obvious overall interspecific egg to body size allometry in these insects. More precisely, the kind of relation involved is one of negative allometry where egg size is proportional to adult size raised to a power close to 0.5 While the overall pattern appears to be relatively robust, it may be questioned whether or not the common trend applies equally to all of the subtaxa, or is instead the result of the superposition of different allometric patterns characteristic to the main subtaxa (and thus the apparent pattern represents an artefact). This problem was investigated using data on estimated egg volumes and wing sizes from those butterfly families, subfamilies and tribes where eggs have been described for an acceptable number of species. Both the species data means, and independent contrasts calculated using an operative taxonomy were used. The results show that significant correlation (and a positive slope lower than 1.0) usually relates egg and adult body size estimates in most taxa. This is not always the case, however: There are butterfly groups where no correlation was found (e.g. some Lycaenidae such as the tribe Theclini in the Lycaeninae, the tribe Graphiini within the Papilionidae, and the heliconiine Nymphalids), and one instance where evolutionary increases in egg and adult body size seem to be negatively correlated (the Riodinine Lycaenids). Between-taxa comparisons demonstrate significant differences occurring at several taxonomic levels. Unfortunately a precise analysis is complicated by the relatively high variance of the independent contrasts obtained, and it is likely that only more precise data (size data, estimates of phylogenetic relatedness) can ultimately contribute to a robust solution.
Index terms: Comparative method, Papilionoidea, Hesperiidae

[3136] BIOLOGY AND FUNCTIONAL MORPHOLOGY OF *PACHYTELES* LARVAE (COLEOPTERA: CARABIDAE: PAUSSINAE)

A. Di Giulio[1], A. M. Fausto[2], A. R. Taddei[2] & A. V. Taglianti[1], [1]Dipartimento di Biologia Animale e dell'Uomo, Università di Roma "La Sapienza", Viale dell'Università, 32, I-00185 Roma. E-mail: andredg@tin.it; vignataglian@axrma.uniroma1.it; [2]Dipartimento di Scienze Ambientali, Università della Tuscia, V. S. Camillo de Lellis, I-01100 Viterbo. E-mail: fausto@unitus.it; artaddei@unitus.it

Larvae of Paussinae (Coleoptera: Carabidae) are very little known. They are characterised by a hyperprognatous cephalic capsule, an upcurved u-shaped abdomen and by the transformation of the last three abdominal segments (and of urogomphi) into a tranverse 6-lobed terminal disk, differently shaped in the various paussid taxa. Most of these larvae are myrmecophilous and live in ant nests; others, as those of the genus *Pachyteles*, are non-parasitic and live in burrows in sandy banks or rotten wood. Several larvae of two new species of *Pachyteles* (Ecuador, Cotopaxy) were reared in the laboratory in order to describe their ecology, behaviour, life cycle and morphology. Some of them were also studied using SEM and TEM to observe the fine morphology of their terminal disk and the ultrastructure of the sensilla present on it. Larvae of *Pachyteles* use their large and strongly sclerotised terminal disk like a plug for closing the entrance of their burrows or for shielding against predators, but also for trapping small invertebrates, attracted by secretion of certain substances. The unusual sequence of preying, performed by a quick dorsal release, is interpreted as the plesiomorphic strategy of preying in larvae of Paussinae. In the laboratory ants and termites are strongly attracted by substances covering the terminal disk, and this could be a pre-adaptation for myrmecophily occurring in Protopaussini + Paussini (all myrmecophilous). The analyses at the electron microscopes point out that the terminal disk, representing an interface between the larva and the environment outside the burrow, is covered by different types of sensilla, assigned to support the vital functions of the larva. In particular, those rosette-like, here described as "sensilla stylotelica", could have different roles in detecting a prey, thanks to their shape and dispersion on the disk. The observations made in free-living *Pachyteles* demonstrate that the terminal disk of Paussinae larvae has primarily evolved in non-parasitic species serving for defence by phragmosys, for preying by an ambush strategy and for receiving signals from outside their burrows; the symphilous glandular function of the disk in appeasing ants (proposed by the authors as primary) is then interpreted as an apomorphy of myrmecophilous taxa.
Index terms: larval morphology, ecology, preying behaviour, *Pachyteles*.

[3137] MORPHOLOGY OF MYCANGIA OF *CNESTUS MURAYAMAI* (COLEOPTERA: SCOLYTIDAE)

H. Goto, Insect Taxonomy and Ecology Laboratory, Forestry and Forest Products Research Institute, Matsunosato 1, Kumizaki-machi, Inashiki-gun, Ibaraki Prefecture 305-8687, Japan, E-mail gotohide@ffpri.affrc.go.jp.

Intersegmental pouches between pro- and mesonotum, a type of mycangia, are seen in four species of the genus *Xylosandrus*, *Xyleborus dispar* and *Eccoptopterus spinosus*, all of which belong to the tribe Xyleborini. During the course of my study on the morphology of mycangia in the tribe Xyleborini, I found that *Cnestus murayamai* has the same type of mycangium. The mycangial pouch of *C. murayamai* has basically the same composition as the mycangia observed previously: the anterior wall is composed of a membrane extended from the pronotum, and the posterior wall derived from the mesonotum. The anteior wall enlarges considerably, ventrally and posteriorly, and is entirely lined with a single layer of secretory cells. The cells near to the border of the posterior wall are much taller than others. The posterior wall elongates posteriorly, and is entirely sclerotized. The wall is basically thin, though it becomes thick near the border with the anterior wall. The mycangial pouch acutely angulates, and a little recurved dorsally at the border between anterior and bosterior walls. The morphology of mycangium of *C. murayamai* shows the closest affinity to that of *Xylosandrus* spp. among the three genera mentioned above in that the anterior wall is lined with secretory cells. However, the mycangial pouch in *X.* spp. does not angulate unlike in *C. murayamai*. In *X. dispar* and *E. spinosus*, the secretory cells lining exist not at the anterior wall but at the posterior wall.
Index terms: *Cnestus murayamai*, morphology, mycangium

[3138] HISTOLOGICAL AND MORPHOMETRICAL ANALYSES ON MANDIBULAR GLANDS OF MONO- AND POLYGYNIC COLONY *MELIPONA BICOLOR* QUEENS

L.F.Gracioli[1] & R.L.M. Silva de Moraes[2], [1,2] Dept. of Biology, Inst. of Biosciences, Univ. Estadual Paulista (UNESP), Av. 24-A, n.1515, Zip: 13506-900, Rio Claro-SP, Brazil. [1]E-mail lucifg@rc.unesp.br .

In colonies of monogynic species, the interaction between individuals and the organization of tasks in the colony occur due to an advanced system of chemical signs. In this system, signs produced by the secretion of the queen's mandibular glands act on workers and are very important. For this reason, the study of the cycle and secretion components of these glands should represent an important contribution to the knowledge of the biology of Melipona bicolour, which is one of the rare species of eussocial bees in which natural polygyny is highly frequent, with several fisogastric queens per colony. This paper presents the results of morphological and morphometrical analyses carried out on the mandibular glands of queens from Melipona bicolour mono- and polygynic colonies. Glands were dissected in saline for insects, fixed in alcoholic Bouin and processed by routine HE colouring technique. The morphological study was made through light microscopy. For morphometrical analyses, both areas of secretory cells and nuclei were measured with an Axioskop microscope, equipped with an Axiohome system. Averages and standard deviations were calculated and Tuckey and Scheffé tests were applied, in order to check for differences between different groups of queens (1 = fisogastric queen in oviposition from a monogynic colony; 2 = fisogastric queen from a polygynic colony not in oviposition process; 3 = fisogastric queen in oviposition, from the same colony as queen 2). The morphological study showed that mandibular glands consist of a secretory cell and a reservoir, sited at the mandibular base. Each secretory cells is provided with canaliculi, kept together by a membrane and associated to the basal region of the reservoir. Canaliculi exit secretory cells and, passing through the cells of the reservoir wall, they convey secretion from secretory cells to the reservoir lumen. Morphometrical analyses showed that queens from polygynic colonies have less developed glandular cells, with smaller nuclei than the glandular cells of queens from monogynic colonies. Since cellular and nuclear areas can indicate the degree of glandular activity, the results suggest more active glands in monogynic colony queens. To justify this result, we can consider that the task of a single queen in a monogynic colony is shared between several in a polygynic colony, plus the possibility of queens having mutual inhibitory action, leading to less developed mandibular glands in polygynic colony queens.

Index terms: histology, morphometry, mandibular gland, *Melipona bicolor*.

[3139] COMPARATIVE MORPHOLOGY OF IMMATURE STAGES OF *NOCTILIOSTREBLA AITKENI* AND *PARADYSCHIRIA FUSCA* (DIPTERA: STREBLIDAE)

G. Graciolli[1] , M. O. Moura[1] & L. Donatti[2],[1]Curso de Pos-graduação em Entomologia, Depto. de Zoologia, Universidade Federal do Paraná. C. P. 19020, CEP: 81531-990. Curitiba, Paraná, Brasil. Laboratório de Sistemática, Ecologia e Evolução. [2]Curso de Pós-graduação em Zoologia, Depto. de Zoologia, Universidade Federal do Paraná.

Streblidae and Nycteribiidae are blood-sucking pupiparous flies and obligate ectoparasites of bats. They show a cosmopolitan distribuition but occur mainly in the neotropics. The streblid batflies present adenotrophic viviparity with the larvae developing inside the female uterous untill the prepupa stage when it is expeling in the roost walls of the host where their life cycle is completed. Inside the uterous the larvae are nourished by "milk glands". There are few descriptions of immature stages of batflies probably due to their complex life cycle. The genera *Noctiliostrebla* and *Paradyschiria* are obligate ectoparasites of fish-eating bats (Noctilionidae) in the Neotrpical Region and these taxons should form a monophyletic group. Based on it, our aim is to describe the mature larvae of *N. aitkeni* and redescribe the mature larvae of *P. fusca* to aid in the elaboration of a comparative morphological analysis of the evolution of this group. The larvae used were preserved in alcohol 70%. The larvae were dehydrated in the alcoholic series, being the critical point obtained in a Balzers CPD-010 with CO_2. After this, the material was coated with gold in a Balzers SCD-030. The material was analysed in a PHILLIPS 505 scanning electron microscope of the Centro de Microscopia Eletrônica (UFPR). Both larvae are yellowish colour broadly oblong oval and flatened bellow, with a well defined operculum on anterior half. In both species we found three large dorsal-posterior spiracles arranged in a triangle. In *N. aitkeni* the spiracles bears a number of single openings lined in a single row and in *P. fusca* they are formed by a single aperture. Dorsally, the cuticle of both species showed a faintly reticulate appearance. In *N. aitkeni* the cucticle are formed by irregular scale-like plates whilst in *P. fusca* there could be found several oval structures irregularly distributed between continuous projections of derm. One of the most recognizable differences in the cuticle of both species is the presence of very small pores in *P. fusca* cuticle. The emerging line of *N. aitkeni* is built up of imbricated cuticle scales whilst in *P. fusca* it is built up by a cuticle elevation.

Index terms: Immature stage, batflies, ectoparasites, morphology, eletronic microscopic

[3140] THE EXTERNAL MICROMORPHOLOGY OF THE EAR MITE *OTODECTES CYNOTIS* (ACARI : PSOROPTIDAE) AS REVEALED BY SCANNING ELECTRON MICROSCOPY

E. D. Green[1], F.C. Clarke[2] & C. Baker[3], [1]Department of Anatomy, [2]Department of Biology, and [3]Electron Microscope Unit, Box 232, Medical University of Southern Africa, MEDUNSA 0204, Pretoria, South Africa.

Otodectes cynotis is a common parasite causing ear mange in cats, dogs and wild carnivores throughout the world. By light microscopy it is morphologically very similar to other *Psoroptes* and *Chorioptes* mites of domestic animals. This is the first scanning electron microscope (SEM) study to investigate the functional micromorphological specializations of *O. cynotis*. Live mites were collected from freshly harvested crusts from the ears of infested cats and fixed directly in 70% ethanol. The samples were ultrasonicated before dehydrating through graded ethanols, and critical-point dried. The mites were sputtercoated with carbon and gold before viewing in a Leica Stereoscan 420 SEM at 5 to 7 kV. This study investigated the taxonomically important structures including as the sexually dimorphic ambulacral structures on the legs III and IV of the adults, opisthosomal lobes and the copulatory attachment organs of adults and instars. Micromorphological details of structures not previous included in descriptions of *O. cynotis* were observed. The microstructure of the gnathosoma confirmed these mites to be surface feeders. The dentate chelicerae are equipped to scrape the integument of the host for epidermal debris that is ingested through the large oral cavity. Any resulting serum which exudes maybe taken up by a ventral sucker formed by fan-like hypostomatic lobes (pseudorutella). The female protonymphs and tritonymphs each had a pair of prominent posterior cup-shaped copulatory tubercles to which the males attach by means of their specialized adanal suckers during precopulatory pairing. The adult females lacked these tubercles. Each of the pair of everted adanal suckers of the males consisted of a marginal cuticular collar surrounding a central sucker plate on which a sensory central papilla occurred. This sensory papilla would be functionally important as a mechanoreceptor during coupling with the female tubercle. In addition to the micromorphology of the genitalia, the genital openings of gravid females as well as the everted aedeagus of the male mites were also observed. The additional micromorphological detail recorded in this study may help in understanding the biological specializations of *O. cynotis*, as well as for future morpho-taxonomical characteristcs.

Index terms: Otodectic mange, morphology, chelicerae, precopulatory organs, genitalia

[3141] THE FUNCTIONAL MICROMORPHOLOGY OF THE WARTHOG LOUSE (*HAEMATOPINUS PHACOCHOERI*) AS REVEALED BY SCANNING ELECTRON MICROSCOPY

E. D. Green[1] & M. Turner[2], [1]Department of Anatomy and [2]Electron Microscope Unit, Box 232, Medical University of Southern Africa, MEDUNSA 0204, South Africa.

Haematopinus phacochoeri is a common ectoparasite of the warthog which is the main host of African Swine Fever (ASF), a virulent disease causing a high mortality rate among domestic pigs. This study investigated the micromorphological specializations of *H. phacochoeri* as a possible vector of ASF.Live lice were collected from an infested warthog and fixed directly in 70% ethanol. Specimens were routinely processed for scanning electron microscopy and viewed in a Leica Stereoscan 420 at 5 to 7 kV. The SEM study of this large louse (6mm in length) reflected a robust external morphology to withstand the harsh grooming of the warthog. The fused thorax characterized dorsally by two notal pits on the prothorax, a pair of large thoracic spiracles and a large central notal pit on the mesothorax, while two lateral spinous processes extended posteriorly from the metathorax. The membranous abdomen was protected dorsally by rows of sclerotized tergites, and laterally by large bulbous compound paratergites on segments 3 to 8, each containing a tubular spiracle. A dentate sclerotized rim reinforced the opening of each spiracle while hexagonal scales, which act as an air filter, lined the internal lumen. Each leg had a large acuminate claw for gripping the hair against its specialized tibial thumb and unique distotibial pad, thus forming six powerful 'grasping organs' for attachment. The shape of the tubular haustellum, which ensheathed six hooked denticles on the anterior tip of the cone-shaped head, is specialized for sucking blood. The eight preoral setae were uniquely arranged in four duplicate pairs. The antennal sensoria used for the orientation by this eyeless louse consisted of a terminal peg organ with 12 sensilla, two pore organs, as well as a double plate organ. The external genitalia including the everted aedeagus were also investigated and found to be species specific.

Index terms: Anoplura, morphology, spiracles, genitalia, antennal sensoria

[3142] EXOCRINE TEGUMENTARY GLANDS OF *BOMBUS MORIO* (HYMENOPTERA, APIDAE) FEMALES: A MORPHOLOGICAL STUDY

A. C. Guerino-Matteoni[1] & C. Cruz-Landim[1], [1]Dep. de Biologia, Universidade Estadual Paulista, Caixa Postal 199, Rio Claro, SP,13506-900, Brasil. E-mail: aguerino@rc.unesp.br. Supported by FAPESP

Bees have tegumentary exocrine glands distributed dorsally and ventrally on the abdomen. These glands probably produce pheromones. Therefore, they are important for communication within the species, acting in social integration processes, mating, foraging, food storage activity and in defense. This work reports the location and morphological features of tegumentary abdominal glands in females (workers and queens) of *Bombus morio*. The study comprehends a morphological comparison among the glands present in small and large workers and in virgin queens. To light microscopy studies the abdomen of each caste was separated from the thorax, fixed in 4% paraformaldehyde and embedded in historesin. Following resin polymerization, the specimens were sectioned 6 um thick and the sections stained with hematoxylin and aqueous eosin. For transmission electron microscopy, the glands were fixed in Karnowsky, embedded in Epon Araldite and contrasted with urany acetate and lead citrate. Two types of tegumentary glands are present in these bees. Epithelial glands (class I glandular cells) and unicellular gland cells (class III glandular cells). The location of the glands varies according to de type of colony individual, being the epithelial glands more disseminated in the small workers than in large ones, and also present in the virgin queens. The unicellular glands in despite of those were more disseminated in large than in small workers, and yet more in virgin queens. The developmental degree of these glands was also taken in account by comparing the epithelium height and cell numbers in the class III glands. It can be said that the small workers have the glandular epithelium more developed. The ultrastructure of the epithelial cells, as well as of the unicellular cells points to a lipidic secretion. The comparison with the behavior of the studied individual shows that the development al degree of the gland depends of the kind of task the bee has in the colonie.

Index terms: *Bombus morio*, exocrine glands, unicellular glands, epithelial glands.

[3143] MORPHOLOGY OF THE LARVA AND OBSERVATIONS ON BIOLOGY OF *PLATYPUS MUTATUS* (COLEOPTERA, CURCULIONIDAE, PLATYPODINAE)

S. Ide, T. B. de Campos, S. D. L. Imenes, M. B. Figueiredo & W. Yamakawa, Centro de Sanidade Vegetal, Instituto Biológico, Av. Cons. Rodrigues Alves 1252, São Paulo SP 04014-900, Brazil, E-mail imenes@biologico.br.

In March/1999, researchers of "Centro de Sanidade Vegetal", Instituto Biológico were asked for a resident in the city of São Paulo to exam a large specimen of an orchidtree (*Bauhinia variegata* - Leguminosae, Caesalpinoidae) with weakening symptoms. The tree was about 20 years old and presented many holes associated with gum and wood dust in the bark. A piece of the bark was cut and brought to the laboratory. In the days following larvae and adults of a platypodine, came out from the heartwood galleries. In December of the same year, a persimmon (*Diospyros kaki* - Ebenaceae) producer from Guararema (state of São Paulo) made a call for checking an extensive woodborer attack in his orchard. The orchard was about 35 years old and approximately 2% of the trees presented holes in the bark from which abundant quantities of gum were been eliminated. The gum was associated with a fibrous wood dust. A close examination of some gum samples showed adults of same platypodine trapped in. A very well damaged tree was selected and a piece of its bark was removed. Soon adults and larvae of the beetle come out from the galleries inside trunk. In both plants the gallery walls were completely black due the growth of a fungus, probably *Ceratocystis* sp. (Ascomycetes) causal agent of the disease known as blue stain of timber, that occurs on stems or roots of some vascular plants and is disseminated by several bark and ambrosia beetles species. The platypodine was identified as *Platypus mutatus*. Larva (terminology as May, 1994)) cylindrical, slightly larger at abdominal segments II-IV; maximum dimensions 12.0 x 2.0 mm, largest head width 1.4 mm; white-cream, cephalic head and pronotal pattern pale brown, anterior clypeal half, labrum and mandibles dark brown; setal distribution on head – 6 des, 3 les, 4 pes, 5 fs, 2 cls; and mouthparts – 2 lrms, 3 ams, 2 als, 1 mds, 2 sts, 2 vms, 1 prms, 2 plbs; labral notches about ¼ of its length; pronotum with a sclerotized and medially compressed plate, 8 pairs of setae, pattern symmetrical, consisting of two irregular and mesad convergent lines enclosing three rings bearing seta; ventral prothorax with 3 lsts; meso- and metathorax with 2 pds, 1 dls, 1 ss and 2 pdas; thoracic spiracle between pro- and mesothorax, oval, airtube dorsad; abdominal segments with 1 ss and at least 1 pdas; abdominal segment IX bearing five pairs of lateral setae and a small, dark horn, caudal declivity sclerotized and microasperate medially, spiracles smaller than the thoracic.

Index terms: *Bauhinia variegata*, *Ceratocystis*, *Diospyros kaki*, Ascomycetes.

[3144] DESCRIPTION OF FINAL LARVAL INSTAR AND PUPA OF *CURINUS COERULEUS* (COLEOPTERA, COCCINELLIDAE, CHILOCORINAE), A PREDATOR OF *ALEUROTHRIXUS* SP. (HEMIPTERA, ALEYRODIDAE) AND NOTES ON THE ASSOCIATED BIOCOENOSIS

S. Ide, A. E. de C. Campos-Farinha, M. C. Campana, L. A. do Couto & M. L. de Miranda, Centro de Sanidade Vegetal, Instituto Biológico, Av. Cons. Rodrigues Alves 1252, São Paulo SP 04014-900, Brazil, E-mail imenes@biologico.br.

Larva campodeiform, maximum dimensions 7 x 2 mm, light brown, head, legs and dorsal thorax dark brown, paired dorsal spots on thoracic nota yellow, ventral thorax and intersegmental areas white cream, scoli dark brown or white cream. Head longer than larger, lighter on anterior region, frontal suture lyre shaped, not attaining the anterior margin of head, epicranial stem absent. Pronotum very hairy, with two pairs of short scoli on posterior angles, lateral margins bearing setose tubercles, meso- and metathorax with three pairs of short scoli on notum and two pairs of lateroventral scoli. Legs densely setose, setae clear. Abdomen with three pairs of elongate scoli on segments I-VIII, one pair dorsal and two lateral, 8 pairs of glandular openings on segments I-VIII. Pupa oval, maximum dimensions 4 x 2 mm, yellow light, head and legs light brown, exposed dorsal surface dark brown, mesonotum with a pair of lateral tubercles, mesopterothecae extending to abdominal segment II, metapterothecae attaining abdominal segment III, abdominal notum I bearing a pair of cylindrical projections abdominal apex bearing a pair of soft projections. The pupa stays inside the last larval exuvia attached by the abdominal apex on the abaxial surface of the leaves. Larvae and pupae of *Curinus coeruleus* were collected in June/1998, during a field research in the area of Instituto Biológico (city of São Paulo) in a guava shrub (*Psidium guajava* - Myrtaceae) heavily infested by *Aleurothrixus* sp. Larvae and pupae of *C. coeruleus* were brought to laboratory for rearing and posterior identification. Associated with the aleyrodid, larvae another species of lady beetle (probably *Azya* sp. – Coccidulinae), one species of a syrphid fly, and at least two species of ant were found. Excepting the ant, all other insects were predating the aleyrodid immatures. The ants were attending and protecting the aleyrodid for their abundant honeydew. *Aleurothrixus* sp. makes large clusters mostly on abaxial surface of apical leaves, with few individuals spreading on adaxial surface. An identified coccoid species was

Index terms: *Azya*, *Psidium guajava*, Coccidulinae.

[3145] SPIRACULAR GLANDS OF *DROSOPHILA MELANOGASTER* PUPARIA ELICIT RECOGNITION RESPONSE IN *TRICHOPRIA DROSOPHILAE*

N. Isidoro[1], R. Romani[1], S. B. Vinson[2] and F. Bin[1], [1]Department of Arboriculture and Plant Protection – Entomology, University of Perugia, Borgo XX Giugno, Perugia 06121, Italy, E-mail: fbin@unipg.it; [2]Department of Entomology, Texas A&M University, College Station, Texas, 77843-2475.

The recognition process takes place usually mediated by physical and chemical stimuli perceived on contact by antennal sensory structures. The diapriid *Trichopria drosophilae* recognizes *Drosophila melanogaster* pupae using two types of multiporous gustatory sensilla (MGS). MGS type I are about 60 arranged in patches on the last two antennomeres. MGS type II consist of 5-6 basiconic sensilla with porous shaft located in a pit on the apical antennomere. Bioassays are carried out using altered females (one or two apical antennomeres removed) with intact puparia or intact females with host horned spiracles of both ends covered with wax or removed. Host recognition does not occur if the apical antennomere is removed or when intact female cannot antennate spiracular horns. The tips of these are covered with an oily secretion which oozes from associated glands. Morphological and behavioural data indicate that MGS type I and II are likely used to detect kairomone/s from different sources, i.e. the puparium body and the respiratory horns, respectively. However, while the former sensilla type may not be relevant, the latter always triggers the recognition response. Some more examples of MGS type I and II are shown in other diapriids

Index terms: antennal gustatory sensilla, oily secretion, recognition kairomone

[3146] DIFFERENT MECHANISMS ENSURE THE FLOW OF CYTOPLASMIC CONSTITUENTS IN NURSE CELL-OOCYTE SYNCYTIA

M. K. Jaglarz, M. Zelazowska & S. M. Bilinski , Inst. of Zoology, Jagiellonian Univ., R. Ingardena 6, PL 30-060 Kraków, Poland, E-mail jagla@zuk.iz.uj.edu.pl

The distribution of actin filaments and microtubules in the nurse cells of two representatives of Hymenoptera (the cuckoo wasp, *Chrisis ignita* and the ichneumonid wasp, *Cosmoconus meridionator*) and one of Anoplura (the pig louse, *Haematopinus suis*) was investigated. All three species have the polytrophic type of ovary which means that each oocyte is connected with a separate group of nurse cells or trophocytes via intercellular bridges or ring canals. These connections are responsible for the transfer of organelles and macromolecules, most importantly various types of RNAs, from nurse cells into the oocyte. To prevent nurse cell nuclei from occluding the canals, in the fruit fly (*Drosophila melanogaster*) that also possesses the polytrophic ovary, a conspicuous actin filament bundles or cables appear in the nurse cell cytoplasm. However, staining with rhodamine-conjugated phalloidin revealed that in the investigated species actin filaments are restricted throughout oogenesis only to the nurse cell subcortical region. The centre of these cells is occupied by large nuclei that are roughly spherical in wasps and highly extended (ameboid) in the pig louse. In the latter species the inner nuclear membrane is lined with a well developed nuclear lamina. The distribution of microtubules correlates well with the fine structure of the nuclei. In the pig louse nurse cells only single, dispersed microtubules occur in the vicinity of the nuclei. In contrast, each hymenopteran nurse cell nucleus is gradually enclosed during oogenesis in a three-dimensional cage of microtubules. After treatment of hymenopteran ovaries with a microtubule depolimerizing agent (colchicine), the nuclei become elongated and occupy peripheral regions of nurse cells. This indicates that the microtubular cages are engaged in maintaining the position of the nuclei in the cell centre during the transfer of cytoplasm. Apparently, the same result is achieved in the pig louse nurse cells due to a largely extended shape of the nuclei. We suggest that both the microtubular cages and highly irregular, lobed nuclei represent functional counterparts of *Drosophila* actin cables. This also indicates that in insect polytrophic ovarioles several different mechanisms exist that ensure flow of cytoplasm from nurse cells into the oocyte.

Index terms: Hymenoptera, Anoplura, oogenesis, polytrophic ovary, cytoplasm transfer.

[3147] INTERSPECIFIC DIFFERENTIATION IN EGGS AND FIRST INSTAR LARVAE OF GENUS *PROCALUS* (COLEOPTERA: CHRYSOMELIDAE)

V. Jerez, Departamento de Zoología, Facultad de Ciencias Naturales y Oceanográficas, Universidad de Concepción, Casilla 160-C. Concepción. CHILE. e-mail: vijerez@udec.cl.
Grant: 96.113.036-1.2

In Chrysomelidae, the chorionic microsculpture and the morphology of the first instar larva, are important diagnostic characters for subfamilies, genera, and may be used as a taxonomic character for specific differentiation. However, the structure and ornamentation of chorion, mycropyle, head, localization of egg bursters, and other structures in first instar larvae has not been considered currently in taxonomic and phylogenetic analysis. The aim of this work is to describe the ultrastructure of egg shell and larvae, at first instar, of six species of *Procalus*, a genus endemic to Austral South America associated to Anacardiaceae. Pairs of *P. mutans, P. reduplicatus, P. silvai, P. viridis , P. artigasi* and *P. ortizi* were collected in the field and maintained in rearing cages in order to obtain the eggs and larva. Chorion ultrastructure and egg bursters was studied with scanning electron microscopy. For each species, the structure of chorion, mycropyle, cephalic capsule, labrum, mandibles, labium , egg bursters and tarsungulus were examined and described. The results of the present study demonstrate that the eggs of *Procalus* species are cylindrical with an exochorion sculptured into poligonal cells; the mycropyle is rounded, slightly invaginated with interspecific differences on the height, number and diameter of aeropyles. The egg bursters are present on top of mesothoracic sclerites and interspecific differences are observed between to the position, form, and length of the hatching spine and setae. Finally, differences are observed in the anterior margin of labrum, chaetotaxie, tasungulus, and mandible teeth at first instar larva.

Index terms: Chrysomelidae, *Procalus* , egg shell, first instar larvae.

[3148] STRUCTURE OF THE BASAL SHEATH AS A POSSIBLE DIAGNOSTIC CHARACTER IN THE TRIBE TERELLIINAE (DIPTERA, TEPHRITIDAE)

J. Kinkorová, Dept. of Zoology, Charles Univ., Prague 2, CZ 128 44, Czech Republic, E-mail kinkor@prfdec.natur.cuni.cz.

The external female genitalia in tephritids consists of the 7th abdominal syntergosternite - oviscapt, the membranous basal (= ovipositor) sheath or eversible membrane, modified by the 8th abdominal segment, and the ovipositor - the 9th segment. The basal sheath connects the oviscapt and ovipositor and when not in use, the ovipositor and the basal sheath are kept in a retracted position within the oviscapt and not externally visible. The shape of the ovipositor and especially the tip has been used as an important generic and species specific diagnostic character while the basal sheath has been mentioned by several authors only as a possible diagnostic character. The membranous basal sheath bears minute scale-like (= tooth-like) cuticular projections. The size and the shape of these projections and their localisation on the sheath (in diagonal rows or overlapping) on both ventral and dorsal sides of the sheath was studied in several genera of the tribe Terelliinae. The results show that the cuticular structures on the sheath can be used as an additional character at least on specific level in the following common central european genera: *Chaetorelia, Chaetostomella, Terellia (Cerajocera), Terellia* and *Orellia*.

Index terms: female external genitalia, ultrastructure, determination

[3149] STRUCTURE OF THE CROP IN THE ADULT QUEEN BLOWFLY, *PHORMIA REGINA*

J. Kinkorova[1], M. Jokes[2], M. Carcupino[3] & J. Stoffolano[4] , [1]Dept. of Zoology, Charles Univ., Prague-2, CZ 128 44, Czech Republic, E-mail kinkor@prfdec.natur.cuni.cz; [2]Res. Inst. of Plant Prod., Prague-6, CZ 161 05, Czech Republic; [3]Dept. of Zoology and Anthropology, Univ. of Sassari, Italy, E-mail carcupin@ssmain.uniss.it; [4]Dept. of Entomology, Univ. of Massachusetts, USA, E-mail stoffolano@ent.umass.edu.

The majority of studies on the crop of adult dipterans focuses on the distribution of various nutrients fed upon and not on how it is regulated for intake or emptying. Evolution of the crop, a liquid storage organ in the adult queen blowfly, is essential for feeding on various nutrients, both proteins (for egg development) and carbohydrates (for energy), both of which are patchily distributed and often not readily available in the environment. The ability to store large quantities of liquid when encountered give adults greater dispersal capabilities. Thus, it is surprising that no known definitive study has been done on its structure, both at the SEM and TEM levels. The crop is a diverticulum connected to the esophagus by a duct and is a bilobed sac capable of considerable distention. Its ability to retain liquids for long periods of time following removal is attributed to sphincters that keep fluid from leaving the crop duct and also to its cuticular, impermeable lining. Circular and longitudinal, visceral muscles produce the contractions of the crop and crop duct. Recent studies show that these muscles are regulated by two peptides (one inhibitory and the other stimulatory). Fluorescent antibody probes reveal that the neurons releasing these peptides produce a net-like covering over the crop lobes and duct. TEM studies reveal a large number of trachea also cover and are located between the two muscle types. TEM studies also show that the neurons delivering these peptides usually follow the course of and are usually associated with the trachea. In addition to acting as a storage organ, the crop plays a significant role in terminating feeding once it reaches its maximum volume.

Index terms: Ultrastructure, diverticulim, Diptera

[3150] MOLECULAR CHARACTERIZATION AND IN SITU LOCALIZATION OF A PEROXIDASE GENE WITH RESPECT TO CHORIOGENESIS IN *DROSOPHILA MELANOGASTER*

O.Konstandi, S.H.Woitek & L.H.Margaritis, Fac. of Biol., Dep.of Cell Biol. & Biophysics, Univ. of Athens, Panepistimopolis, Kouponia, Athens, GR-15701, Greece, e-mail: lmargar@cc.uoa.gr. This work was supported by a TMR grant N° ERB4061PL970047 to Prof. L.H. Margaritis.

The formation of the chorion is well studied in Diptera (especially in *Drosophila melanogaster*) and constitutes one of the most interesting subjects for developmental research. Choriogenesis occurs in *Drosophila melanogaster* follicles of stages 11 to 14 during oogenesis. The chorion protects the laid egg and the embryo from the enviroment and supports important procedures for the embryonic development. The hardening of the chorion (the outermost layer of the eggshell) is due to the formation of di- and tri- tyrosin bonds between the chorion proteins. Treatment with o-diaminobenzidine and H_2O_2 of follicle sections for TEM and light microscopy proves that the responsible enzyme catalysing the formation of such bonds is a peroxidase. Those results were also verified via biochemical studies through SDS-PAGE electrophoresis and peroxidase activity specific staining. The peroxidase is studied at the molecular/genetical level as well as at the biochemical level. So far three peroxidase genes are known: a) peroxidasin, an enzyme matrix protein that is localized in the oocyte, b) the DmPO gene isolated from an embryonic cDNA library and c) a peroxidase gene localized in nurse cells of the early stages of the follicle development. RT reactions were performed using mRNA from staged follicles (11-14) as template and primers that were raised according to conserved regions of mammalian and insect peroxidases. Sequencing of the PCR products revealed that the Flqu product exhibits 100% homology with the cDmPO clone. A cDNA library was constructed from choriogenic follicles that was screened against the Flqu product to isolate a full length clone. The Flqu clone was characterized by Northern and Southern analysis. The localization of the Flqu clone was determined by in situ hybridization.

Index terms: Drosophila, Diptera, choriogenesis, oogenesis

[3151] THE OVARY STRUCTURE AND OOGENESIS IN *POLYSTOECHOTES PUNCTATUS* (NEUROPTERA: POLYSTOECHOTIDAE)

J. Kubrakiewicz, Zoological Inst., Univ. of Wroc law, 50-335 Wroc law, Sienkiewicza 21, Poland, e-mail: jkubrak@biol.uni.wroc.pl

As in other neuropterans, the ovary of *P. punctatus* consists of several ovarioles of meroistic-polytrophic type. Each ovariole is differentiated into an anterior germarium and a posterior elongated vitellarium that comprises most of the ovariole length. The germarium houses germ cell clusters at initial stages of differentiation Within the transitional zone between the germarium and the vitellarium the germ cells (cystocytes) forming individual clusters are diversified into the oocyte and a group of its accompanying nurse cells but none of the clusters is completely invested by somatic follicular tissue or comprises the whole width of the ovariole. The vitellarium is formed by a linear array of several well developed egg chambers in progresively advanced stages of previtellogenesis and vitellogenesis. Each egg chamber consists of a single cluster of cystocytes together with the associated somatic follicle cells. Some follicle cells form a monolayer epithelium that envelopes the posterior and lateral aspects of the oocyte while some other, more stretched follicle cells cover the nurse cells. As a rule a few individual follicle cells are also found among the nurse cells. The plasma membranes of the nurse cells are smooth; in some places, however, adjacent nurse cells form extensive interdigitating microvilli. The nurse cells are polyploid. In the early previtellogenic egg chambers their nuclei contain several nuleolar aggregations. Each aggregation is formed by a few fine granular spherical bodies of various size, surrounded by smaller accumulations of a dense granular material. During previtellogenesis the latter material gradually disappears. From histochemical and ultrastructural studies it is evident that the extrachromosomal amplification of rDNA takes place in the oocyte nucleus. At the onset of previtellogenic growth the oocyte nucleus contains one or two large prominent nucleoli associated with the centrally located DNA-positive accumulations. These accumulations comprise condensed chromosomes of meiotic prophase together with the extrachromosomal rDNA material. The chromosomes remain condensed throughout the oogenesis and form a few dense aggregates randomly disposed within the karyoplasm. Dispersion of amplified rDNA material coincides with the fragmentation of nucleoli and the beginning of intense transcription. As a result the number of nucleoli in the oocyte nucleus increases while their size is reduced. Eventually the oocyte nucleus is filled with numerous tiny multiple nucleoli. Roughly spherical multiple nucleoli are surrounded by a dense granular RNA-positive material that „buds off" from their surface.This work was supported by a grant No. 0389/P04/99/16 from the KBN.

Index terms: polytrophic ovary, germ cell activity, rDNA amplification

[3152] ANALYSIS OF HUNCHBACK IN *NASONIA VITRIPENNIS*

D. S. Leaf[1], L. Westendorf[2], N. L. Reeves[3] & M. A. Pultz[4], [1,2,3,4] Biology Dept., Western Washington Univ., Bellingham, WA, USA 98225, E-mail: leaf@biol.wwu.edu.

We are examining how developmental regulatory genes have been modified or conserved during evolution by comparing the early development of *Nasonia vitrepennis (Nv)*, a parasitic wasp, to *Drosophila*. Genetic screens for zygotic mutations affecting embryonic patterning in *Nasonia* have identified a number of zygotic genes affecting early development, including *headless*. Since *headless* mutant embryos resemble *Drosophila* embryos lacking both maternal and zygotic *hunchback* function, we have hypothesized that *headless* is *Nv hunchback*. To determine whether *headless* is a mutation in *Nv hunchback*, we have begun with meiotic mapping experiments to determine whether *headless* is inseparable from *Nv hunchback*. We have taken advantage of a system for mapping polymorphisms using interspecific crosses between *Nasonia vitripennis* and *Nasonia giraulti (Ng)*, developed by Jack Werren (Univ. of Rochester). Based on a single nucleotide polymorphism in a highly conserved region of *Nasonia hunchback*, we designed a primer that amplified the *Ng* version but not the *Nv* version of *hunchback*. We then assayed the surviving adult sons of mothers heterozygous for *Nv/Ng* and *headless/headless*$^+$. In 105/105 genomes so analyzed, the *Ng* version of *hunchback* segregated with the wild-type allele of the *headless* gene, consistent with the hypothesis that the *headless* mutant phenotype is caused by a mutation in *Nv hunchback*.. Based on these results, we are further analyzing the *Nv hunchback* allele of *headless* mutant embryos. Using RACE PCR, we have cloned and sequenced the 5'and 3' ends of *hunchback* mRNAs from early *Nasonia* embryos. The 3' untranslated regions of the mRNAs that we have analyzed lack recognizable *nanos* recognition element (NRE) sequences like those found in the *Drosophila* and *Tribolium hunchback* genes. This result is consistent with prior genetic results indicating that *Nasonia hunchback* may function only zygotically. Analysis of the *Nv hunchback* predicted protein sequence has revealed further differences relative to both *Drosophila* and *Tribolium hunchback* genes. In the cDNAs that we have analyzed, *Nv hunchback* lacks recognizable D-box sequences and also lacks the carboxy-terminal zinc fingers. Moreover, *Nv hunchback* has an additional zinc finger not present in the *Drosophila* or *Tribolium hunchback* genes. These differences are unexpected, given that *Drosophila* is more closely related to *Nasonia* than to *Tribolium*. This work is supported by the NSF.

Index Terms: Hymenoptera, A-P axis, pattern formation, embryogenesis

[3153] STRUCTURAL AND ULTRASTRUCTURAL OBSERVATIONS OF SPERM OF TWO SPECIES OF PARASITOIDS (HYMENOPTERA: EULOPHIDAE)

J. Lino Neto[1,2] & H. Dolder[2], [1]Departamento de Biologia Geral, Universidade Federal de Viçosa, 36571-000, Viçosa MG, Brazil; [2]Departamento de Biologia Celular-IB, Universidade Estadual de Campinas, 13083-970, Campinas SP, Brazil. E-mail: linoneto@unicamp.br. Financial support: Fapesp - Capes

Most of the Chalcidoidea are parasitoids of other insects, and therefore potentially important for biological control. As this superfamily is still little known, we believe that the structural characterization of their sperm could contribute to phylogeny and taxonomy studies. Sperm from the seminal vesicle of *Palmistichus elaeisis* and *Trichospilus diatraeae* were spread on clean glass microscope slides and coverslips. The first were stained with DAPI and photographed in a fluorescence and phase contrast microscope. The latter were prepared by routine methods for scanning electron microscopy (SEM). The spermatozoa of *P. elaeisis* and *T. diatraeae* are slender and quite long, measuring about 185 µm and 120 µm in length, respectively. They are wavy along their entire length and it is possible to distinguish the head from the flagellum. In both species, the head region consists basically in the nucleus which clearly differ between the two species. In *P. elaeisis*, it is very long, measuring about 56 µm, and fine, with approximately 0.35 µm in diameter along its entire length. Still in this species, this structure is helicoidially twisted only in its anterior two thirds. In *T. diatraeae*, the nucleus is helicoidially twisted along its entire length and measure only about 20 µm in length. It gradually tapers anteriorly from the base (0.52 µm in diameter) up to one third of its length, where it continues with a constant diameter. The flagellum consists of an axoneme and two mitochondrial derivatives (DM). In *P. elaeisis*, the axoneme has the typical 9+9+2 microtubule arrangement. On the other hand, the two central microtubules are not observed in the axoneme of *T. diatraeae*. In both species, the DM are alike in cross section and placed very close to the axoneme. In longitudinal sections and in SEM, they can be seen to coil regularly around of the axoneme. In *P. elaeisis*, these structures are almost as long as the axoneme. However, in *T. diatraeae*, they are much shorter than the axoneme. In both species, as in other chalcidoids, the DM spiral around the axoneme which is itself twisted to accompany this spiral. The present study shows that the structural diversity of chalcidoid spermatozoa is sufficient to furnish useful characters for phylogenetical analyses at the subfamily level and, possibly, of the genus.

Index Term: Chalcidoidea - Parasitoids - Sperm - Phylogeny

[3154] MORPHOMETRIC DIFFERENCES OF *TRIATOMA INFESTANS* FROM THE EASTERN AND WESTERN REGIONS OF PARAGUAY

López E[1], Acosta N.[1], González N.[1], Fernández M.J.[1], Ferreira E[2], Rojas de Arias A[1]
[1]Instituto de Investigaciones en Ciencias de la Salud. Rio de la Plata y Lagerenza, CP 2511.Asunción-Paraguay. [2]. Servicio Nacional de Erradicación del Paludismo.

In order to compare *Triatoma infestans* population from different geographical origin and to study morphometric variations of males and females, populations from 4 departments endemic for Chagas disease were studied within the National Program of Chagas Control. Morphometric characters, 7 in the head and 4 in each wing of 150 specimens, were measured. T Test was used to measure the differences between means and the uni and multi-variate analysis were used to evaluate size and conformation variables.The sexual dimorphism in size, where females are significantly bigger than males, is a general rule for triatomines and was confirmed by this study. Metric differences were also found when comparing males ($P<0.01$) and females ($P< 0.05$) from Eastern and Western regions being smaller the ones from the former region. In the uni-variate non-parametric analysis, significant differences were observed in the eye conformation and size($P<0.05$), and in the total length and conformation of the head ($P<0.01$). In specimens from the Department of Paraguari, both variables, were smaller. In the analysis of the main components, no significant differences were observed. However, there was a trend of conforming only one group in the populations of the Western region (Boqueron and Presidente Hayes) while the populations from the Eastern region (Paraguarí y Cordillera) tended to be different from the former and between them ($P<0.0001$). These results support the hypothesis which states that the differences between populations could be attributed to environmental factors. The evaluation of the shape or the persistence of these differences in successive generations maintained in laboratory could corroborate the existence or not of genetic variations between populations.
Index terms: *T. in*festans, Paraguay, morfometric,Chagas control

[3155] COMPARATIVE ULTRAMORPHOLOGY OF THE HEART OF *DOLICHODERUS* AND *CAMPONOTUS* (FORMICIDAE)

R. M. Marques[1] & F. H. Caetano[1], [1]Dept. of Biology, I.B. Unesp, P.O. Box 199, 13506-900 - Rio Claro - SP, Brazil, E-mail: renatomm@ms.rc.unesp.br. Supported by FAPESP.

Insects have an open circulatory system and generally possess pumping structures and various diaphragms to ensure that hemolymph flows throughout the body. The main pump structure is a pulsatile vessel that runs almost the entire length of the body and is known as the dorsal vessel. The posterior portion of the vessel are usually named the heart, whereas the anterior portion may be termed the aorta. Associated with the heart are the aliform muscles and pericardial cells. There is also some valves or ostia in the heart which controls the hemolymph flow (CHAPMAM, 1975). Workers of *Dolichoderus (M) bispinosa* were collected and anesthezied at low temperature and their abdomem were dissected in physiology solution for insects (7,5g NaCl + 2,72g KH_2PO_4 + 2,38g Na_2HPO_4). The cuticle with the heart and associated structures was fixated with Karnovsky solution and dehydrated with cetone. After, the material was submited to Critical Point Balzers CPD 030 for the complete dehydration. The stubb containing the material were covered with carbon/gold at Sputtering Balzers SCD 050 and examinated on Scanning Electron Microscope JEOL-P15. The dorsal diaphragm of *D. (M) bispinosa* is thin, with free edges between their points of attachment on the body wall, almost covering the whole extension of the heart as seem in *Camponotus rufipes* (MARQUES & CAETANO, 1999) in agreement with CHAPMAN (1975). This dorsal diaphragm has the same function as in *Apis mellifera* which throught the free edges the blood flows to incurrent ostia at the heart wall (SNODGRASS, 1956) and works to maintain the hemolymph flow (CHAPMAM, 1975). The incurrent ostia, in a lateral view, is a vertical slit in the wall of the heart and look like a arrow in a dorsal view. This is similar to the complex ostia-valve wich occurs in *C. rufipes* (MARQUES & CAETANO, 1999) and was described for *A. mellifera* (SNODGRASS, 1956). A great number of pericardial cells were found laterally associated to the heart. The aliform muscles form a network with pericardial cells and support the heart at its middorsal position. The heart is holded by numerous and thin filaments, probably muscles fibers, attached to the internal side of tergites just above it. This discription is similar to others insects like *A. mellifera* (SNODGRASS, 1956) and *C. rufipes* (MARQUES & CAETANO, 1999). Pericardial cells projections insert directly to the heart wall. Its agrees with specialized literature. The function of those cells is control the heartbeat by producing Indolalkyl-amine (WIGGLESWORTH, 1974).
Index terms: hemolymph, ostia, aliform muscles, dorsal vessel, abdomem.

[3156] A COMPARATIVE STUDY OF THE SPERMATHECA IN BEES (HYMENOPTERA, APOIDEA)

G. F. Martins[1] & J. E. Serrão[1], [1] Dept. of General Biology, Fed. Univ. of Viçosa, 36571-000, Viçosa, MG, Brazil. E-mail jeserrao@mail.ufv.br. Supported by Brazilian Research Agencies CNPq and FAPEMIG.

Among bees species there are a great variation in the number of eggs production. Thus the spermatozoa amounts stored in the spermatheca can be different among the species. Therefore, studies of spermatheca structure can be relationed with different social behavior in bees. In these study the structure of the spermatheca was analyzed in the following species of bees: *Bombus morio* (queen), *Epicharis flava*, *Epicharis affinis*, *Centris aenea*, *Centris sp.*, *Euglossa sp.*, *Eulaema nigrita*, *Xilocopa frontalis*, *Thygater analis*, *Thygater sp.* (Apidae) and *Augochloropsis sp.* (Halictidae). The bees were dissected in presence of saline solution, the reproductive system was removed and the spermatheca isolated and transferred to 4% paraformaldehyde in phosphate buffer. The pieces were embedded in historesin and the 4µm sections were stained with Dominici solution. Measurements of spermatheca and spermathecal chamber volume and the epithelium height were made on sections by Image Pro-Plus 4.0 software. All spermatheca were filled with spermatozoa and were formed by a single layered epithelium of columnar cells, covered by a thin cuticular intima. Flat epithelial cells constituted the spermathecal duct and externally a well developed muscular coat envelops it. The obtained measurements were: 1) spermathecal volume ($x10^4$ µm^3): 942,79 em *B. morio*, 604,72 in *E. flava*, 1086,48 in *E. affinis*, 426,81 in *C. aenea*, 323,96 in *Centris sp.*, 179,76 in *Euglossa sp.*, 1588,71 in *X. frontalis*, 208,47 in *T. analis* and 168,63 in *Thygater sp.*; b) chamber volume ($x10^4$ µm^3): 333,07 in *B. morio*, 167,55 in *E. flava*, 551,73 in E. affinis, 79,53 in *C. aenea*, 59,69 in *Centris sp.*, 43,21 in *Euglossa sp.*, 649,56 in *X. frontalis*, 42,40 in *T. analis* and 80,74 in *Thygater sp.* and c) epithelial height (µm): 64,56 in *B. morio*, 59,82 in *E. flava*, 46,53 in *E. affinis*, 68,99 in *C. aenea*, 37,97 in *Centris sp.*, 42,03 in *Euglossa sp.*, 73,89 in *E. nigrita*, 74,24 in *X. frontalis*, 62,27 in *T. analis* and 18,42 in *Thygater sp.* These results may be relationed with the specimen size and sociability level of bees.
Index terms: bee, reproductive system, spermatheca

[3157] OVIPOSITION PATTERNS OF PROCONIINI SHARPSHOOTERS (CICADELLIDAE: CICADELLINAE) IN CITRUS

R.C. Marucci[1], J.M. dos Santos[2] & J.R.S. Lopes[1], [1] Dept. Entomologia, Fitopatologia e Zoologia Agrícola, ESALQ/USP, C.P. 09, Piracicaba, SP 13418-900, Brazil, E-mail rcmarucc@carpa.ciagri.usp.br; [2] Dept. Entomologia e Nematologia, FCAV/UNESP, Jaboticabal, SP 14870-000, Brazil.

Sharpshooter leafhoppers (Hemiptera: Cicadellidae: Cicadellinae) of the tribe Proconiini show an intriguing behavior, in which pre-ovipositing females secrete a liquid (through the anus) that is deposited by the hind tibia on the costal area of the forewings, where a solid, rounded and whitish deposit is formed. Following oviposition, the females scrap the hind tibia over this deposit and then spread the collected secretion on the eggs. The oviposition pattern of three Proconiini sharpshooters, *Acrogonia* sp., *Oncometopia facialis* and *Homalodisca ignorata*, was studied on citrus plants, to better characterize this behavior, whose function is unknown. Adults of each species were collected on citrus trees in northern State of São Paulo, Brazil, and confined on sweet orange (*Citrus sinensis*) potted plants for a 3-day oviposition period. Number of egg masses obtained were 12; 321; and 9 for *Acrogonia* sp., *O. facialis* and *H. ignorata*, respectively. Most (>90%) were laid on the lower side of the leaves; none was observed on stems or petioles. Eggs of *Acrogonia* sp. were elongated, laid externally on the leaf surface and arranged side-by-side in 1 or 2 layers per egg mass. Eggs of *O. facialis* and *H. ignorata* were laid underneath leaf epidermis, covered by just a thin plant membrane. Eggs masses of *H. ignorata* were comb-shaped and slightly curved, while those of *O. facialis* were rounded, with egg compartments more clearly separated. Mean numbers (± SEM) of eggs per egg mass were 8.4±4.3; 4.8±2.25 and 14.7±4.5 for *Acrogonia* sp., *O. facialis* and *H. ignorata*, respectively. Most egg masses (85.5%) of *O. facialis* and all of *Acrogonia* sp. and *H. ignorata* were covered with the whitish secretion. Visualization of this secretion on females wings, under a scanning electron microscope, revealed the presence of structures resembling brochosomes, which differed in shape and size among the three Proconiini species. Compared with males, females of the three species showed a pronounced development of the row III in the hind tibia. This is thought to be an adaptation of the females to collect the secretion from the anus and spread it on the wings or over the egg masses.
Index terms: egg-laying behavior, xylem-feeding leafhoppers, brochosomes

[3158] MORPHOLOGY AND EVOLUTION OF THE SECONDARY GENITALIA OF LIBELLULOIDEA (ODONATA: ANISOPTERA)

M. L. May, Dept. of Entomology, Rutgers Univ., 93 Lipman Drive, New Brunswick, NJ 08901-8524, U.S.A., E-mail may@aesop.rutgers.edu.

To test and extend current hypotheses about historical evolution of secondary genitalia of Odonata, I describe here accessory genitalia and musculature of Libelluloidea, including: Cordulegastridae, *Zoraena diasatatops*; Synthemistidae, *Synthemis eustalacta* and *Choristhemis flavoterminata*; Gomphomacromiidae, *Gomphomacromia paradoxa*; Corduliinae (s.l.), *Oxygastra curtisii*, *Didymops transversa*, and *Cordulia shurtleffi*; and Libellulinae, *Libellula quadrimaculata*. These represent a substantial fraction of the taxonomic and morphological diversity within the Libelluloidea. I find that: 1a) The anterior hamules (AH) are fused with the anterior lamina as previously noted in *C. shurtleffi* and *L. quadrimaculata* but also, undoubtedly by independent evolution, in *S. eustalacta*. 1b) The AH are poorly correlated with the form of the female ovipositor. E.g., of the 2 species with a long and complete ovipositor, *Z. diastatops* has very large AH but *G. paradoxa* has quite small ones; *S. eustalacta*, which has a complete, albeit shorter ovipositor, lacks AH. In all other species the ovipositor is reduced to a small, bilobed vulvar lamina, although one, *D. transversa*, has large AH. 2a) The posterior hamules (PH) of *Z. diastatops* and *G. paradoxa* hook inward and probably engage the ovipositor of their respective females. 2b) The PH of *O. curtisii* are chelate and probably designed to grip the vulvar lamina of females. Closure of the claw is brought about by rotation of the anterior frame. 3a) Muscle 1 (M1; dorsal) is not reduced in cordulines (except slightly in *C. shurtleffi*), *G. paradoxa*, or synthemistids, suggesting that these taxa depend strongly on dorsal flexion of the abdomen at the segment 2-3 joint to compress the penis vesicle, as in non-libelluloid dragonflies. 3b) Muscle 4 is relatively hypertrophied in *C. shurtleffi* and *L. quadrimaculata* (in which M1 is reduced) but also in *D. transversa*. Also, M6 inserts, via an apodeme, more caudally in *L. quadrimaculata* than in the cordulines or *Z. diastatops*, but *G. paradoxa* and the synthemistids also exhibit a (direct) caudal insertion. 4a) Muscle 9a is absent in species lacking a functional AH, regardless of taxonomic position. In these species, $M8_{II}$, which opposes M9a, is also reduced or absent. 4b) In *G. paradoxa*, the extreme lateral insertion of M9a on AH suggests that it acts as an adductor (depressor) of AH, rather than as an abductor (elevator), as in all other species. 5) Muscle 9b is similarly developed in all taxa except *L. quadrimaculata*, in which it is absent. 6). Both M9c and M11, which are probable antagonists, retracting and extending the genital ligula (GL), respectively, are similarly developed in all taxa. In *Z. diastatops*, M11 is inserted posteriorly on raised apodemes, possibly providing enhanced mechanical advantage during the initial phase of GL rotation.

Index terms: copulation, dragonflies, Corduliinae, Libellulinae, Synthemistidae

[3159] THE WEEVIL GENUS *ARAUCARIUS* (CURCULIONIDAE, COSSONINAE) - NEW INVESTIGATION OF AN UNUSUAL TIBIAL STRUCTURE

R. Mecke[1,2], W. Engels[2] & M. H. M. Galileo[3], [1]Lab. Pesq. Biol., Pontifícia Univ. Católica, P. O. Box 1429, Porto Alegre, RS, 90619-900, Brazil; [2]Zoolog. Inst., Univ. Tübingen, Auf der Morgenstelle 28, 72076 Tübingen, Germany, E-mail roland.mecke@t-online.de; [3]Mus. Ciênc. Nat., Fundação Zoobot., P. O. Box 1188, Porto Alegre, RS, 90001-970, Brazil.

The weevil tribe Araucariini (Cossoninae) includes 6 genera, all of them occurring in the southern hemisphere. The main character separating these genera from all other Cossoninae is the presence of additional spines on the tibiae. These spines are of special interest because of their extraordinary structure. They emerge from a socket and therefore it has been supposed that they are true tibial appendices and not just processes. The conclusion was, that they are of the same origin as hairs and homologous to the tibial processes of many Scolytinae. However, this never has been analysed with electron microscopy and some taxonomists didn't believe that the spines in Araucariini have the same structure and origin as the so-called articulated spines of the Scolytinae tibia. During a recent investigation of the insect fauna, associated with *Araucaria angustifolia* in the State of Rio Grande do Sul (Brazil), two new Araucariini-species have been detected and have been described now as *Araucarius crassipunctatus* and *A. kuscheli*. Additionally the tibial spines of the two new and of two already known species of this genus have been analysed using a scanning electron microscope. It could be proofed, that the tibial appendices of *Araucarius* have a clear separating suture between spines and socket and are equal to the articulated spines of Scolytinae. On this base it may be suspected that there really is a phylogenetic relationship between the subfamilies Scolytinae and Cossoninae.

Index terms: *Araucarius crassipunctatus*, *Araucarius kuscheli*, *Araucaria angustifolia*, morphology, phylogeny.

[3160] MORPHOLOGICAL ASPECTS OF THE EGG, 1ST AND 5TH NYMPHAL INSTARS OF THE BURROWING BUG, *ATARSOCORIS BRACHIARIAE* BECKER, 1996 (HEMIPTERA: CYDNIDAE)

M. O. Medeiros[1] & O. Sales Jr.[1], [1]Centro de Controle Biológico, Univ. Federal de Mato Grosso, Av. Fernando Corrêa, s/n, Cuiabá, MT 78060-900, BR, ccb@cpd.ufmt.br.

This research was aimed at morphologically characterizing the egg and the 1st and 5th nymphal instars of the burrowing bug, *Atarsocoris brachiariae*. Observations were made under a stereomicroscope. Measurements were taken from 100 individuals for each development stage, with a sliding caliper. The egg stage showed lengths ranging from 0.8 through 2.7 mm and widths from 0.6 through 2.4 mm, respectively with or without the effect of humidity. The egg is ovoid, almost cylindrical, whitish, whitish-yellow or light yellow depending on the development of the embryo. When freshly laid it is bright, humid and slightly viscous. The chorion is firm, with a laced, irregular surface. The 1st instar nymph is very distinct morphologically from the other instars, measuring 2.30x±0.460 length and 1.74±0.393 width, on average. It is egg-shaped, milky white to pale yellow, ventrally depressed and has the body covered with light-colored bristles. The head is not distinct, with 8-segmented antennae. The forelegs are well developed, with robust tibiae adapted for excavating. The middle and hind legs are ambulatorial, with no special modifications. The body is flexible and wrinkled. The abdomen is 10-segmented, uniform in width from the 1st through the 5th segment, the first being larger than the others. The remaining abdominal segments taper off toward the end of the body. The 5th instar nymph is on average 5.15x±0.340 mm in length and 3.23±0.299 mm in width. The head is amber-yellow on its dorsal surface, with seven bristles along each anteocular margin, brown in color; the ventral surface, antennal segments and rostrum are yellow-white. The thorax has an amber-yellow notum with a series of bristles along the external margins of the pronotum and the mesothoracic wing buds, which extend over the 3rd abdominal segment; the ventral surface (sternum and pleura) and femurs are yellowish; the tibiae are yellowish with brown spines; tarsi lacking. The abdomen has a milky white-yellow dorsum; tergum 4 with a fine and narrow middle plate on the posterior margin; tergum 5 with a wider middle plate; tergum 6 with middle plate a little smaller than the previous; all plates amber-yellow; sternal plate bright white-yellow and milky. The female has a small biconcave marking above the anal opening, lacking in the male.

Index terms: description, morphology, *Brachiaria*, pest

[3161] ULTRASTRUCTURAL STUDIES ON THE SALIVARY GLANDS OF *RHODNIUS DOMESTICUS, R. PROLIXUS AND TRIATOMA INFESTANS* (HEMIPTERA: REDUVIIDAE)

R. M. Mejrelles[1], M. Steindel[2] & M. J. Soares[1], [1]Lab. Biologia Celular de Microrganismos, Depto. Ultra-Estrutura e Biologia Celular, Inst. Oswaldo Cruz / FIOCRUZ, Av. Brasil 4365, 21045-900 Rio de Janeiro, RJ. [2]Depto. Microbiologia e Parasitologia, Universidade Federal de Santa Catarina, Caixa Postal 476, 88040-900 Florianópolis, SC, Brazil. e-mail: rosane@ioc.fiocruz.br. This work has been supported by Capes and FIOCRUZ.

The study of the triatomine insects has medical and epidemiological interest, as they are the invertebrate hosts of the hemoflagellates *Trypanosoma cruzi* (the causative agent of Chagas' disease, which is transmitted to other vertebrates by fecal contamination), and *Trypanosoma rangeli*. The later colonizes the salivary glands (being transmitted by the bite), produces only a transient infection in Man, but is often pathogenic to the insect hosts. Despite the main role these insects play in the transmission of these protozoa, and the several lines of investigation of the host-parasite relationships, few data is available on the fine structure of these hemipteran insects. Thus, in this study we describe some ultrastructural aspects of the salivary glands of *Rhodnius domesticus* (infected or not with *Trypanosoma rangeli*), *Rhodnius prolixus* and *Triatoma infestans*. For transmission electron microscopy (TEM), the salivary glands (SG) were dissected in PBS and immediately placed in 2.5% glutaraldehyde in 0.1 M cacodylate buffer, pH 7.2. The specimens were fixed over-night, then washed in 0.1 M cacodylate buffer, post-fixed for 30 minutes in 1% osmium tetroxide in cacodylate buffer and dehydrated in graded acetone. The SG were embedded in Epon and examined under a Zeiss EM-10C transmission electron microscope. For scanning electron microscopy (SEM), the SG were dissected and fixed according to the TEM protocol, but after dehydration the glands were critical-point dried. The SG were adhered with adhesive tape to SEM stubs, coated with a 20 nm thick gold layer in a sputtering device and then observed in a Zeiss DSM-940 scanning electron microscope. The SG of the triatomines are grouped into two pairs, located close to the pharynx. SEM showed that while in *T. infestans* each SG pair is formed by three units, in *Rhodnius* spp. each SG pair is made up by a larger elongated unit, with a small round accessory gland located close to the central region of the larger unit. TEM showed that the SG are formed by a monolayer of epithelial cells, enveloped by a thin basal lamina, where muscle cells are immersed. The epithelial cells can be either mono- or binucleated and present usually several microvilli directed towards the gland lumen. Salivary glands of *Rhodnius domesticus* infected with *Trypanosoma rangeli* showed no visible morphological alterations due the presence of the parasites, but different aspects of the parasite penetration inside the cells could be observed.

keywords: salivary gland ; ultrastructure; hemiptera; triatominae.

[3162] COMPARATIVE MORPHOLOGY, TAXONOMIC STUDIES AND TRIBAL REASSIGNMENT OF THE NEOTROPICAL GENERA OF CLEOMENINI (COLEOPTERA, CERAMBYCIDAE)

J. R. M. Mermudes[1] & D. S. Napp[1], [1] Departamento de Zoologia, Universidade Federal do Paraná, Caixa Postal, 19020, Curitiba - PR, 81531-990, Brazil. E-mail: mermudes@bio.ufpr.br.

A detailed morphological comparative study of the Neotropical genera of Cleomenini - *Listroptera, Dihammaphora, Pandrosos, Eupempelus, Fregolia, Haenkea* and *Dihammaphoroides* -, based on their type species, along with other congeneric species, is presented. The study provided the recognition of new characters to better define the genera and their affinities, but also stressed the heterogeneity of the group. The results, when compared to the studied representatives of *Cleomenes* and Rhopalophorini, showed that: 1) *Listroptera, Haenkea* and *Dihammaphora* are closely related, sharing several synapomorphies with *Rhopalophora* and having no affinities with *Cleomenes*; the hypotheses of its transference to Rhopalophorini and its unity as a group within this tribe, must be taken in account; 2) *Pandrosos* may be reassigned to Rhinotragini; 3) *Fregolia* must be allocated within a Cerambycinae tribe with coarsely faceted eyes; 4) the affinities of *Eupempelus* remain inconclusive, despite some similarities with the Heteropsini; 5) *Dihammaphoroides*, though sharing several features with *Listroptera, Haenkea* and *Dihammaphora*, presents many peculiarities along with some similarities to *Cleomenes*, requiring further investigation. The study also pointed out non-congeneric species under the same genus name.
Index terms: Cerambycinae, Taxonomy, morphological study

[3163] MORPHOLOGICAL COMPARATIVE STUDY OF THE *PTYCHODERES ELONGATUS* AND *TRIBOTROPIS PRASINATUS* (COLEOPTERA, ANTHRIBIDAE)

J. R. M. Mermudes[1] & S. A. Vanin[2], [1] Departamento de Zoologia, Universidade Federal do Paraná, Caixa Postal, 19020, Curitiba - PR, 81531-990, Brazil. E-mail: mermudes@bio.ufpr.br; [2] Departamento de Zoologia, Instituo de Biociências, Universidade de São Paulo, Caixa Postal, 11461, São Paulo - SP, 05422-970, Brazil.

The genus *Ptychoderes* was proposed by Schoenherr for *Anthribus elongatus* and was allocated in "Diviso Secunda - Anthribides" with other nineteen genera. Lately, the genus *Tribotropis* was proposed by Jekel for *Phloeotragus prasinatus*. Lacordaire was the first to recognize the tribe creating the group "Phloeotragides" formed by five genera: *Phloeopemon* (Oriental), *Cerambyrhynchus* (Australian), *Phloeotragus* (Afrotropical), *Ptychoderes* and *Tribotropis* (Neotropical). However Jordan considered questionable the groups proposed by Lacordaire, mentioning that the divison into small groups of genera were antiquated and not being tenable. With some exceptions, the information of the family in Neotropical region is still scarce and restricted to the original descriptions. Very few studies are available dealing with taxonomic revision, accurate morphological studies, or classification of higher-taxa. Thus a detailed comparative study of external morphology, mouth parts, endosternites, wing venation, male and female terminalia of *Ptychoderes elongatus* and *Tribotropis prasinatus* are reported and discussed, to give support to a revision of the genus *Ptychoderes* and the phylogenetic relationship among the neotropical genera in tribe Phloeotragini. The specimens studied were provided by the following institutions: DZUP, Departamento de Zoologia, Universidade Federal do Paraná, Curitiba; MNRJ, Museu Nacional, Universidade Federal do Rio de Janeiro, Rio de Janeiro; MZSP, Museu de Zoologia, Universidade de São Paulo, São Paulo.
Index terms: Anthribinae, Phloeotragini, Taxonomy, Neotropical, fungus-weevil

[3164] A FRESH AND SIMPLIFIED VIEW ON CRICKET PHALLIC STRUCTURES

A. Mesa, Dept. de Biologia, Instituto de Biociências, Univ. Estadual Paulista (UNESP), Av. 24A 1515, 13506900, Rio Claro, SP, BRAZIL. E-mail: alejomesa@linkway.com.br

Having some difficulties and sometimes disagreements in the interpretation of the structures and the nomenclature used by the majority of the taxonomist dealing with cricket phallic structures, and in spite of the paucity of the Rio Claro collections, the author decided to adopt a partially new simplified nomenclature. The principal points here sustained are as follows. The phallic sclerites in crickets consist of five basic elements. Two of them are ectophallic dorsally arranged in the dorsal lobe of the phallus and connected by flexible tissue. Other two sclerites are endophallic and are also connected by flexible tissue. Both ecto and endophallic sclerites are named proximal and distal according their relative position and may consist of a single structure or to be longitudinally split into two lateral parallel elements. A fifth sclerite in crickets named "virga" or "stylet" according different authors is placed in the median line of the ventral face of the dorsal phallic lobe. This sclerite is related with the formation, holding and transference of the spermatophore or its inclusion. In acridoid species a fifth sclerites named "epiphallus" is placed in the base of the dorsal face of the phallus. The phallic cricket sclerites are similar in position to those observed in acridids but with the following differences: the stylet is not present in grasshoppers and the crickets fail to have any sclerite placed at the base of the dorsal face of the phallus as the one named "epiphallus" in grasshoppers. Whether the parallelism in the remaining four cricket and grasshopper phallic structures are due to homology or not is a question not considered here. Discordance in the use of the terms "epiphallus" and "rami" in cricket phallic structures are discussed.
Index terms: Gryllidae, phallic sclerites, epiphallus.

[3165] THE ABDOMINAL SHIELDS OF TANSY FEEDING CASSIDINE SPECIES – DEFENCE VERSUS ATTRACTION

C. Müller[1, 2] & M. Hilker[2,1] Boyce Thompson Inst., Tower Road, Ithaca, NY 14850, USA, e-mail cm227@cornell.edu; [2] Freie Univ. Berlin, Inst. für Zoologie, Haderslebener Str. 9, 12163 Berlin, Germany.

Faeces of herbivorous insects are known both to reject predators and parasitoids and to emit kairomones that may attract them. Many cassidine larvae (Coleoptera, Chrysomelidae) collect their exuviae and faeces at their abdominal tips and form a so-called abdominal shield. In laboratory bioassays, we examined whether larvae of *Cassida* spp. feeding on tansy (*Tanacetum vulgare*, Asteraceae) are protected against generalist predators by their shields as is known for numerous other cassidine larvae. While the abdominal shield of *C. stigmatica* consists of exuviae only (exuvial shield), *C. denticollis* larvae carry a complex faecal shield. The efficacy of both shield types towards predators was compared. Our results show differences between both the predator species and the two shield types. Adult ladybirds (*Coccinella septempunctata*) treated both larvae in a different way. They were not deterred by larvae of *C. stigmatica* with exuvial shields, but avoided larvae of *C. denticollis* with faecal shields. Other predators were affected by larvae with both shield types in a similar way. While both shield types deterred adult earwigs (*Forficula auricularia*), they both were ineffective against lace wing larvae (*Chrysoperla carnea*). In contrast, exuvial and faecal shields motivated foragers of the ant *Myrmica rubra* to attack their prey larvae. Possible chemical and physical characteristics responsible for the ants' behaviour were studied in further olfactometer and contact bioassays. Volatiles of faecal shields attracted the ants, while odour from exuvial shields did not. Faecal shields emitted host plant derived mono- and sesquiterpenes in much higher quantities. Also contact cues of faecal shields were proved to motivate the ants to attack the larvae. We conclude, that chemical and visual stimuli are involved in the interaction between the predators and the cassidine larvae with their shields and cause different reactions in the various species.
Index terms: *Cassida denticollis, Cassida stigmatica, Tanacetum vulgare*, faeces, defense, kairomone.

[3166] EXTERN ANATOMY DESCRIPTION OF *ANTICARSIA GEMMATALIS* (LEPIDOPTERA: NOCTUIDAE) THROUGH THE SCANNING ELECTRONIC MICROSCOPY

A.T. Murata[1], J.E. Miranda[2], S. A. De Bortoli[2], [1]Dept. de Biologia, Fac. Filosofia, Ciências e Letras de Ribeirão Preto, Univ. de São Paulo, Av. dos Bandeirantes, 3900, 14040-901, Ribeirão Preto, SP, Brasil (Bolsista Fapesp) , E-mail: murataat@asbyte.com.br; [2]Dept. de Fitossanidade, , Unv. Estadual Paulista, 14884-900, Jaboticabal, SP, Brasil, (FAPESP Fellowship).

The Lepidoptera is one of the largest insect orders, with more than 100,000 species on the world. Larvae of many species in this order are destructive, having great economic importance in to the agriculture. The larvae have a clear division into head, thorax and 10-segmented abdomen. This work was carried out with the objective to show the external anatomic description of *A. gemmatalis* Hueb., 1818 by using the scanning electronic microscopy, a very useful tool to detail the anatomic structures of small animals, like insects. The larvae were fixed with 3% glutaraldehyde in 0.05 M potassium cacodilate buffer pH7.4 at 8°C overnight following by washing with the same buffer for 1 hour. The specimens were then fixed with 2% OsO_4 in the same buffer and conditions, followed by washing as above and dehydration in a routine graded ethanol series. Soon after, specimens were dried by the critical point dryer, being used the carbon dioxide transition liquid. Specimens were submitted to gold-palladium metalization. Latter on, the samples were examined in scanning electronic microscope JEOL JSM 25SII and the material was documented as electronmicrografies. External anatomic details were described and discussed.

Index terms: SEM, velvetbean caterpillar, Insecta.

[3167] ISOLATION AND COMPARISON OF *MARINER*-LIKE SEQUENCES (MLSS) AMONG SOME LEPIDOPTERAN INSECTS AND INVERTEBRATES

Y. Nakajima[1], T. Negishi[1], H. Fujimoto[2], K. Hashido[2], T. Shiino[3], K. Tsuchida[2], N. Takada[2] & H. Maekawa[2], [1] Gene Res. Center, Univ.of the Ryukyus, Okinawa, Japan.; [2] Div. of Radiol. Prot. and Biol., Natl. Inst. of Infect. Diseases, Tokyo, Japan. [3] AIDS Res. Center and Commit. in Res. Info. Lab., Natl. Inst. of Infect. Disease, Tokyo, Japan.

The *mariner*-like sequences (MLSs) among some Japanese Lepidopteran insects were isolated by the PCR method using two sets of primers which are consensus primers designed from the MLSs of Lepidopteran insects and the inverted terminal repeat (IR) of the MLS of *Hyalophola cecropia*. Consensus primers succeeded in amplifying the 500 bp bands in all screening Lepidopteran species. In the case using the IR primer, it could be amplified the 1.2 kbp band corresponding to the full length of MLS. The products of this 1.2 kbp size were also amplified in genomic DNAs of coral and grasshopper. Isolated clones were sequenced and compared each other. The phylogenetic and multi-alignment analysis among these isolated novel MLSs indicated that they were very similar and classified into the cecropia subfamily of MLS. It showed the horizontal transfer of MLSs occurred in Japanese islands. Phylogenetic analysis using data base sequences also revealed a new group of Lepidopteran MLS, which is classified, into the mellifera subfamily. Moreover, the coral MLS had the complete ORF coding for the transposase similar like that of *Attucus atlas*. This type of MLS could be active.

[3168] THE EGGSHELL OF *LEPTINOTARSA DECEMLINEATA*: STRUCTURAL AND BIOCHEMICAL ANALYSIS OF THE CRYSTALLINE CHORION LAYER

I. S. Papassideri, I. Trougakos, and L. H. Margaritis, Fac. of Biol., Dep. Of Cell Biol. & Biophysics, Univ. ofAthens, Panepistimiopolis, Kouponia, Athens, GR-15701, Greece, e-mail: lmargar@cc.uoa.gr.

The Coleopteran, *Leptinatarsa decemlineata*, is known as the «Colorado potato beetle». It is one of the most important parasites of the potato cultivation. The structure of *Leptinatarsa decemlineata* crystalline eggshell was studied by transmission electron microscopy, optical diffraction and computer reconstruction. The composition was processed by gel electrophoresis of the pure isolated crystalline eggshell. A mature follicle consists of the oocyte and the surrounding eggshell layers. The oocyte is surrounded by the vitelline membrane which may be is covered by a wax layer. This in turn, is also surrounded by a crystalline chorionic layer, which is 850 nm thick and has a periodicity of 11 nm. The biophysical analysis of the crystalline layer has shown that the parallel striations possibly reflect a helicoidal arrangement of the composed molecules. On the other hand when the components of purified crystalline chorion were subjected to SDS-PAGE electrophoresis, 5 proteins were detected with 60 kd, 40 kd, 38kd, 30 kd, and 28 kd respectively, suggesting that the helicoidal structure is possibly formed from these proteins. Experiments are in progress to clarify the way the eggshell layers are produced and self- assemble so that to create the crystalline arrangement, and the further characterization of its components.

Index terms: Leptinotarsa decemlineata, Coleoptera, crystalline eggshell, 2-D reconstruction, electrophoresis, protein analysis

[3169] ANTENNAE OF HYDROPHILID BEETLES AND THEIR SIGNIFICANCE IN RESPIRATION

G. Pass & W. Pröll, Department of Evolutionary Biology, Institute of Zoology, University of Vienna, Althanstrasse 14, A-1090 Vienna, Austria, E-mail: Guenther.Pass@univie.ac.at

Hydophilids have short, clubbed antennae which are used for breathing. The water-repellent surface of the antennal flagellum forms an air tube which leads to the plastron structures at the ventral side of the thorax and abdomen. Comparative investigation of the cuticular structures on the antennae and the plastron structures on the body using SEM were undertaken in *Hydrous piceus, Hydrophilus caraboides, Anacaena limbata, Cercyon impressus, Spercheus emarginatus,* and *Hydraena gracilis.* The antennae bear various Sensilla trichodea and S. basiconica in extraordinarily high densities ($1.7 - 4.2 \times 10^6$ sensilla/cm^2) which forms the functional basis for the adhesion to air. In the dung-living *Cercyon impressus,* the antennae bear 1.3×10^7 sensilla/cm^2 which is the highest sensilla density ever measured; this probably can be interpreted as adaptation to the high viscosity of the environmental medium of this species. The plastron structures on the body consist of trichomes with similar dimensions and densities as the sensilla on the antennae. Respiratory behaviour was observed in detail in *Hydrous piceus.* At a water temperature of 25°C, the beetles rise to the surface in approximately 10 min intervals and rest there on average for 12 sec for gaseous exchange. The use of antennae in respiration in hydrophilid beetles obviously led to an evolutionary change in their sensory apparatus and physiology. Underwater chemical orientation is now largely performed by the maxillary palps which are held like antennae and bear a specific sensilla complex at their tips.

Index terms: *Hydrous piceus*, sensilla, plastron, evolution

[3170] A COMPARATIVE STUDY OF THE CARDIAC VALVE AND CARDIA IN CORBICULATED BEES (HYMENOPTERA, APINAE)

E. B. M. I. Peixoto[1] **& J. E. Serrão**[1], [1]Dept. of General Biology, Univ. of Viçosa, Viçosa, M.G. CA 36571-000, Brazil, E-mail jeserrao @ mail.ufv.br. Supported by Brazilian Research Agencies FAPEMIG and CNPq.

The digestive tract of bees is, anatomically, subdivided on three regions: (1) foregut: pharynx, oesophagus, crop and proventriculus; (2) midgut; (3) hindgut: ileum and rectum. The posterior region of proventriculus is projected into the midgut lumen forming the cardiac valve, which blocks the food reflux to the crop. The cardiac valve is an epithelial fold forming two layers (inner and outer) separated by an irregular basal membrane. The outer epithelium makes the transition between the fore- midgut epithelia. The more anterior midgut epithelium is differentiated region defined as cardia. Some authors suggest that this region of the midgut don't has a role in the absorption of nutrients, but is may be involved in the production of peritrophic membrane. The purpose of this work is to study the histological and histochemical aspects of the cardiac valve and cardia on different bee species, with regard to establish phylogenetic relationships. We studied 17 species of Meliponini; one of Apini, Bombini, Eucerini and Halictidae; three of Centridini and five of Euglossini. The specimens were preserved in paraformaldehyde and embedded in historesin. Sections were stained with Dominici. In all Meliponini bees the cardiac valve is tubular with an the outer layer formed by columnar cells strongly vacuolated; the inner layer has a small cells less vacuolated and strong positive reaction to Dominici. The cardia is evident, long, accompanying the longitudinal arrangement of the valve, showing slender and tall cells. Anatomically, a short dilated region without circumvolutions characterizes the cardia. In Apini and Bombini the cardiac valve is similar to Meliponini, however the fore- midgut transition occurs directly between the outer layer of the cardiac valve and the midgut, which suggests the absence of cardia. This feature is also observed anatomically like a non- differentiated region from anterior midgut end, that is, with circumvolutions. In Halictidae, the cardiac valve shows a membranous aspect; another kind of valve showing foliaceous aspect, were found in Centridini, Eucerini and Euglossini tribe. In both types, the transition region is small and the cardia is very short when compared with Meliponini. These results suggest that well developed cardia is a synapomorphy for Meliponini, while its absence defines another monophyletic group formed by Apini+Bombini. Euglossini is a more basal group because it is similar to outgroup (Eucerini, Centridini and Halictidae) analyzed.

Index terms: bee, digestive tract, cardia, cardiac valve, Hymenoptera

[3171] MORPHOLOGY OF THE MALE REPRODUCTIVE SYSTEM IN BUTHIDAE AND BOTHRIURIDAE SPECIES (ARACHNIDA, SCORPIONES).

A.V. Peretti & M. Battán Horenstein, Cátedra de Diversidad Animal I, FCEFyN, Universidad Nacional de Córdoba, Av. Vélez Sarsfield 299 (5000), Córdoba, Argentina, E-mail: aperetti@com.uncor.edu, moira_battan@hotmail.com.

Male reproductive system of different species (*Bothriurus flavidus* Kraepelin, *B. cordubensis* Acosta, *B. bonariensis* (C. L. Koch), *B. chacoensis* Maury & Acosta, *Brachistosternus ferrugineus* (Thorell), *Timogenes dorbignyi* (Guérin-Meneville), *T. elegans* Mello-Leitão (Bothriuridae) and *Zabius fuscus* (Thorell) (Buthidae) were analyzed comparatively. Those structures that accompany the paraxial organ: testis, seminal vesicle and accesory glands, were examined. The presence of accesory glands was established for some species of Bothriuridae and the buthid *Zabius fuscus*. It was confirmed that testis continue in the seminal vesicle through the vas deferens which widen to form the "ampulla of the vas deferens" in the proximal region of the seminal vesicle. Both, structures and glands vary in size and shape depending on species. It could be established the presence of sperm packages in bothriurids. Said packages consist of many spermatozoa surrounded by a membrane which breaks, once the sperm is in the female genital atrium, leaving the spermatozoa free. It was proved the absence of sperm packages in *Zabius fuscus* since free spermatozoa were found in the sperm drop.The implications of these data and the relation with other families will be discussed.

Index terms: accesory gland, testis, seminal vesicle, sperm package

[3172] MUSCLE REGRESSION IN BELOSTOMATID BUGS (HETEROPTERA: BELOSTOMATIDAE)

P.J. Perez Goodwyn[1], [1]Inst. de Limnología R.A. Ringuelet, C.C. 712, 1900 La Plata, Argentina. E-mail: **Erro! Indicador não definido.**

Differential flight muscle regression was registered in *Belostoma elegans* and *B. oxyurum*. A two year survey in contrasting habitats showed the preference for the more stable ones by *B. oxyurum*, and the more unstable ones by *B. elegans*. Fibrillar muscles were regressed in most of the *B. oxyurum* specimens, and developed for flight in most *B. elegans*. No positive correlation between egg production and muscle regression was found in any species. IVth and Vth instar larvae of both species were raised up in laboratory under unstable conditions. When moulting to adult stage none had their muscles developed, suggesting that the muscle development should be achieved later. *B. oxyurum* with its muscles regressed was found in quiescence during a dry-up of a sampled environment, thus this species would have to survive unexpected changes this way, and *B. elegans* would emigrate flying. The differential muscle development is associated with the ecological strategies of these two species.

Index terms: *Belostoma elegans*, *B. oxyurum*, fibrillar muscle, flight

[3173] ULTRAMORPHOLOGY OF THE ECTAL MANDIBULAR GLAND OF *POLISTES VERSICOLOR* (HYMENOPTERA: VESPIDAE)

T. A. O. Pietrobon[1] **& F. H. Caetano**[1], [1]Depto. Biologia, Univ. Estadual Paulista, P.O.Box 199, CEP 13506-900, Rio Claro, São Paulo, Brasil. E-mail- taop@rc.unesp.br. Supported by FAPESP

The insects salivar system, are composed by the mandibular gland, the hypopharingeal gland, and the salivary or thoracic gland. These glands are arranged in pairs and have been studied extensively in social insects for their relation with the social organization. Wasps presents two pairs of mandibular glands, one pair is named mesal mandibular gland and the another pair as ectal mandibular gland. The last one, homologous to the mandibular gland of ants and bees. The function of the ectal mandibular gland varies between wasps: secreting compounds for sexual attractiveness, territorial marking and dominance pheromones, or simply lubrication of the mouthparts. The present work shows the ultramorphology of the ectal mandibular gland of *Polistes versicolor* and its opening in the mandibular region. The ectal mandibular gland was removed still joined to the mandible and fixed in Karnovsky solution, dehydrated in crescent ethanol series and twice in P.A. acetone. Next, the material was submited to the critical point Balzers CPD 030 for a complete dehydration, and covered with gold at sputtering Balzers SCD 050. The material was examined in Scanning Electron Microscope Philips SEM 505 and photographed with Neopan SS 120 film. The ectal mandibular gland of *P. versicolor* is connected to the mandible base. The secretory portion is constituted by spherical cells, which cover the distal portion of the reservoir. Each secretory cell is connected directly to the reservoir by canalicule and some times two canalicules join in a common duct before arrive to the reservoir. The reservoir is formed by flattened cells. In the mandible, the ectal mandibular gland forms an excretory tube that penetrates inside the mandible and opens near to the base. Cuticular projections were found near to this opening which is protected by the clypeus when the mandible remains closed. These projections may be used in the gland secretion dispersion. The ultramorphology aspects of the ectal mandibular gland of the *P. versicolor* is very similar to that founded in many species of ants and wasps.

Index terms: *Polistes versicolor*, ectal mandibular gland, scanning electron microscopy, wasps

[3174] ULTRAMORPHOLOGY OF THE ECTAL MANDIBULAR GLAND OF *POLISTES VERSICOLOR* (HYMENOPTERA: VESPIDAE)

T. A. O. Pietrobon[1] & F. H. Caetano[1], [1]Depto. Biologia, Univ. Estadual Paulista, P.O.Box 199, CEP 13506-900, Rio Claro, São Paulo, Brasil. E-mail- taop@rc.unesp.br

The insects salivar system, are composed by the mandibular gland, the hypopharingeal gland, and the salivary or thoracic gland. These glands are arranged in pairs and have been studied extensively in social insects for their relation with the social organization. Wasps presents two pairs of mandibular glands, one pair is named mesal mandibular gland and the another pair as ectal mandibular gland. The last one, homologous to the mandibular gland of ants and bees. The function of the ectal mandibular gland varies between wasps: secreting compounds for sexual attractiveness, territorial marking and dominance pheromones, or simply lubrication of the mouthparts. The present work shows the ultramorphology of the ectal mandibular gland of *Polistes versicolor* and its opening in the mandibular region. The ectal mandibular gland was removed still joined to the mandible and fixed in Karnovsky solution, dehydrated in crescent ethanol series and twice in P.A. acetone. Next, the material was submited to the critical point Balzers CPD 030 for a complete dehydration, and covered with gold at sputtering Balzers SCD 050. The material was examined in Scanning Electron Microscope Philips SEM 505 and photographed with Neopan SS 120 film. The ectal mandibular gland of *P. versicolor* is connected to the mandible base. The secretory portion is constituted by spherical cells, which cover the distal portion of the reservoir. Each secretory cell is connected directly to the reservoir by canalicule and some times two canalicules join in a common duct before arrive to the reservoir. The reservoir is formed by flattened cells. In the mandible, the ectal mandibular gland forms an excretory tube that penetrates inside the mandible and opens near to the base. Cuticular projections were found near to this opening which is protected by the clypeus when the mandible remains closed. These projections may be used in the gland secretion dispersion. The ultramorphology aspects of the ectal mandibular gland of the *P. versicolor* is very similar to that founded in many species of ants and wasps.
Index terms: wasps, mandible, salivar system, secretory cells, canalicule, reservoir

[3175] SOME HYPOTESIS ON THE REDUCTION OF THE ANTENNAE IN *DIASPIS ECHINOCACTI* FEMALE (RHYNCHOTA DIASPIDIDAE) DURING ONTOGENESIS

F. Porcelli & A. Di Palma, Di.Bi.C.A. – Dipartimento di Biologia e Chimica Agro-Forestale ed Ambientale, Via Amendola, 165/A 70126 Bari – Italy. E-mail: porcelli@agr.uniba.it.

The world "reduction" is widely used referring to the antennae of adult armoured scale females. Despite the general acceptance of this meaning, no evidence does exist how this peculiar process happens. Moreover this reduction occurs between the first and second instar while between the second and the third (adult female) it has been not observed anymore. The final result is an adult female antenna bearing a functional chemosensillum made up by two joint units, probably derived from the chemosensilla present on the larval antenna. The aim of this study is to suggest possible interpretations of the antennal reduction by means of experimental amputations of antennomeres in the first instar. *Diaspis echinocacti* female is subject to two moulds: the first involves major changes while the second doesn't. The first exuvial cast is retained into the protein-wax dorsal shield. So it is possible to recover and study together the first and the second instar. In this way we could compare the development of the whole and cut antenna in the same specimen during ontogenesis. We considered three situations: a) the two apical antennomeres cut in the larva: the second instar develops only a basal antennal body devoid of any joined seta(e); b) four antennomeres cut: a very reduced antenn

[3176] DESCRIPTION OF INTERNAL REPRODUCTIVE ORGANS OF *COSMOCLOPIUS NIGROANNULATUS* (HEMIPTERA, REDUVIIDAE)

L.R. Redaelli, L. M. dos Santos, L.M. G. Diefenbach & S.M. Jahnke, Dep. Fitossanidade, Univ. Federal do Rio Grande do Sul, Av. Bento Gonçalves, 7712, Porto Alegre, CEP: 90046-900, Brasil, E-mail smjahnke@yahoo.com

The detailed knowledge of the internal reproductive organs of insects is an important tool to the comprehension of their life cycle and reproductive strategies. *C. nigroannulatus*, have been studied by representing an efficient predator of agricultural pests. This work aimed to describe, mensurate and illustrate the internal reproductive system of adults of *C. nigroannulatus*. 5th instar nymphs were collected in a tobacco experimental plot, in the Dep. Fitossanidade, Universidade Federal do Rio Grande do Sul, in Porto Alegre (30°01'S; 51°13'W), RS, and brought to the laboratory in order to obtain immature adults. The individuals, soon after emergence, were killed in ethyl ether fumes and dissected in 70% ethyl alcohol in a stereomicroscope WILD M5 and measured in 25X. Reproductive adults were collected in the experimental area, where various ovipositions were observed. *C. nigroannulatus* females have the internal reproductive system composed by 2 ovaries, laterally situated in the abdominal cavity and formed by seven ovarioles, with terminal filaments that join forming the suspensory ligament. The immature ovary length is around 2,5 times shorter than those of the sexually mature female. The number of oocytes per ovary in mature females varies from 18 to 35, in immature females oocytes are not discernible. Each ovariole opens into the calix of its respective lateral oviduct. The common oviduct is short relative to the system as a whole. The lateral oviducts of mature females are 1,3 times longer and 1,5 times wide than those of immatures. The common oviduct opens in the ventral side of the genital chamber. A pair of accessory glands opens into the initial and final portion of this chamber. In males, the pair of tests lies at the sides of the alimentary tract in median position in the abdominal cavity. Each testis is wrapped by a delicate membrane of orange coloration and continued by a short deferent duct which ends in a long and tangled epididymis, of orange coloration. This is continued by a long ejaculatory duct which receives in its terminal portion an accessory gland formed by 5 filaments. The testis dimensions are similar in sexually mature and immatures males.
Index terms: Insecta, Tobacco, Reproductive biology.
a results in the second instar; c) in some cases no antenna at all develops as a result of very basal antennomere removal. In order to explane our observations, two hypotesis are proposed: (a) the reduction is due to antennomere deletion; (b) it is due to antennomere joining. We propose to consider the reduction as the result of a joining process. In fact the progressive loss in the second instar antennal parts is more or less related to the number of cut antennomere in the larva.
Index terms: functional morphology, armoured scale, chemoreceptor

[3177] EARLY EMBRYOLOGY AND SEGMENTATION GENES EXPRESSION IN THE TEPHRITID FLY *ANASTREPHA* SP. 2 (DIPTERA; TEPHRITIDAE)

C.C. Ribas[1], J.C. Carvalho[2], D. Selivon[1], E. Abdelhay[2] & A.L.P. Perondini[1], [1] Depto. de Biologia, Inst. de Biociências, Univ. de São Paulo, Rua do Matão tr.14, Cidade Universitária, São Paulo, Brasil, 05501-000. E-mail: ribasc@usp.br; [2] Inst. de Biofísica, Univ. Federal do Rio de Janeiro, CCS, Bl-G, Sala G1-059, Ilha do Fundao, Rio de Janeiro, RJ, Brasil, 21949-900.

Segmentation is a basic feature of the insect body plan, and is established during the initial stages of embryogenesis. The genes responsible for controlling segmentation have been studied in a variety of insect species and their patterns of expression have been shown to be conserved in many of them. In the present work, we studied the early stages of embryogenesis and segmentation gene expression in the tephritid fly *Anastrepha* sp.2. It has been reported before that the embryos of this genus extrude masses of yolk at the anterior and posterior poles of the egg (Selivon *et al.* 1996). The embryos were sampled in intervals of one hour and fixed. The nuclei were stained with DAPI to determine in which stage of development each embryo was. The pattern of expression of the maternal effect gene *bicoid* and of the gap gene *Krüppel* were characterized by *in situ* hybridization (probes for *D. melanogaster*'s mRNA). The patterns of expression of the gap genes *hunchback* and *Krüppel* (Monoclonal antibodies against *Drosophila melanogaster*'s proteins), of the pair rule gene *even-skipped* (Monoclonal antibody 2B8) and of the segment polarity gene *engrailed* (Monoclonal antibody 4D9) were characterized by immunohistochemistry. The embryonic development of *Anastrepha* sp.2 follows a general pattern similar to *D. melanogaster*. The *bicoid* mRNA was detected in the anterior pole of eggs during the five first cleavage cycles. The protein Hunchback was detected in embryos from just after oviposition until formation of the syncytial blastoderm, always in the anterior half of the embryo. The mRNA and protein of the gene *Krüppel* were detected in the middle region of the embryos at the stage of syncytial blastoderm. The protein Even-skipped was detected in seven transversal stripes during cellular blastoderm and beginning of gastrulation. The protein Engrailed was detected in 14 transversal stripes during germ band extension. These results indicate a highly conserved structure of the gene products involved, and a similarity between the patterns of expression of these genes in embryos of *Anastrepha* sp.2 and *D. melanogaster*, suggesting that their functions have been conserved during the evolution of these two dipteran families.
Selivon,D., Morgante,J.S., Perondini,A.L.P. Inv. Repr. Dev., v.26, n.1, p.1-7, 1996.
Index terms: development, fruit fly, cleavage, germ band, body plan.

[3178] MOUTH PARTS AND THE FEEDING HABITS OF COCCINELLIDS (COLEOPTERA)

C. Ricci & L. Ponti, Dept. of Arboriculture and Plant Protection, Faculty of Agriculture, Univ. of Perugia, Borgo XX Giucno, 06121 Perugia, ITALY, E-mail: cricci@unipg.it.

Coccinellids are characterised as phytophagous, mycophagous or predacious depending on the nature of their food. This is reflected in the structure of the mouth parts, especially of the mandibles and galeae. Recent studies on coccinellid morphology and behaviour have raised many questions in particular about their mouth-parts. We have made a comparative study on mandibles and galeae in relation to feeding habits of representative species of different tribes of Palearctic coccinellids. The structures were observed under Scanning electron microscopy (SEM) and the behaviour by using a video camera fixed to a stereomicroscope which was connected to a monitor and video recorder. Three new types of mandibles are described. From the studies it results that the mandible, at groove level and margins, is the most diversified structure among the species (e.g. in Aleurophagous species the ventral margins have transverse vein-like elevations; in Myco-pollinivorous species dorsal and ventral margins being respectively equipped with 7- 8 multicellular teeth-like processes and 20-22 multicellular spine-like processes forming a kind of comb or rake). In some species extraintestinal digestion was noted and compared with other Coleopteral species. The aphid feeders have two modes of feeding. One group seizes one of the appendages of its prey and injects digestive juices into the victim. The empty exoskeleton of the prey is then abandoned. In the second group small prey are ingested whole. Wen an adult female aphid is captured and body fluid exudes from the cornicles when squeezed by the predator, the latter moves to one of the cornicles and uses its mouth parts, temporarily modified into a sucker, to suck the aphid dry. Then it masticates and ingests the exoskeleton sometimes discarding the tarsi. Coccidiphagous species generally feed on stationary prey, which if young enough are ingested whole. If the prey is large the Coccinellid bites dorsal segment and sucks out the body juices, and the consumes the empty skin, like aphidophagous species. like, feed mainly on eggs, breaking the chorion with a unidentate mandible and sucking out the contents. According to morphological structures and feeding behaviour the authors propose new groupings of coccinellids.
Index terms: mandibles, galeae, phytophagous, mycophagous ,predaceous species, function morphology.

[3179] THE LARVA AND PUPA OF CULICOIDES BAMBUSICOLA LUTZ OBSERVED WITH SEM, AND ADDITIONAL NOTES ON THE ADULTS (DIPTERA: CERATOPOGONIDAE)

M.M. Ronderos [1] & G. R. Spinelli[1], [1]Departamento Cientfico de Entomología, Museo de La Plata. Paseo del Bosque s/n, 1900 La Plata, Argentina.

The bamboo breeder species *Culicoides bambusicola* Lutz was originally described based on female and male adults from Río de Janeiro and San Pablo, giving as well a brief references to its larva and pupa (Lutz, 1913). Although these inmatures stages were posterioly redescribed by Lane (1947_), Barbosa (1952) and Forattini (1957), the knowledge of its morphology, especially the larva, has not been adecquately achieved. During a monthly sampling program of hematophagus Diptera in the area influenced by the Yacyretá dam lake in the Paraná River, betwen Argentina and Paraguay, the specimens were collected breeding internodo from tacuara canes. In this paper the larva and pupa of *Culicoides bambusicola* are redescribed and illustrated, including photomicrographies, based on examination with both Scanning Electron Microscopy (SEM) and phase-contrast stereoscope. The larva exhibits the characters stated by previous authors (Murphree & Mullen, 1991) for larvae of tree hole breeding species: diffuse yellowish brown thoracic pigmentation, large setae of caudal segment, particularly "o" and "i" setae, and the extensive epipharingeal laterals curtains. The two light traps that were setted during two years near tacuara canes in Corpus, did not collected specimens of *Culicoides bambusicola*, suggesting that the species is poorly attracted by light. This is in accordance to most of the already valid records for *C. bambusicola*, wich are based on specimens collected in canes internodes. The records for Guatemala and Venezuela stated by Forattini (1957) correspond to erroneous synonymies with *C. germanus* Macfie and *C. gabaldoni*, respectively. A diagnosis and illustrations of the adults stage from type material and specimens emerged in laboratory is also provided.
Index terms: Ceratopogonidae, *Culicoides bambusicola*, SEM, larva, pupa

[3180] (LEPIDOPTERA: PYRALIDAE) OVARIAN FOLLICLES

D. C. Santos* & E. A. Gregório, Centro de Microscopia Eletrônica, Inst. Biociências, UNESP, Campus de Botucatu, CP. 510, CEP. 18618-000, Botucatu, S.P., BR. E-mail daniela_santos@yahoo.com.

Each Lepidoptera ovarian follicle (polytrophic meroistic type) is composed by an oocyte interconnected to seven nurse cells, surrounded by a monolayer of somatic follicular epithelial cells. During the oogenesis, the nurse cells are responsible to synthesize some of the yolk elements; these elements are transported from the nurse cells to the oocytes through the ring-shaped canals. After the nurse cells have no longer any function they are known to die. There are few ultrastructural studies about nurse cell death in insect ovarioles, but none in *Diatraea saccharalis* ovarian follicles. This study aims to characterize the morphological features of nurse cells death in the last vitellogenic stage of the *D. saccharalis* ovarian follicles by light and transmission electron microscopy (TEM). Ovarioles of adult insects were fixed for 24h in 2% glutaraldehyde - 4% paraformaldehyde solution. The ovarioles submitted to the TEM preparations were post-fixed in 1% osmium tetroxide for 2h and embedded in Araldit. For light microscopy preparations the ovarioles were embedded in JB4 - Polysciences resin and the sections submitted to Toluidine Blue and Bromophenol Blue staining. In the last vitellogenic stage of *D. saccharalis* ovarian follicles, the nurse cell initially shrinks, becoming smaller than the ones observed in the previous stages; they exhibit regular and round shape, losing contact with the neighboring cells. These cells are positive for Toluidine Blue and Bromophenol Blue. The cytoplasm is reduced, with many deep and irregular processes toward the nucleus; it contains many dense granules and electron-dense mitochondria. The nucleus and cytoplasm gradually condense and the chromatin forms highly dense clumps. Finally, the cells start to dismantle itself, by pinching off portions of cytoplasm and nucleus as "apoptotic bodies". The neighboring follicular cells ingest these apoptotic bodies into digestive vacuoles. Our results show that after the nurse cells complete it's cytoplasm transfer to the oocyte, they become redundant into the follicle, been eliminated by apoptosis in the ***D. saccharalis*** ovarian follicles. According to the literature, cells that are no longer necessary to the development of the organism are selectively deleted by apoptosis process. (Supported by FAPESP - Proc. 97/06903-8)
Index terms: *Diatraea saccharalis*, nurse cell death, ovarian follicles, ultrastructure

[3181] SUB-CELLULAR STRUCTURES OF THE OOCYTE CYTOPLASM IN THE VITELLOGENIC FOLLICLES OF *DIATRAEA SACCHARALIS* (LEPIDOPTERA: PYRALIDAE) REVEALED BY ZIO TECHNIQUE

D. C. Santos* & E. A. Gregório, Centro de Microscopia Eletrônica, Inst. Biociências, UNESP, Campus de Botucatu, CP. 510, CEP 18618-000, Botucatu, S.P., BR. E-mail daniela_santos@yahoo.com.

In the polytrophic meroistic ovarioles, each ovarian follicle is composed by an oocyte interconnected to their nurse cells, surrounded by a monolayer of follicle cells. The nurse cells in such ovarian follicles are supposed to synthesize most of the yolk elements (RNA, lipids and glycogen), which are transferred to the oocyte through the ring-shaped canals during the oogenesis process. In the great majority of insects, the oocyte is responsible to synthesize mainly yolk proteins. There are few works using the ZIO technique to reveal the sub-cellular structure of the insect ovarian cells during the oogenesis. The aim of this investigation is to describe the ultrastructural organization of the oocyte cytoplasm in the vitellogenic ovarian follicles of *Diatraea saccharalis*, to determine their role in the yolk synthesis. Ovaries removed from adult insects were fixed for 24h in 2% glutaraldehyde - 4% paraformaldehyde buffered solution. For the Osmium Zinc Iodide staining (ZIO), the ovaries were rinsed in Tris-amino-methane buffer solution (pH 4.5) and incubated in ZIO solution (Zn, I, Tris-amino-methane and OsO_4) for 17h, at 10°C. Dehydration and embedding follow the conventional protocol for transmission electron microscopy (TEM) preparations. The oocyte cytoplasm exhibits a network of vesicular and tubular structures positive for the ZIO reaction, interpreted as developed smooth endoplasmic reticulum. The amount of smooth endoplasmic reticulum decreases during the oocyte development, so in the later vitellogenic stages this organelle is visualized only in the oocyte cortex. Conventional TEM preparations show lipid droplets and homogeneously and dense membrane-bounded granules in the oocyte cytoplasm. Some of these dense granules are positive for ZIO reaction. Many scattered Golgi complexes were visualized with small vesicles at the cis face as well as vacuoles of variable sizes located at the trans region. All the Golgi elements of the oocyte were heavily stained by the ZIO technique. Our results suggest a role played by the *Diatraea saccharalis* oocyte in the synthesis some of the granules of the yolk during the vitellogenic stages, with lipidic content. The oocyte is also responsible for the synthesis and accumulation of the lipid droplets not surrounded by a proper limiting membrane, as this element is not present in the nurse cell cytoplasm. (Supported by FAPESP- Proc. 97/06903-8)
Index terms: *Diatraea saccharalis*, ovary, cytochemistry, oocyte; yolk

[3182] SILK SYNTHESIS IN SALIVARY GLANDS OF *Apis mellifera* (HYMENOPTERA: APIDAE) WORKERS AT THE END OF LARVAL DEVELOPMENT

E.C.M. Silva[1] & R.L.M. Silva de Moraes[2], [1,2] Dept. of Biology, Inst. of Biosciences, Univ. Estadual Paulista (UNESP), Av. 24-A, n.1515, Zip: 13506-900, Rio Claro-SP, Brazil. [2]E-mail rsmoraes@rc.unesp.br .

Larval salivary glands, or silk glands, of bees consist of a secretory portion and lateral and common ducts. The secretory portion synthesizes the silk that will form the cocoon for larval metamorphosis. The purpose of this paper was to detect the stages of silk production, in salivary glands at the end of larval development, and along these glands, in order to establish the time and the glandular region where this synthesis begins, the morphological and histochemical characteristics and the molecular order of this secretion. To this end, silk glands of the larval 5th instar of *Apis mellifera* workers were dissected, fixed and processed accordingly by: 1) inclusion in historesin, whose sections stained with Xylidine Ponceau, for total proteins, were analyzed under conventional and polarized light microscopy; 2) Scanning Electronic Microscopy for morphological analysis; 3) Smashing of unstained glands for analysis under polarized light microscopy. The results showed that, at the beginning of the 5th larval instar, the secretion present in the lumen of the glandular portion secretory has a homogeneous aspect, it's positive to protein and shows neither molecular order nor compaction. The glands from the middle of the 5th instar has a homogeneous central secretion, positive to proteins, without molecular order, while the peripheral secretion, positive to protein, varied from homogeneous to fibrilar, the latter birefringent. It's only at the end of the 5th instar that the glands present lumen full of fibrilar secretion, organized in tactoids, highly proteic, compacted, birefringent and with a more defined optical direction pattern in the proximal secretory portion and in the lateral duct. Analysis via Scanning Electronic Microscopy of broken glands showed the presence of fibers of the secretion in the glandular lumen, well visible in the central region of this lumen and, only when the ephitelium was broken, the intact secretion presents a smooth surface and transversal commissures, which could represent the places where the fibers change direction to form the optical direction pattern. It is possible that the smooth surface of this fibrilar secretion represents the newly-synthesized layer that is not completely polymerized. In all the methods applied, the lateral duct showed secretion located in the central lumen. This is probably because the cells of the lateral duct remove the water from the secretion, making it more compact and, jointly with compressing secretion at this, lead to its re-orientation.

Index terms: histochemistry, polarized microscopy, scanning electronic microscopy, secretion

[3183] MORPHOLOGICAL STUDY OF THE ADULT OF *MEIBOMEUS CYANIPENNIS* (COLEOPTERA:BRUCHIDAE)

J.A.P. da Silva[1], C.S.Ribeiro-Costa[1] & L. M. Almeida[1], [1]Dept. of Zoology, Univ. Fed. of Parana, P.O.Box 19020, 81531-990, Curitiba, Parana, Brazil, E-mail stra@bio.ufpr.br.

Detailed morphological studies are the base for the knowledge of characters changes in a taxonomic group, contributing directly for a realiable reconstruction of phylogeny. The genus *Meibomeus* is compoused by 18 species distributed in the West Hemisphere. The most commom host plants of this genus are the herbaceous species belonging to the genus *Desmodium* (Fabaceae), which contribute for soil enrichment and is a good resource of food for the cattle; some can infest planted areas with grass or perennial cultures. As the South American species of *Meibomeus* are being revised, one species was selected, *M. cyanipennis*, for a first attempt to recognize taxonomic characters. Structures were clarified with KOH 10% followed by a wash with H_2O_2, when necessary; drawings were made under microscope and, for some characters, the electronic microscope was also used. *Meibomeus cyanipennis* has metalic body, antenna entirely black, front and middle tarsi ferruginous, elytral stria 4 greatly abbreviated basally, hind tarsus infuscated, tibial mucro of hind leg well developed, pecten with large tooth slender followed by five or six much smaller teeth, first abdominal sternum with polished lateral apical band. Male genitalia with median lobe fractured, ventral valve triangular, internal sac short and with small spicules regulary distributed. This species show affinities with other undescribed species from Brazil and Argentina, differing from that by the well developed tibial mucro of hind leg and absence of a cluster of long spicules, in the internal sac of male genitalia.

Index terms: seed beetle, Acanthoscelidini, description, *Desmodium*.

[3184] MORPHOMETRIC ANALYSIS OF THE BRAIN IN THE CASTES OF *ACROMYRMEX SUBTERRANEUS* (HYMENOPTERA, FORMICIDAE) DURING THE POST-EMBRYONIC DEVELOPMENT

P. A. O. SOARES[1] & J. E. SERRÃO[2], [1]Dept. of Animal Biology - Entomology, Fed. Univ. of Viçosa, Viçosa, MG, 36571-000, BRAZIL, E-mail: pasoares@alunos.ufv.br, [2]Dept. of General Biology, Fed. Univ. of Viçosa, Viçosa, MG, 36571-000, BRAZIL, E-mail: jeserrao@mail.ufv.br. Supported by Brazilian Research Agencies CAPES and FAPEMIG.

The ants have a great variation of behavior patterns, which can be related with morphological differences among species. Thus they have stimulated studies by neuroanatomists and neuroethologists, because there are possible relationships between brain compartments and learning and memory of the insects. Studies of brain growth of the insects can be relationed with structural and functional differences as well as show the developmental pattern of this organ. In this study the brain area was analyzed among worker, queen and male pupae of *Acromyrmex subterraneus* during their development. Brain volume was calculated in workers by Cavallieri method. The pupae were divided according to eye and body pigmentation: unpigmented eyes (UE); weakly pigmented eyes (WE); pigmented eyes (PE) and pigmented body (PB) as well as newly-emerged adults (AD). Measurements were made with Image Pro-Plus 4.0 software. The results show that among workers the major area of brain occurs in adults, while in queens there are no statistical deference ($P<0,5$) among the different developmental stages. In males WE and PE pupae and adults have not significative differences, however UE and PB pupae are statistically different in relation to other stages. These results may be relationed with the more complex behavior pattern of the worker, which have an increase in the brain area of the adult. Comparative analysis among castes show that UE, WE and PB pupae of queens have greater brain area when compared with workers and males. The UE, WE and PB pupae of workers are similar to males. In all castes the PE pupae are statistically different being the major ($0,622mm^2$) and minor ($0,337mm^2$) areas observed in queens and males respectively. These results can be associated with individual size, because is largely known that queens are the greatest individuals of the colony. In adult workers and queens have similar brain areas. The brain volume in workers was similar among all pupal stages with an increase in adult.

Index terms: brain, morphometry, ant, post-embryonic development, neurogenesis

[3185] CHARACTERIZATION OF *SPODOPTERA* SPECIES (LEPIDOPTERA: NOCTUIDAE) OF SOUTHERN BRAZIL

A. Specht[1,2] , F.A. Melo[1], G.F. Bianchini[1] & E. Corseuil[2], [1] Curso de Agronomia, UNISUL, Av. José Acácio Moreira, 787, CEP 88704-900, Tubarão, SC, Brasil, E-mail specht a@pucrs.br; [2] PPG Biociências, PUCRS, Av. Ipiranga, 6681, C. Postal 1429, CEP 90619-900, Porto Alegre, RS, Brasil, E-mail corseuil@pucrs.br.

The *Spodoptera* genus is composed of oligophytophagous and poliphytophagous species, key plague of several crops on different world regions. Many times, his agricultural importance determine the employment of control forms, how for the results assurance need a accuracy identification of species. In case of groups how Lepidoptera, yonder of the knowledge of adult forms is essential the information of larval forms because is in this phase, when case damage, was collected and needed become identified as quick as possible. In the Southern Brazil occur *S. dolichos*, *S. eridania*, *S. frugiperda*, *S. latifascia* and *S. marima*. The first four species are spread through whole America and show a good characterization both adult and larval forms. *S. marima* whose distribution to limit on Neotropical Region is less studied, fail the caterpillars description. This work aims characterize the larval morphology of *S. marima* and adjust a dicotomic key for identification of *Spodoptera* spp. caterpillars occurring of Southern Brazil Region. In field, where collected adults of *S. marima*, maintained on laboratory conditions for caterpillars acquire. At lest instar the larvae was sacrificed on boil water and maintained on ethyl alcohol 70%. The exemplars was analyzed on stereoscopic microscope for the setal map elaboration. The larval characters of this specie was compared with the others *Spodoptera* species, obtained in the bibliographic fonts and after analyzed make up a key for identification of species occurring in the Southern Brazil through larval characters. Moreover, due specified of morphological characteristics, were described the espermatophores of five species. Large structural differences were observed indicating the importance of its, with the genitally study, for the better species differentiation.

Index terms: Moth, Morphology, Immature stages, Systematic.

[3186] CORRELATION BETWEEN COMPLEXITY OF MALE AND SIMPLICITY OF FEMALE GENITALIA IN THE TWO BASAL CLADES OF HETEROPTERA (ENICOCEPHALOMORPHA, DIPSOCOROMORPHA)

P. Štys, Dept. **of Zoology, Charles University, Viničná 7, Praha 2, CZ-12844, Czech** Republic; E-mail alice.exnerova@atlas.cz.

The enicocephalomorphans (Aenictopecheidae, Enicocephalidae) are sister group to the Euheteroptera; the dipsocoromorphans (six families with minute species living interstitially, e.g. in litter, gravel, moss, marsupial lawn) represent the most basal euheteropteran clade. The genitalia and abdomen of the ENICOCEPHALOMORPHA are always symmetrical. The males of Aenictopecheidae have internal telescopic or external permanently erected phallus and mobile parameres, regardless whether the females have retained or lost the ovipositor. The male genitalia of Enicocephalidae are more diverse, always lack the phallic component, and the parameres (if present) are immobile; the genitalia may be extremely complex (homology of most components unknown) to extremely simple. Complete absence of female external genitalia is positively correlated with male extremes. The male genitalia and abdomen of DIPSOCOROMORPHA are symmetrical to asymmetrical, are formed by the phallus and mobile parameres, and by additional symmetrical or asymmetrical articulated claspers of laterotergal origin which may be situated on pregenital, genital, and even postgenital segments. Also the mediotergites may be strongly asymmetrical and equipped with diverse processes. The details are always species-specific, the basic architecture genus- to family-specific. Females have retained the generalized to strongly modified ovipositor, or may have lost the external genitalia completely. However, the female abdomen and genitalia are always symmetrical and do not ever exhibit any indication of structures fitting the complex equipment of males. On the contrary, the female genitalia of species with most complex male abdomen (like in two genera of Schizopteridae possessing the secondary genitalia which perform insemination) are missing, and only large genital opening is present. We could speculate that male diversity evolved by sexual selection maximalizing the libido of both sexes. However, no specialized tangoreceptors have been found in females, and the actual mode of copulation is known in one dipsocoromorphan species only. Index terms: morphology, sexual coevolution

[3187] ONTOGENESIS OF THE OVARY OF *PORPHYROPHORA POLONICA* (INSECTA, HEMIPTERA, COCCINEA: MARGARODIDAE)

T. Szklarzewicz, Dept. of Systematic Zoology, Inst. of Zoology, Jagiellonian Univ., R. Ingardena 6, PL-30060 Kraków, Poland, E-mail szkla@zuk.iz.uj.edu.pl.

Developing ovaries of *Porphyrophora polonica* are spindle-shaped and contain about 450 cystocyte clusters that are arranged into rosettes. Cystocytes in the rosette remain interconnected by intercellular bridges that are filled with an amorphous fusomal material (fusome). All fusomes in the cluster associate, forming a polyfusome. Cystocytes are morphologically similar, they are cone-shaped and have large spherical nuclei. At the beginning of the third instar, the cystocyte clusters grow out of the spindle-shaped ovary. Consequently, the gonad of the third larval instar consists of numerous ovarioles radially arranged around a central, tube-shaped part, termed a lateral oviduct. Simultaneously, cystocytes differentiate into oocytes and trophocytes. All germ cells residing within the ovariole belong to one cluster. At the time oocytes become recognizable from trophocytes, polyfusomes disappear and are replaced by a characteristic labyrinth of membranes. In the ovarioles of the older third instar larva a tropharium (trophic chamber) and vitellarium can be distinguished. The oocytes are observed in basal as well as in the apical parts of the tropharia. The oocyte that develops first in the vitellarium becomes surrounded by a monolayered follicular epithelium. The ovary of the adult female is composed of about 300 synchronously developing telotrophic ovarioles. Each ovariole is differentiated into an anterior tropharium and posterior vitellarium that contains only one developing oocyte. The tropharium encloses trophocytes and arrested oocytes. The number of germ cells in ovarioles varies from 12 (7 trophocytes + 4 arrested oocytes + 1 developing oocyte) to 19 (respectively, 14+4+1). The central, cell-free area of the tropharium is occupied by a trophic core, which is connected both with trophocytes (by cytoplasmic strands) and oocytes (by nutritive cords). Observation of older ovarioles has shown that arrested oocytes are capable of further development.
Index terms: oocytes, oogenesis, ovariole, trophocytes.

[3188] STRUCTURE OF OVARIOLES IN *ADELGES LARICIS* (INSECTA, HEMIPTERA, APHIDINEA: ADELGIDAE)

T. Szklarzewicz, A. Wnêk & S.M. Biliński, Dept. of Systematic Zoology, Inst. of Zoology, Jagiellonian Univ., R. Ingardena 6, PL-30060 Kraków, Poland, E-mail szkla@zuk.iz.uj.edu.pl.

The paired ovaries of adult females of *Adelges laricis* are composed of 5 short telotrophic ovarioles in various stages of development. In the ovariole the terminal filament, tropharium (=trophic chamber) and vitellarium can be distinguished. All germ cells residing within the ovariole belong to one cluster and are differentiated into oocytes and trophocytes (=nurse cells). The number of germ cells in ovarioles varies from 50 to 92. The tropharium encloses trophocytes and arrested oocytes. The centre of the tropharium is occupied by a cell-free region, termed a trophic core, which is connected both with trophocytes and oocytes. Trophocytes are joined to the core by cytoplasmic strands, oocytes by nutritive cords. The strands as well as trophic core and nutritive cords are filled with parallel arranged microtubules. The trophocyte nuclei are roughly spherical or oval and contain irregular nucleoli. The perinuclear cytoplasm of trophocytes is filled with fine-granular nuage material and electron-dense clumps. The latter are associated with numerous mitochondria. The vitellarium consists of 1 to 2 developing oocytes that are surrounded by follicular cells. During vitellogenesis the ooplasm becomes filled with reserve substances: yolk spheres and lipid droplets. The posterior pole of the vitellogenic oocyte is invaded by endosymbiotic microorganisms. They are elongated and surrounded by a dense cell wall and a membrane of a host cell. The cytoplasm of microorganisms is granular and not differentiated into distinct zones. In *Adelges laricis*, like in other insects, endosymbionts are transmitted transovarially, *i.e.* the eggs are infected by microorganisms from the mother's symbiont mass, termed the mycetome.
Index terms: aphids, endosymbiotic microorganisms, oogenesis.

[3189] MORPHOMETRIC STUDY OF THE GREEN LACEWING'S WING

K. M. Takahashi[1,2] & S. De Freitas[1], [1]Depto Fitossanidade, Univ. Estadual Paulista-Campus de Jaboticabal, Via de Acesso Paulo Donato Castellane s/n, 14870-000, São Paulo/Brazil. [2]E-mail: takahashi@asbyte.com.br.

The green lacewing occurs naturally in several plants, promotting biological control for several pests. There is not a strong knowledge about ecology and biology of this natural enemy. The objective of this experiment was determine characteristics that allow to identify diferent chrysopids species. The study was carried out in Green Lacewing Biosystematics Laboratory and the species analyzed were collected in citrus and nuts orchads at Jaboticabal Experimental Station in UNESP. It was collect examples of *Ceraeochrysa cubana, C. cincta, C. caligata, C. everes, C. scapularis, Chrysoperla defreitasi e C. externa.* On each specie, the anterior wings were detached and placed between two sheets of glass for later analyzes. The results showed several characteristics that look alike in all species: narrow wing; acute apex; narrow base costal area; long subcostal; subcostal and radial not together; no marked wing; wide back cells; forked 1A; C1 cell smaller than C2; open DCC cell; forked CU2; basal gradiforme reach in PSM; gradiformes in two series, diferent numbers and paralels; oval intramediana; long M2 cell; PSM and PSC well separeted; Rs little sinuous; Post-margin cross based unforked; subcostal cross present. Acording to the morphometric analyzes observed, exchanging the confiance grade, the number of necessary meassures for a good diferentiation between the species also changes. According to the Lambda value verified that the measure of the distance of the intercept point between the line that pass in the intramediana apex and the costal in the post margin until the pterostigma final part, and, the intercept point distance between the line that pass in the intramediana apex and the costal in the post margin until the pseudocubital extremity final are the best for the species identification. The obtained result was, in average, a fine adjust became 93% correspond a correct identification when is used a conventional analizys.
Index terms: biological control, green lacewing, insecta, morphometric.

[3190] DIFFERENTIAL SORTING OF THE CONSTITUTIVELY CO-SECRETED VITELLINE MEMBRANE AND YOLK PROTEINS OF *DROSOPHILA* IN THE VITELLOGENIC OVARIAN FOLLICLE CELLS; A HIGH RESOLUTION IMMUNO-ELECTRON MICROSCOPY STUDY OF THE FOLLICLE CELLS SECRETORY AND OOCYTE ACCUMULATIVE PATHWAYS

I. P. Trougakos, I. S. Papassideri and L. H. Margaritis[1], Fac. of Biol., Dep.of Cell Biol. & Biophysics, Univ. of Athens, Panepistimopolis, Kouponia, Athens, GR-15701, Greece, e-mail: lmargar@cc.uoa.gr.

Conventional and freeze-fracture electron microscopy, immuno-electron microscopy of ovarian cryosections and confocal immunocytochemistry were used to analyze the ultrastructure of the ovarian follicle cells secretory and the oocyte accumulative pathways, as well as the distribution of the major protein classes being secreted constitutively by the follicle cells during the vitellogenic and choriogenic stages of *Drosophila* oogenesis. Our results clearly demonstrated that at the vitellogenic follicle cells the co-secreted vitelline membrane and yolk proteins are either sorted into distinct secretory vesicles or they are segregated in different parts of bipartite vesicles by differential condensation. Following their exocytosis only the vitelline membrane proteins are incorporated into the forming vitelline membrane while the yolk proteins (along with their hemolymph circulating counterparts) diffuse through gaps among the incomplete vitelline membrane and are internalized by the oocyte where they are finally stored into the α-yolk granules. The immunolocalization of vitelline membrane antigens in the associated body of the α-yolk granules may indicates that this structure is a transient repository for the proteins being accidentally co-internalized into the oocyte along with the yolk proteins. Interestingly, in the early choriogenic follicle cells the co-secreted vitelline and early chorion proteins were immunolocalized to be evenly intermixed into the same secretory vesicles, suggesting that these proteins are not sorted within the trans-Golgi network of the follicle cells. To our knowledge this is the first report that provides evidence for condensation-mediated sorting of constitutively co-secreted proteins.
Index terms: *Drosophila*, endocytosis, exocytosis, protein sorting, vitelline membrane proteins, yolk proteins

[3191] LARVAL AND PUPAL MORPHOLOGY OF THE GENUS *MAGELLOMYIA* (TRICHOPTERA: LIMNEPHILIDAE): COMPARATIVE CHARACTERIZATION OF THE SPECIES CITED FOR SOUTH AMERICA

Alejandra del C. Valverde, Facultad de Cs. Exactas y Naturales, UBA. Dto. de Cs. Biológicas, 4to. Piso, Pab II. Ciudad Universitaria. CP: 1428, Buenos Aires, ARGENTINA.E-mail: **Erro! Indicador não definido.**

About 25 species of *Magellomyia* are known for South America, only 5 of which have had their immature stages described: *Magellomyia limnophilus, M. appendiculata, M. masafuera, M. porteri* and *M. bruchina*. Flint (1982) gave some relevant data on the larval morphology of *M. capillata* and compared it with *M. appendiculata*. Another species is added here, most probably *M. affinis,* from Sierra de la Ventana, province of Buenos Aires, Argentina.The object of the present work is to perform a comparative study of the larval and pupal characters of the different species present in South America. Specimens were examined pertaining to the following species: *M. appendiculata, M. limnophilus, M. bruchina* and *M. affinis*. In order to make comparisons with *M. masafuera, M. porteri* and *M. capillata*, information was obtained from the literature since no material from these species was available. The identification is unmistakable, since in all cases metamorphotypes were collected or larvae were bred until they molted into adults. With the adults or the pharate adults a good identification can be obtained since there is not so much character overlap as in the case of the larvae. In the present paper a comparative description of the larvae and pupae of *Magellomyia* is summarized. Of the whole set of studied characters those that provide information to differenciate species are: head colour and muscle scars; shape of the prosternal sclerite; setae of the metanotum and thoracic legs; presence of sclerites in the first abdominal venter; average gill filaments and their distribution in the abdomen; number and distribution of lateral tubercles; bladelike setae of the ninth abdominal tergite, the anal prolegs and the perianal sclerites. On the pupae the observed characters are: arrangement of the swimming hairs on the legs, apical processes and dorsal hooks plates of the abdomen. The rest of the studied characters, even if they are usually employed to describe specimens, would be diagnostic of the genus, but do not provide relevant information to differentiate species.
Index terms: *M. limnophilus, M. appendiculata, M. masafuera, M. affinis, M. bruchina.*

[3192] ULTRASTRUCTURE OF THE LYONET'S GLAND IN *DIATRAEA SACCHARALIS* (LEPIDOPTERA: PYRALIDAE) LARVAE

E. Victoriano & E. A. Gregório, Centro de Microscopia Eletrônica, Inst. Biociências, UNESP, Campus de Botucatu, C.P. 510, CEP 18.618-000, Botucatu, SP, BR. E-mail evictoriano@yahoo.com.

The Lyonet's gland is usually found in Lepidoptera larvae, close to the excretory duct of the silk gland. As the Lyonet's gland communicate with the latter one, it may be considered an accessory gland of the silk gland. The role played by this gland is still uncertain; it may be involved in the exchange of small molecules as well as in a secretory process of cement for the silk elements. This work aims to describe the ultrastructure of the Lyonet's gland in *Diatraea saccharalis* larvae, offering suggestions regarding its possible function. The insects were reared in artificial died, under laboratory-controlled conditions. The Lyonet's gland together with silk glands were fixed for 24h in 2% glutaraldehyde and 4% paraformaldehyde buffered solution and post-fixed in 1% osmium tetroxide for 1h before being prepared for transmission (TEM) and scanning (SEM) electron microscopic observation. SEM shows that Lyonet's glands in *D. saccharalis* larvae are paired small structures located bilaterally in the ventral side of the head. Each of them is composed of clustered long cells resembling leaves, around the posterior region of each silk gland duct. Under TEM observations, each cell is surrounded by a thin basal lamina. The large nucleus is stellate and extensively branched containing large nucleolus and loose chromatin. The cytoplasm presents large and empty canaliculli with small and scarce microvilli. The basal membrane forms numerous infoldings which intrude deeply into the cytoplasm. Numerous and well-developed mitochondria are concentrated between these infoldings; although they occur around the canaliculi. The cytoplasmic membrane system is poorly developed, including the rough endoplasmic and Golgi apparatus; free ribosomes and microtubules are numerous. Our ultrastructural results suggest that the Lyonet's gland in *D. saccharalis* larvae may be involved in the uptake of small molecules from the hemolymph and released of "materials" to the silk gland duct; no evidences of macromolecules synthesis and secretion was noticed. (FAPESP fellowship - Proc. 98/03020-0)
Index terms: *Diatraea saccharalis*, Lyonet's gland, accessory glands, ultrastructure

[3193] MAJOR TRENDS IN THE EVOLUTION OF HYMENOPTERAN MORPHOLOGY

L. Vilhelmsen & F. Ronquist, Department of Systematic Zoology, Evolutionary Biology Centre, Uppsala University, Norbyvägen 18D, SE-752 36 Uppsala, Sweden.

We examined general trends in the evolution of hymenopteran morphology by mapping selected character systems on a recent estimate of basal hymenopteran phylogeny. We document strong directionality in the evolution of adult skeleto-musculature, wing venation, and larval anatomy. In the adult body, the trend is towards fewer sclerites, fewer muscles, more articulations between sclerites, and less exposed membrane. The driving force may be selection pressure for functional efficiency. Sophisticated articulations and tight integration of fewer skeletal parts allow the wasp to execute complex movements with fewer muscles: the skeleton passively does more of the work. Reduction of exposed membrane may also improve protection against predators and restrict water loss. In the wing, there is a trend towards simpler venation, possibly due to irreversible loss of veins during evolutionary phases of decreasing body and wing size. In larval anatomy, there is a tendency for reduction of extremities and sense organs correlated with a transition in larval biology from free-living, mobile, externally feeding forms to forms feeding internally in confined spaces. These evolutionary trends appear to be created by ratchet-like mechanisms and by selection pressures acting over millions of years but opposed by strong phylogenetic inertia. The trends have important implications for optimisation, polarisation, and weighting of morphological characters.
Index terms: exoskeleton, musculature, wing venation, larval anatomy, Hymenoptera.

[3194] COMPARATIVE MORPHOLOGY OF THE PYGOPHORE IN PODOPINAE (PENTATOMIDAE: PENTATOMOIDEA)

J. Vilimova, Department of Zoology, Charles Univ., Vinicna 7, Praha 2, Czech Republic, CZ 128 44.

Morphology of the 9th abdominal male segment, pygophore (= genital capsule), was studied in 47 genera from the pentatomid subfamily Podopinae. The basic plan of the podopine pygophore was suggested. The structure of the plesiomorphic pygophore was rather simple and corresponding to the presumed basic plan in the other pentatomoidean taxa. The apomorphic, more complicated, pygophoral structures evolved later. All the pygophoral rims were infolded into an external opening, which shifted to the dorsal position (from posterior). Different modifications, e. g. grooves, tubercles, or ridges, evolved on the ventral pygophoral wall (topographically posterior). Processes arised out of the pygophoral rims, the most conspicuous ones on the ventral rim, and particularly on lateral rim, where large processes are developed, separated by an incision of variable size from the remainder of rim. The parandria, large, hollow, moveable processes of the lateral rim, are an autapomorphic feature of the Podopinae, and they otherwise occur only in Aradidae (Aradoidea). The infoldings of particular rims are modified into other structures. The internal pygophoral structures are modifications of infolding of the ventral rim, shifted inside the pygophore. Infolding of the lateral rim formed a wide, mostly flat pygophoral area, with small to large structures, among which the dorsal processes are the most conspicuous ones. They developed within Pentatomidae several times as a result of convergence.
Index terms: pygophoral rim, infolding of rim, parandria, pygophoral area, dorsal processes

[3195] THE MORPHOLOGY OF THE POSTEMBRYONIC STAGES OF *GONATOPUS CHILENSIS* (HYMENOPTERA: DRYINIDAE), WITH CONSIDERATIONS ABOUT THE INMATURE LARVAE NUTRITION AND ITS RELATED STRUCTURES

E.G. Virla [1] & S. Mangione[2], [1] CONICET. "INSUE", M. Lillo 205 (4000) S.M. de Tucumán, Argentina. E-mail: evirla@infovia.com.ar; [2] Fund. M. Lillo. Inst. de Morfología Animal, M. Lillo 251 (4000) S.M. de Tucumán, Argentina. E-mail: lmopty@tucbbs.com.ar.

The postembryonic stages of *Gonatopus chilensis*, parasitoid of planthoppers (Delphacidae) vectors of "Mal de Río Cuarto disease of Corn" in Argentina, are described. The external morphology of the eggs and larval stages doesn't differ from other species of Gonatopodinae already known. Our studies on the internal anatomy put emphasis in the description of the tegument, cephalic lobes and alimentary canal, mentioning to the formation of the mandibles and silk glands. We observed structures such as a specialized muscular pharynx ("pharyngeal pump") present from the first larval instar, a sphincter between the esophagus and the gastric cavity, gastric content and a conspicuous mouth opening. These observations contradict hypothesis formulated by other authors on the mode of feeding of the dryinid larvae. The anatomical differences observed between *G. chilensis* and other species, as well as contradictory interpretations on the function of cephalic lobes and the manner of nutrition of the Gonatopodinae larva demonstrates the necessity of continuing with investigations in order to clarify these aspects.
Index Terms: anatomy - parasitoids - Delphacidae - vectors - corn

[3196] CHORIOGENESIS IN *DACUS OLEAE* WITH RESPECT TO PEROXIDASES

S.H.Woitek, O.Konstandi & L.H.Margaritis, Fac. of Biol., Dep.of Cell Biol. & Biophysics, Univ. of Athens, Panepistimopolis, Kouponia, Athens, GR-15701, Greece, e-mail: lmargar@cc.uoa.gr. This work was supported by a TMR grant N° ERB4061PL970047 to Prof. L.H. Margaritis.

The olive fly *Dacus oleae* is an economic important pest that causes serious harvest losses every year in all olive oil producing countries. The egg of that fly is laid inside olives and the larvae eventually destroy the fruit. To avoid further extensive use of insect pesticides a possibility for biological control is in need. Therefore a good knowledge of the molecular basis of development of *Dacus oleae* is necessary. In previous studies we have shown that the eggshell properties are responsible for the effectiveness of the egg-laying process and that peroxidase inhibition included in cultured flies can prevent egg-laying. Similarly to *Drosophila melanogaster* this enzyme causes covalent cross linking of the eggshell proteins producing a resilin-type configuration with rubber like properties. We were interested in isolating the peroxidase gene that codes for this special enzyme. First, RT reactions were performed using as template ovarian mRNA of *Dacus oleae* and primers from conserved regions for mammalian and insect peroxidases amplifying a 500 bp fragment of the functional region. The PCR products were subcloned in pBS KS'plasmid vector. The sequencing results revealed a 98% homology with the cDmPO clone isolated from both *Drosophila melanogaster* embryonic and staged 11-14 follicle cDNA library. The locus of DoPO was analysed by *in situ* hybridization. Finally a *Dacus oleae* ovarian cDNA library was constructed and screened a) with the DoPO PCR fragment to isolate peroxidase family genes and b) via a differential screening with probes specific for each choriogenic stage (11-14) The analysis of so isolated clones shall provide us with a better knowledge of genes and their products that are involved in choriogenesis and its fine regulation.
Index terms: olive fly, Drosophila melenogaster, oogenesis

[3197] A SEM AND TEM COMPARATIVE STUDY OF TYPE I AND III SECRETORY GLANDS IN THE GENITAL APPARATUS OF THE COCKROACH NAUPHOETA CINEREA

J. WÜEST, Museum of Natural History, POBox 6434, CH-1211 Geneva 6, Switzerland.

The glandular tissues of the female genital tract (oviducts, uterus, spermathecae, accessory glands 1, 2 and 3) of the cockroach Nauphoeta cinerea were studied by TEM and SEM, after elimination of living tissue by natrium hypochlorite. This comparative study allows some valuable observations concerning the morphology of these glands on the level of cuticule structure, e.g. intracellular tubules. Those tubules correspond to type I and III of Quennedey. Within type I (short tubules, no tubule cells), we noticed two types of organisation, a classical one, corresponding to the description by Quennedey (very short tubules: accessory gland 2, producing proteins and enzymes for oothecae) and a slightly different one, with longer tubules, somehow intermediate between type I and type III (accessory glands 3, producing phenol derivatives). Type III glands correspond to oviducts, uterus, spermathecae and accessory glands 1. There are slight differences in the organization of the cuticule, the density and the implantation of the tubules in those different tissues.
Key words: Ultrastructure, Glands, SEM, TEM

[3198] ANTENNATION AND SEXUALLY DIMORPHIC ANTENNAE OF THE BLISTER BEETLE, *EPICAUTA HIRTICONIS*

E. C. Yang[1,2], Y. S. Chow[2], R. S. Tsai[2] & C. F. Guey[1], [1]Dept. of Entomology, Natl. Chung Hsing Univ., Taichung 402, Taiwan R.O.C., ecyang@dragon.nchu.edu.tw; [2]Inst. of Zoology, Academia Sinica, Taipei 115, Taiwan R.O.C.

Most of the sexually dimorphic features found in the insects are associated with reproductive behavior, and their behavioral traits can often be used as taxonomic features. In blister beetle (Meloidae) genera, the antennation and the position the male takes during courtship delivery are characterized in different species groups, though in most cases the function of these features so far remains a mystery. Like other species in Meloidae, the antennation of the male adult blister beetle, *Epicauta hirticonis*, was noted as an important role during its courtship behavior: the male antennae grasp the female's by twisting the male antennae and then vibrate. It is reasonable to believe that the specialized use of the grasping region of the male antennae might indicate some specialized morphological features on the antennae of this beetle. To seek any correlation between the antennation function and the antennal morphology, the distribution of the sensilla and pores on the antennae of the beetle were examined with electron microscopy. Five types of sensilla, including longer and shorter sensilla trichodea, socketed and non-socketed sensilla basiconica, and sensilla campaniformia, were observed on the male antennae. Similar sensillar types were also found on the female antennae except the longer sensilla trichodea. Two main types of pores, opening of epidermal gland and sieve-like pore group, were observed on the antennae according to their arrangement and distribution as well. In terms of distribution, none of the sensilla matches the segments 3 ~ 9 of male or 6 ~ 11 of female which are contacted and twisted to each other during the courtship. However, the distribution of sieve-like pore groups, which were only found on the male antennae, is segments 3 – 9, suggesting this specialized morphological feature might be related to the antennal twisting behavior.

Index terms: copulatory behavior; antenna; sexual dimorphism; Meloidae

[3199] NURSE CELLS DEGENERATION DURING OOGENESIS OF *APIS MELLIFERA* (HYMENOPTERA, APIDAE)

A. A. Zacaro, Instituto de Biociências, Departamento de Biologia, UNESP, Caixa Postal 199, CEP: 13.506-900, Rio Claro, SP, Brasil, E-mail aazacaro@rc.unesp.br. (*) Financial support: CAPES/CNPQ

Each ovary of *Apis mellifera* queen are formed by 160-180 long meroistic polytrophic ovarioles. Morphologically, the ovariole can be subdivided into three regions: terminal filament, germarium and vitellarium. In the germarium, germ cell clusters are originated by mitotic divisions from one single germ cell or cystoblast. Before entering the vitellarium, each germ cell cluster differentiates into an oocyte nurse cell complex. Basically during previtellogenesis, nurse cells contribute transcriptionally and translationally supporting the oocyte and determining the beginning of its euplasmatic growth. Further enrichment of the euplasm of the oocyte is achieved during vitellogenesis, a phase which is characterized by the uptake of vitellogenin from the haemolymph by an epithelium surrounding the oocyte and which is originated from differentiated somatic cells; however, before the completion of vitellogenesis and euplasm formation, nurse cells begin to degenerate. Although during oogenesis the process of degeneration can be showed inside the egg tube in the germinative and somatic cells, prior or post cell differentiation by histological parameters such as morphology changes of nuclei and/or cytoplasm in sections stained with Haematoxylin and Eosin (HE), the purpose of this work is to describe the features of the degenerating nurse cells obtained from different histochemical treatments, such as Periodic Acid Schiff (PAS), Bromophenol Blue (BB), Sudan Black B (SBB) and Toluidine Blue (TB). Ovaries of *Apis mellifera* were fixed with 4% paraformaldehyde containing salts of insect physiological solution (final pH 7.4 adjusted with PBS) and routine processed for historesin infiltration and embedding. The morphological features obtained by these histochemical methods can be compared to those well described events of nurse cell degeneration or apoptosis during the oogenesis of *Drosophila melanogaster* which have been analyzed by refined methodologies. The histochemistry showed the presence of proteins, lipids and probably lipoproteins during nurse cell degeneration; however it was demonstrated that neutral glyco-conjugated proteins were not present during this process. Surprisingly, SBB methodology allowed the visualization of a strong positive staining inside and outside the egg tube only in the nuclei and cytoplasm of degenerating nurse cells and somatic cells (phagocytes), respectively. This strong SBB positive staining observed in these two types of cells is not coincident with the results obtained with Haematoxylin, though SBB can behave like cationic dyes binding to negatively charged cell and tissue structures.

Index terms: histochemistry; trophocyte; phagocyte; haemocyte; ovary; apoptosis

[3200] MORPHOLOGICAL CHARACTERISTICS OF COMMUNICATION ORGANS OF ADULT *BACTROCERA (DACUS) OLEAE (DIPTERA: TEPHRITIDAE)*

S. S. Zacharioudakis[1], G.J. Tsiropoulos[1] & L.H. Margaritis[2], [1]Biology Inst., National Centre for Scientific Research "Demokritos", Athens 153 10, Greece, E-mail stelza@mail.demokritos.gr; [2]Department of Biology, Division of Cell Biology and Biophysics, Athens Univ., 157 10 Athens, Greece.

Scanning electron microscope images showing the ultrastructure of *Bactrocera oleae* communication organs are presented. Different types of sensilla have been found in each organ, and are classified by their length, distribution and possible functional activity. In antennae, at least four types of sensilla have been found probably serving chemical communication including pheromones. In mouthparts, labellum houses at least three types of sensilla, while maxillary palps have also three types, mostly serving food recognition and acceptance behavior. In tarsi, four types of sensilla are used by the fly to detect chemical molecules on landing surfaces. Finally, the female ovipositor is equipped with one major type of sensillum, serving the physicochemical detection of the oviposition substrate, controlling thus, egg deposition behavior.

Index terms: Sensilla, pheromones, feeding behavior, egg laying behavior

[3201] CHARACTERISTICS OF SPERMATOZOA OF A STINGLESS BEE *MELIPONA MARGINATA* (HYMENOPTERA: APIDAE: MELLIPONINI)

U. S. Zama, J. Lino Neto & M. A. H. Dolder, Depto. de Biologia Celular e Estrutural , UNICAMP, CP 6109, Campinas, SP, Brazil. E-mail: uyrazama@hotmail.com

Melipona marginata is a Meliponini bee. This group is characterized as being sting-less. Seminal vesicles were dissected and fixed for 4 h in a solution containing 2.5% glutaraldehyde, 3% sucrose and 5mM CaCl2 in 0.1 M cacodylate buffer at pH 7.2. After rinsing in buffer, the specimens were postfixed with 1% osmium tetroxide and 0.8% potassium ferocyanide in the same buffer. Dehydratation was carried out in acetone and embedding in Epon 812. Ultrathin sections were stained with uranyl acetate and lead citrate. In some cases, the ethanolic phosphotungstic acid (E-PTA) method for detection of basic proteins was applied. The spermatozoon of *M. marginata* is long and fine. The head region contains an acrossome and a nucleus. The acrossome is conical and formed by an acrossomal vesicle covering a perforatorium which is embedded in the nucleus. In transverse section, this structure is circular at the anterior region and triangular near the nucleus. In the both cases the vesicle is separated from the perforatorium by a clear, EPTA-negative, layer which is reduced to the vertices in triangular cross sections. The nucleus is long, compact and, in the conventional preparation, homogeneous. However, with the EPTA method some regions differ appearing EPTA-positive (basics proteins). The flagellum contains an axoneme, two mitochondrial derivatives and two accessory bodies. The axoneme follows the 9+9+2 microtubule arrangement, with nine outer, single, accessory tubules, 9 doublets and 2 central single microtubules. Next to the nucleus, the centriole has the components typical for insects, this is, only the doublets and nine accessory microtubules. In the final portion, the microtubules are disorganized, losing the central pair first and then the doublets. The accessory microtubules, are the only EPTA-positive ones. The mitochondrial derivatives are EPTA-negative and asymmetrical, where one often is longer than other in both length and diameter. In both, the mitochondrial cristae appear only peripherally, opposite to the position of the axoneme. The bigger derivative has, next the cristae, a region of paracristaline EPTA-positive material. Between the nucleus and the smaller derivative, and usually limited to this region, is a very long, EPTA-positive centriolar adjunct. Nevertheless this structure frequently extends laterally or between the derivatives. Accessory bodies are present between axoneme and mitochondrial derivatives. In transverse sections, they have a triangular shape and appear EPTA-negative. This spermatozoon is very similar that described for others Hymenoptera. However, it is conspicuous for the very long centriolar adjunct, and the fact that it may advance parallel to the smaller mitochondrial derivatives.

Key words: *Melipona marginata* - Meliponini - Spermatozoa

[3202] THE SALIVARY GLANDS OF *PACHYCONDYLA (= NEOPONERA) VILLOSA* (HYMENOPTERA: FORMICIDAE) LARVA: FUNCTIONAL CHANGES IN LAST INSTAR

F.L. Zara[1] & F.H. Caetano[1], [1]Dept. of Biology, IB, UNESP, P.O. Box 199, 13506-900, Rio Claro, SP, Brazil. E-mail: fjzara@rc.unesp.br. Supported by FAPESP.

The salivary glands in some insects are related to silk spinning and/or digestive enzymes production. The silk production has been extensively studied in Lepidoptera and the digestive enzymes production has been studied in Diptera. In ants, the salivary glands were studied in *Solenopsis invicta, Acromyrmex octospinosus* and *Camponotus pennsylvanicus* and related to enzymes production for digestion of solid or semi-solid food. The ultrastructural analysis of silk production in ants does not was described. In this work, we described the ultrastructure in last instar of the salivary glands when producing digestive enzymes and the changes to silk spinning production. The larvae of *P. villosa* were dissected and fixed in glutaraldehyde 2,5% in cacodylate buffer for 2 hours and processed to transmission electron microscopy routine. The salivary glands cells when producing digestive enzymes have a basal cellular membranes profusely folded and intercellular junctional membranes presents a few large spaces. The rough endoplasmic reticulum and Golgi bodies changes from layers and cisternae to large vesicles accordant to the physiological state of the cell and characterize a not synchronized secretory cycle. The enzymes are released to the lumen by microapocrine secretion, similar to observed in salivary glands of *Drosophila lebanonensis* (Diptera) and midgut of *Spodoptera frugiperda* (Lepidoptera). The stage of silk production is detected after a behavioral act, where the nurse worker separates the mature larva. In this moment, the cells of salivary glands presents only one physiological state (synchronized secretory cycle) characterized by basal cellular membrane poorly folded, intercellular junctions membrane presents some small spaces, lamelar rough endoplasmic reticulum, vesicular Golgi bodies and a few secretory vesicles containing silk, which undergo exocytosis. The silk into the lumen shows two forms: tactoids and floculated materials.
Index terms: ants, silk, ultrastructure, secretory cycle, digestive enzymes

[3203] GENOME AND FUNCIONAL GENOMICS OF XYLELLA FASTIDIOSA

M.A. Machado, A. A. de Souza, M.A. Takita, E. C. Localli, H. D. Coletta Filho & M. Cristofani, Centro de Citricultura Sylvio Moreira, Instituto Agronômico de Campinas, C.P. 04, CEP 13490-970 Cordeirópolis, SP, Brazil. E-mail: marcos@centrodecitricultura.br. Supported by FAPESP.

The citrus variegated chlorosis (CVC) was first related in 1987 in Brazil affecting all sweet orange varieties The disease spread rapidly by graft propagation of infected budwoods, and by xylem feeding homopterans vectors. CVC is now a major concern to the Brazilian citrus industry. In 1998 a network of 35 laboratories (ONSA, organization for nucleotide sequence and analysis), supported by FAPESP and coordinated by Dr. A. Simpson (Ludwig Institute for Cancer Research), started sequencing the complete genome of *Xylella fastidiosa*, the causal agent of CVC. The genome of the *X. fastidiosa* was sequenced using a libraries of cosmids and plasmids, covering 15-fold the genome and obtained by DNA shotgun of the strain 9a5c isolated of sweet orange Valência. The sequencing was conduced on ABI 377 using BigDye terminator. The software Phred/Phrap/Consed was used for assemble always using base quality of at least 20. The chromosome contain 2,679,572 bp. Plasmids of 51,158 bp and 1,286 bp were also found. At least 2,950 putative proteins, covering 86% of the genome, were identified. About 39% were considered hypothetical proteins. Analysis of genes related to pathogenicity were also performed. Several hypothetical models of pathogenicity of *X. fastidiosa* could be supported with the data of the genome. Functional analysis of the genome has been conduced in several laboratories in the State of São Paulo. All proposals should focus as main subject the pathogenicity of the bacterium in sweet orange, or alternative hosts, and the interactions with the vectors. Since there was a lack of information on basic aspects of its biology, several projects were involved in developing known on minimal growth medium, capacity of transformation, over expression of genes of toxins and/or exoenzymes, as well as physiological aspects of infected plants. Models of pathogenicity are arising of these projects.

Index terms: *Xylella fastidiosa*, genome and functional genomics, citrus variegated chlorosis

[3204] MECHANISMS OF INSECT VECTOR TRANSMISSION OF *XYLELLA FASTIDIOSA* AND IMPLICATIONS FOR CONTROL

A. H. Purcell[1], [1]Univ. of California, Div. of Insect Biology, Berkeley, CA, 94720-3112, USA. E-mail purcell@nature.berkeley.edu

The bacterial plant pathogen *Xylella fastidiosa* has a unique combination of vector transmission characteristics: (i) no latent period, but (ii) adult vectors can transmit throughout their lives. The loss of vector infectivity after molting suggests that the foregut is the operative site for vector transmission, but low numbers (hundreds or less) of detectable (cultivable) bacteria within the insect head enable efficient transmission, implying that the critical retention site for bacteria within the vector's foregut is small. Yet to be discovered is how the bacteria attach to the insect foregut, the operative site from which bacteria are re-inoculated into plants, and how vectors release bacteria during vector feeding to infect plants. A comparison of Pierce's disease (PD) of grape and citrus variegated chlorosis (CVC) illustrates how differences in vector transmission and plant host range call for different control strategies. Vector transmission is much more efficient for PD than for CVC. Most spread of chronic PD infections in California appear to be from areas outside vineyards. Bacterial infections of grape made near the preferred feeding site for vectors, the tips of growing canes, made during summer months usually do not spread downward fast enough to avoid being eliminated by winter pruning fo dormant vines. In California, vector acquisition of bacteria from chronically infected grape is only likely beginning in June or July. But after this date, new infections of the tips of stems have a low probability of persisting until the following winter. This may explain why the spread of chronic PD in vineyards appears to be from vectors originating outside the crop. The recent introduction of the vector *Homalodisca coagulata* into California may change this situation because adult *H. coagulata* frequently feed on the bases of growing stems. Vine to vine spread of bacteria by *H. coagulata* could establish infections during summer months that dormant pruning does not eliminate. This vine to vine propagation of chronic infections by *H. coagulata* may account for the exponential increase of PD recently observed where *H. coagulata* is abundant, in contrast to the "simple interest" type of annual increases of PD previously noted in California. Unlike PD, the typically exponential nature of the spread of CVC in Brazil strongly suggests that tree to tree spread of *X. fastidiosa* is important for CVC. Furthermore, the effectiveness of sanitation (systematic removal of symptomatic branches or trees and planting pathogen-free young trees) in controlling CVC implies that for CVC: (i) citrus is the main source of inoculum for disease spread to other citrus plants, and (ii) vector infectivity or transmission efficiency (or both) is probably low.

Index terms: epidemiology, *Homalodisca*, plant disease, sharpshooter

[3205] PHYSIOLOGICAL ADAPTATIONS OF LEAFHOPPERS THAT FEED ON XYLEM FLUID: EXPLORING NUTRIENT LIMITATIONS AS A COMPONENT OF INTEGRATED CROP MANAGEMENT

P. C. Andersen[1], **B.V. Brodbeck**[1] **& R.F. Mizell III**[1], [1]Univ. of FL. NFREC-Quincy, 30 Research Road, Quincy, FL, 32351-9500, USA. E-mail pca@gnv.ifas.ufl.edu

Leafhoppers that feed on xylem fluid have evolved numerous adaptations in order to subsist on this dilute food source. Most of the solutes in xylem fluid (osmolarity = 5 to 50mM) consist of inorganic ions and organic compounds in monomeric form (amino acids, organic acids and sugars). Xylem fluid is characterized by extremely low concentration and diversity of secondary compounds, and amino acid profiles are highly unbalanced with respect to an idealized diet or to insect biomass. The proportion of nitrogen to carbon in xylem fluid of most woody plant species is analogous to that of pure protein, owing to high concentrations of the amides. Adult *Homalodisca coagulata* [also known as the glassy-winged leafhopper (GWSS)], *H. insolita* and *Cuerna costalis* assimilate organic compounds with unprecedented efficiency (>99%). Excess nitrogen is excreted primarily in the form of ammonia, thus conserving 636 and 1926 J/mol of energy compared to urea or uric acid, respectively. Other adaptations of adult leafhoppers includes extremely high feeding rates (up to 100 times body weight per day), diurnal adjustments in feeding rates to maximize nutrient acquisition and polyphagy (or host switching) that coincides with seasonal or phenological changes in plant chemistry. Feeding is not inhibited at high xylem tensions, and is in fact often highest during midday when xylem tensions are maximum (1.5 to 2.5 MPa). The theoretical maximum suction that the cibarial pump is capable of generating is 0.3 to 0.4 MPa; adaptations that allow feeding against high xylem tensions are not currently understood. All facets of GWSS behavior and performance thus far examined have been inexorably linked to xylem fluid chemistry. Seasonal shifts in abundance of adult leafhoppers on different hosts, and leafhopper feeding rates have been correlated with the concentration of the amides in xylem fluid. Artificial diet studies have established that performance of most insects is maximized with balanced profiles of dietary amino acids, yet the performance and behavior of adult GWSS is positively correlated to highly unbalanced amide diets. Adult GWSS in the southeast United States has a host range exceeding 100 plant species; however, immature GWSS are restricted to few host species. Immature GWSS require a more balanced amino acid profile for successful development, and are much less efficient than adults at assimilating high concentrations of amides. These metabolic limitations of immature GWSS, and the concominantly restricted host range, suggest that this life stage is the most vulnerable to control via crop management practices.

Index terms: *Homalodisca coagulata*, amides, amino acids, carbon, nitrogen

[3206] PEAR LEAF SCORCH IN TAIWAN

L. S. Leu

ABSTRACT NOT RECEIVED

[3207] STATUS OF XYLELA FASTIDIOSA IN EUROPE AND IMPLICATIONS FOR QUARANTINE STRATEGIES WORLDWIDE

ABSTRACT AND AUTHOR NOT RECEIVED

[3208] IMPACT OF *XYLELLA FASTIDIOSA* DISEASES IN SOUTH AMERICA

R.P. Leite Jr, Área de Proteção de Plantas, IAPAR, C.P. 481, Londrina, PR 86001-970, Brasil, E-mail ruileite@pr.gov.br. Fellow of CNPq.

Diseases caused by *Xylella fastidiosa* have been reported from South America as early as the 30's. Plum leaf scald disease (PLS) was first reported in the delta region of the Paraná River, Argentina, in 1935. The disease was later reported from Brazil and Paraguay. PLS was very severe on Japanese plum (*Prunus salicina* L.) and its hybrids. Contaminated propagative plant material played a major role in the spread of the disease to new areas. The presence of insect vectors is very important for the spread of the bacterium from tree to tree within plum orchards. Orchards of the widely planted Japanese plum Santa Rosa cultivar was vanished by PLS in the Brazilian States of Paraná, Santa Catarina and Rio Grande do Sul in the middle 70's and early 80's. Nowadays, PLS is present in almost all plum growing areas of Argentina and Brazil. Highly praised PLS resistant plum cultivars are not available for planting. Strategy for control of PLS involves basically the planting of disease free nursery trees in isolated areas. Citrus variegated chlorosis (CVC) caused by a strain of *X. fastidiosa* was first reported in the Northwest region of the State of São Paulo, Brazil, in 1987. A similar disease of citrus called "pecosita" had been reported in the region of Missiones, Argentina, since 1984. CVC is a very serious disease on sweet oranges (*Citrus sinensis* Osb.), affecting all commercial cultivars of oranges, such as Pera, Hamlin, Natal, Valencia and Folha Murcha. The disease has not been observed in other *Citrus* spp., as mandarins, lemons, acid limes, and grapefruit. Contaminated nursery trees was the most import way for the spread of CVC to new areas. Several sharpshooters of the Cicadellidae family have been identified as vectors of *X. fastidiosa* in citrus. The disease is already present in all major citrus growing areas of Brazil, and in the Northeast citrus growing area of Argentina. Disease control strategy involves the production of healthy nursery trees under screenhouse conditions, control of insect vectors, and pruning of affected sweet orange trees. More recently, *X. fastidiosa* has been associated with a leaf scorch type of disease on coffee trees (*Coffea arabica*) in Brazil. Infected coffee trees show marginal necrosis of the leaves, short internodes, and dieback of branches. Association of *X. fastidiosa* with coffee trees is widely spread and has been found in all coffee growing regions of Brazil. However, no assessment of the damage caused to the coffee crop has been made yet.

Index terms: Citrus, Coffee, Plum, CVC, citrus variegated chlorosis, plum leaf scald

[3209] VECTOR AND EPIDEMIOLOGICAL ASPECTS OF CITRUS VARIEGATED CHLOROSIS

J.R.S. Lopes[1], S.R. Roberto[2], P.T. Yamamoto[2], T.A. Giustolin[1], F. Laranjeira[1] & A. Bergamin Filho[1], [1]Depto. Entomologia, Fitopatologia e Zoologia Agrícola, ESALQ/USP, C.P. 09, Piracicaba, SP 13418-900, Brazil, E-mail jrslopes@carpa.ciagri.usp.br; [2]Depto. Científico, Fundecitrus, C.P. 391, Jaboticabal, SP 14801-970, Brazil.

Citrus variegated chlorosis (CVC) is a serious disease affecting sweet oranges (*Citrus sinensis*) in Brazil and Northern Argentina, caused by the xylem-inhabiting bacterium, *Xylella fastidiosa*. The pathogen is transmitted by 11 species of sharpshooter leafhoppers (Hemiptera: Cicadellidae, Cicadellinae) found in citrus groves and nurseries in São Paulo State. Transmission efficiency to citrus is relatively low, ranging from 1 to 17%, depending on the vector species. Among sharpshooters that use citrus as a host, species of the tribe Cicadellini tend to be more efficient than those of the tribe Proconiini. *Acrogonia* sp., *Bucephalogonia xanthophis*, *Dilobopterus costalimai* and *Oncometopia facialis* are thought to be "key" vectors for CVC spread in orchards, because of their abundance on citrus trees. *B. xanthophis* is the main vector in citrus nurseries and young groves, due to its prevalence on young citrus plants. Vector populations in citrus, measured by yellow sticky trap catches, increase after the onset of spring rains and peak in late spring and summer. Higher vector populations are found in the Northern region of São Paulo State. These sharpshooters feed and develop on a variety of plants in surrounding habitats, mainly wild shrubs and trees, which may serve as important breeding hosts and source of vectors for colonization of citrus orchards. The progress of CVC over time, assessed bimonthly for over 2 years, was best expressed as a double-sigmoid curve for each of three plots. Rate of symptomatic plants increases mainly during the spring and summer. The final disease proportion ranged from 0.14 to 0.98. Ordinary-runs analysis indicated some within-row aggregation of CVC-diseased trees for two of the three plots studied. Dispersion indices calculated as (ν_{obs}/ν_{bin}) indicated a high degree of aggregation in one plot, and slight aggregation in the other two plots. When the binary form of Taylor's power law equation was used to analyze spatial dependency over time, significant aggregation of trees with CVC was indicated only for one plot when the quadrat size was 4x4 trees. A better understanding of time of infection as well as how the inoculum (vector infectivity and bacterial population) vary over the year would be necessary to improve CVC management.

Index terms: *Xylella fastidiosa*, *Citrus sinensis*, transmission, epidemiology

[3210] MANAGEMENT STRATEGIES FOR CITRUS VARIEGATED CHLOROSIS

Marcos Pozzan[1], Vanderlei Rodas[1], Julia Beretta[2] & Ken Derrick[2], [1]Montecitrus Trading, P. O. Box 34, Monte Azul Pta, SP, Brazil, 14730-000, E-mail marcos.pozzan@montecitrus.com.br, [2]CREC, University of Florida, Lake Alfred, 33850, EUA.

A new disease of citrus was discovered in the northern area of Sao Paulo State in 1987. The disease was named citrus variegated chlorosis (CVC) and was found to be caused by a strain of the bacterium *Xylella fastidiosa*. Following its initial discovery, the disease spread rapidly and is now a major constraint to citrus production in Brazil. Various strains of *X. fastidiosa* cause several serious diseases of plants and are readily transmitted by sharpshooters. Most strains of *X. fastidiosa* have wide host ranges and transmission of the bacteria from alternate hosts, usually weeds, to the agronomic host by sharpshooters is important in the epidemiology of the diseases they cause. Alternate hosts do not appear to be involved in CVC, and spread of the disease is from citrus to citrus. This observation and the finding that the bacteria move slowly in infected trees led to the development of control strategies for CVC in Brazil. Plants should be propagated using CVC-free trees, since bud transmission of the disease can occur, although it is rare when using buds with small amounts of wood. Nurseries should be as far as possible from groves, should be kept free of weeds and monitored frequently for sharpshooters. Insecticides should be used when necessary to suppress sharpshooter populations in both nurseries and groves. It is important to make regular inspections for CVC and trees less than four years old with symptoms should be removed immediately. Any affected branches of older trees should be removed on a regular basis. Control of CVC is based on reducing the inoculum pressure. Removing limbs with symptoms does not "cure" a tree but reduces the amount of inoculum in the grove. Regular inspections should be made even in young groves planted with trees from "disease free" nurseries. Symptoms may not have been seen on plants in the nursery, but the trees may be infected and show symptoms within a year of being planted in a grove. Growers should assume that they have CVC in their groves and make every effort to keep the amount of inoculum to a minimum. They should also be aware that it is very difficult to control CVC in their groves if citrus on adjacent properties is not under a good control program. Moreover, it is almost impossible to manage CVC in a grove that is adjacent to an abandoned grove where both CVC and sharpshooter populations are out of control. There should be a requirement in Brazil that all the trees in abandoned groves be burned.

Index terms: *Xylella fastidiosa*, citrus, sharpshooters

[3211] IDENTIFICATION OF A PLANT VIRUS RECEPTOR IN THE INSECT VECTOR CELLS

R.B. Medeiros [1,2] & T.L. German [1], [1]Dept. Plant Pathology, University of Wisconsin, 1630 Linden Dr., Madison, WI, 53706, USA; [2]Dept. Fitopatologia, Universidade de Brasília, Campus Univ., Asa Norte, Brasília, DF, 70910, Brazil.

An unidentified 50 kDa protein is a candidate receptor for tomato spotted wilt *tospovirus* (TSWV, *Bunyaviridae*) in its main vector, the western flower thrips, *Frankliniella occidentalis* Pergande. To identify, clone and characterize the TSWV receptor we constructed a thrips cDNA expression library and screened for virus-binding polypeptides by a far-Western assay. Sequence analysis revealed that all selected clones have four motifs in common with beta integrins [the hantavirus (*Bunyaviridae*) receptors], which indicates structural similarity and evolutionary implications. One of the clones (TR313) is expressed at high levels in larvae (susceptible stage) but at poor levels in adults (resistant stage), shares homology with an arylphorin receptor, localizes in the guts (receptor expected site) and anti-TR313 antibody inhibited TSWV infection of thrips tissues. These data indicate that TR313 is the TSWV receptor in thrips cells.

Index terms: *Frankliniella occidentalis*, virus vector, *Tospovirus*.

[3212] CHAPERONIN CAMOUFLAGE: AN INTRIGUING PHENOMENON IN THE TRANSMISSION OF LUTEOVIRUSES BY APHIDS

S. A. Hogenhout [1], M. Verbeek [2], F. van der Wilk [2], R. W. Goldbach [3] & J.F.J.M. van den Heuvel [2], [1]Dep. of Entomology; The Ohio State University-OARDC, 1680 Madison Ave., Wooster OH 44691, USA. E-mail: hogenhout.16@osu.edu; [2]Plant Research International, P.O. Box 16, 6700 AA Wageningen, the Netherlands; [3]Lab. of Virology, Wageningen, the Netherlands.

Luteoviruses essentially replicate in the phloem tissue and are transmitted from plant to plant by aphids in a circulative persistent manner. To reveal what aphid-derived proteins are involved in virus transmission, a virus overlay assay was developed. The assay demonstrated that luteoviruses bind with high affinity to the chaperonin GroEL synthesized by the bacterial endosymbionts (genus *Buchnera*) of aphids. GroEL is abundantly produced by these bacteria and released into the hemolymph. Feeding of aphids with diets containing tetracyclin resulted in non-detectable levels of GroEL in the hemolymph, reduction of virus transmission by more than 70%, and degradation of the major virus capsid protein. Moreover, *Beet western yellows virus* (BWYV) mutants devoid of its minor capsid protein, the surface-exposed readthrough domain (RTD), were more rapidly degraded after injection into the hemolymph of aphids than wild-type viruses. These experiments indicated that GroEL is involved in the persistent nature of luteoviruses in the hemolymph of aphids and that the RTD contains the GroEL-binding site(s). GroEL belongs to a conserved protein family of 60-kDa chaperonins, are involved in folding of other nonnative proteins in the cytosol of prokaryotes, mitochondria and chloroplasts, and have typical double-doughnut structures composed of two back-to-back stacked rings of seven subunits each. Virus particles may interact with GroEL to prevent recognition of the virus capsid by defense mechanisms of aphids (molecular mimicry). To reveal whether the GroEL-luteovirus interaction is similar to that of this chaperonin with nonnative proteins, the virus-binding site of GroEL was studied. Deletion mutant analysis and single amino acid changes of GroEL subunits revealed the involvement of several hydrophilic residues in binding *Potato leafroll virus* (PLRV). These residues are part of the so-called equatorial domain, which is discontinuous in the linear GroEL subunit and forms the waist in the double-doughnut structure of 14-mers. The virus-binding residues are part of α-helices located to the interior and exterior of GroEL 14-mers, and are positioned in a cavity, which might be accessible for the surface-exposed RTD of luteoviruses. The finding that hydrophilic residues of the equatorial domain are involved in PLRV binding is surprising, since generally hydrophobic residues of the apical domain at the opening of the central channel of GroEL 14-mers are involved in nonnative protein binding in the bacterial cytosol.

Index terms: GroEL; *Buchnera*; PLRV; BWYV; molecular mimicry

[3213] BIOLOGY OF CRINIVIRUSES AND WHITEFLY-TRANSMISSION

T. Tian[1], L. Rubio[1], H.-H. Yeh[1], B. Crawford[1], V. Medina[2], & B. W. Falk[1], [1]Department of Plant Pathology, University of California, Davis, 1 Shields Ave., Davis, CA 95616, USA, E-mail txtian@ucdavis.edu. [2]Dept de Produccio Vegetable I Ciencia Forestal de la Universitat de Lleida, Avda Alcalde Rovira Roure 177, 25 198 Lleida, Spain

Whitefly transmitted closteroviruses belong to the genus *Crinivirus* within the family *Closteroviridae*. In recent years, this group of viruses is emerging as important pathogens of agricultural crops world wide. So far, at least 6 viruses have been recognized as members in genus *Crinivirus* and 4 of them were discovered in the 1990's. All criniviruses share distinct biological characteristics: 1) They all possess large positive sense ssRNA genomes which are divided into two segments; 2) They are absolutely phloem limited within infected host plants; 3) They are transmitted by specific whitefly vector(s) in a semi-persistent manner. Extensive studies have been done on a number of criniviruses. However, most of our knowledge on this virus group is from studies using *Lettuce infectious yellows virus* (LIYV), the type member of the genus. The LIYV genome is composed of RNA 1 (8,118 nt) and RNA 2 (7,193 nt). Studies have shown that LIYV RNA 1 encodes for proteins essential for virus replication and RNA 2 encodes for the "closterovirus hallmark gene array" (P5, a small hydrophobic protein; HSP 70 homolog, P59, major and minor capsid proteins) and two other genes. Immunoblot analyses indicated that purified LIYV virions contain the HSP 70 homolog, P59, major and minor capsid proteins. Using transmission electron microscopy and immuno-gold labeling, we showed that virions are mophorlogically polar, composed with the major capsid protein (ca. 90% length) and the minor capsid protein (ca. 10% length) localized at at one end. When the whitefly, *Bemisia tabaci* was fed with the purified virions, LIYV was transmitted to host plants. However, transmission could be neutralized by antiserum against the minor capsid protein, while antisera against the HSP 70 homolog, P59, and major capsid protein were unable to prohibit whitefly transmission. Although the precise mechanism(s) of crinivirus whitefly-transmission remains unclear, our work suggests the involvement of the minor capsid protein in whitefly-transmission.

Index terms: *Bemisia tabaci, Crinivirus, Lettuce infectious yellows virus*

[3214] DO GEMINIVIRUSES LEAD A DUAL LIFE STYLE: MOVEMENT WITHIN THE PLANT VS. PLANT-TO-PLANT

R. L. Gilbertson[1], M. J. Soto[1], M. R. Sudarshana[1] & W. J. Lucas[2], Dept. of Plant Pathology[1] and Section of Plant Biology[2], Univ. of Califorina, Davis,USA 95616

Geminiviruses are an economically important group of plant-infecting viruses characterized by: (1) their twinned icosahedral virus particles and (2) single-stranded DNA genomes. There are three genera of geminiviruses. Mastreviruses are transmitted by leafhoppers, infect monocots and have a monopartite genome (~2.8 kilobases [kb]); curtoviruses are transmitted by leafhoppers, infect dicots and have a monopartite genome (~2.8 kb); and begomoviruses are transmitted by whiteflies (e.g., Bemisia tabaci and B. argentifolii), infect dicots and usually have a bipartite genome composed of two ~2.7 kb DNAs. In this presentation, aspects of the genetics of these viruses will be discussed, with emphasis on the identification and role of viral genes involved in insect vector transmission. The capsid protein (CP) can play a multifunctional role in the life cycle of a virus. However, the begomovirus CP is not necessary for viral replication, cell-to-cell spread, long-distance transport or symptom development. A Bean dwarf mosaic virus reporter system was generated by replacing the CP with the green fluorescent protein (GFP). This allowed for monitoring of the viral infection process throughout the entire life cycle of the plant. However, a functional CP was required for whitefly transmission of Bean golden mosaic virus. Subsequent comparative studies of whitefly-transmissible vs. non-whitefly transmissible begomovirus isolates correlated amino acid differences in the CP with loss of whitefly transmissibility. Thus, the CP is the determinant of insect transmission of the begomoviruses and this presumably relates to the role of virus particles in acquisition and transmission (i.e., plant-to-plant spread). There is little or no conservation in the CP gene sequences of begomoviruses and curtoviruses. Evidence that the differences in the CP sequences related to insect vector specificity (i.e., whether a geminivirus was transmitted by leafhoppers or whiteflies) came from a study in which the CP gene of the curtovirus Beet curly top (BCTV) was inserted in place of the CP of the begomovirus African cassava mosaic virus (ACMV). The hybrid virus was infectious and the insect vector specificity of ACMV was changed from whiteflies to leafhoppers. Genetic analyses of monopartite geminiviruses have revealed that the CP is required for movement and systemic infection. We are currently investigating the role of the BCTV CP in movement and leafhopper transmission using a series of alanine scanning mutants. Mutants are assayed for replication competence, infectivity and leafhopper transmission. The results of these experiments will be presented and discussed in terms of the role of the CP in insect transmission of geminiviruses.

[3215] INSERTIONAL MUTAGENESIS OF *SPIROPLASMA CITRI* IN RELATION TO PATHOGENICITY

P. Gaurivaud , F. Laigret , J.-L. Danet , M. Garnier & J. M. Bové, Laboratoire de Biologie Cellulaire et Moléculaire, IBVM, INRA et Université Victor Segalen Bordeaux 2, B.P. 81 - 33883 Villenave d'Ornon cedex, France

Spiroplasma citri is the causal agent of citrus stubborn disease. It infects many plant species other than citrus, including periwinkles (*Catharanthus roseus*), where it induces stunting, leaf yellows and wilting, leading to periwinkle death in few weeks. This wall-less bacterium is transmitted from plant to plant by phloem-feeding leafhoppers such as *Circulifer haematoceps* and *Circulifer tenellus*. Phytoplasmas are other plant pathogenic mollicutes, but contrary to the spiroplasmas, they have not yet been obtained in culture. All phytopathogenic mollicutes are restricted to the sieve tube elements of the phloem tissue. The mechanisms involved in their phytopathogenicity are poorly understood. Recently, a so-called non-pathogenic mutant of *S. citri*, mutant GMT 553, was obtained by random insertion of transposon Tn*4001* into the genome of the wild-type strain GII-3. This mutant had the same characteristics as the wild-type strain except that (i) it did not induce symptoms within four weeks after the insect-transmission period and after this period, symptom production was concomitant with the occurence of revertants, and (ii) the rate of multiplication of the mutant in periwinkle plants was approximately two-fold lower than that of the wild-type strain. Transposon Tn*4001* is inserted in the first gene of the fructose operon. This operon comprises three genes. The first gene (*fruR*) codes for a putative transcriptionnal regulator protein belonging to the DeoR family, the second gene codes for the fructose PTS permease and the third for the 1-phosphofructokinase. Transcription of the fructose operon in the wild type strain GII-3 results in two messanger RNAs, one of 2.8 kb and one of 3.8 kb. Insertion of transposon in the genome of mutant GMT 553 abolished transcription of the fructose operon and resulted in the inability of this mutant to use fructose. Functional complementation experiments of mutant GMT 553 with wild type genes demonstrated that those complemented strains able to use fructose regained phytopathogenicity and grow in the periwinkle as fast as the wild-type strain. Because of reversion of mutant GMT 553, the role of fructose utilisation in the phytopathogenicity of *S. citri* remained unclear. Other fructose operon mutants were produced by homologous recombination. Plants infected with such mutants remained symptomless for 4 weeks, then they developed symptoms, and these symptoms remained mild and occurred in the absence of revertants. These observations suggest that fructose negative mutants are not totally non-phytopathogenic: late symptoms do occur, but, in the absence of revertants, they remain mild. In plants maintained at 23 °C, the wild-type spiroplasma multiplies less actively and induces later symptoms that in plants grown at 30 °C. Even though at 23 °C symptoms occur late, they became much more severe than in the case of plants infected with fructose negative spiroplasmas where the symptoms remain mild unless revertants appear. Therefore, fructose utilization might be directly involved in pathogenicity. *S. citri* and companion cells should be in competition for fructose utilisation. Utilization of fructose by the spiroplasmas could result in less active companion cells and modification of carbohydrate partitioning, as observed in periwinkles infected by phytoplasmas.

[3216] CYTOPATHOLOGY AND DOUBLE MEMBRANE-BOUND VIRUS-LIKE PARTICLES ASSOCIATED WITH HIGH PLAINS DISEASE AND OTHER DISEASES CAUSED BY ERIPHYID MITE-BORNE AGENTS OF UNKNOWN ETIOLOGY

K. S. Kim[1], K. K. Ahn[2], and R. C. Gergerich[1], [1]Dept. of Plant Pathology, Univ. of Arkansas, PS 217, Fayetteville, AR 72701; [2]Novartis Seed Co., ltd., Kyunggi-Do, Korea.

At present, at least twenty plant diseases have been reported to be caused by viruses or virus-like agents transmitted by eriophyid mites. Of these, a group of eight diseases is characterized based solely on the results of ultrastructural studies which revealed the presence of novel cytopathological structures infected cells of various hosts ranging from monocotyledonous grasses to large trees. These are unique double membrane-bound particles (DMPs) having a quasi-spherical, virus-like structure with a diameter of 100-200nm. No definite properties of these DMPs have been established because of the difficulties of purifying them from infected plants. However, studies of the most recently discovered diseases of this group, thistle mosaic and high plains disease (HPD) revealed that the DMPs were associated with intracellular inclusions that have been considered to be viroplasms, the site of virus replication and/or assembly. Immunspecific gold labeling studies using antiserum to a 32 kDa protein specific for HPD, showed labeling of the DMPs and their associated viroplasmic inclusions, thereby supporting the hypothesis that the inclusions are indeed viroplasms. Based on these findings and the fact that diseases associated with DMPs have common characteristics of viral diseases such a symptomatology (mosaic, mottling, chlorosis, stunting etc.) and graft- and mite vector-transmissibility, it is believed that the DMPs are viral in nature and the causal agents of the diseases. The DMPs may represent the particles of a new group of plant viruses.

[3217] A WAY TO DIFFERENTIATE VECTOR SPECIFICITY BY THRIPS IN TOMATO SPOTTED WILT VIRUS TRANSMISSION

T. Nagata[1], A.K. Inoue-Nagata[2], J. van Lent[3], R. Goldbach[3] & D. Peters[3], [1]Dept. of Virology, EMBRAPA/Hortaliças, C.P. 218, 70359-970, Brasília, DF, Brazil, E-mail tatsuya@cnph.embrapa.br; [2]Dept. of Molecular Biology, EMBRAPA/ Recursos Genéticos e Biotecnologia C. P. 2372, 70770-900, Brasília, Brazil. [3]Dept. of Virology, Wageningen Univ. & Res., Binnenhaven 11, 6709 PD, Wageningen, The Netherlands.

Viruses belonging to the genus *Tospovirus* cause serious losses in many agricultural, horticultural and floral crops worldwide. Recent studies revealed large diversities in the N gene, by which currently more than 13 distinct species have been recognized. Among these viruses, *Tomato spotted wilt virus* (TSWV) is the most widespread one and vectored by several thrips species. The vector competence was studied using *Frankliniella occidentalis*, an efficient vector of TSWV. The temporal development of the infection was chased by ELISA, light and electron microscopy using immunolabeling against the nucleocapsid (N) protein of TSWV. The anterior part of midgut is the primary infection target. The virus, then, seem to escape from the midgut to the midgut muscle cells, the other regions of the midgut, and the salivary glands. The latter may attract the infection by migration of the virus through a structure called "ligament". After establishing a thorough infection of the salivary glands, the virus is transmitted with some saliva to the plant material. Studies on the infection in specimens of a non-vector *T. tabaci* population demonstrated a temporal virus protein accumulation in the midgut. The accumulation of viral N protein in *T. tabaci* indicated a successful establishment of a TSWV infection in this non-vector. However, the accumulation in *T. tabaci* was much lower and less intense than in *F. occidentalis*, and was almost completely lost when they became adults. Analysis of the various tissues revealed that the infection remained mainly restricted to the midgut and midgut bound muscle cells during the larval development, but did not reach the salivary glands. Release of virus from midgut cell into neighboring tissues was not observed by electron microscopy in *T. tabaci*, but was observed in *F. occidentalis*. Our observations strongly suggest that the limited tissue tropism and subsequent failure to transmit the virus by *T. tabaci* is due to a limited virus replication in the midgut and its failure of virus escape from the midgut. Vector competence and specificity related with tissue tropism and virus circulation barriers will be discussed.

Index terms: *Frankliniella occidentalis*, *Thrips tabaci*, Tospovirus.

[3218] THE EFFECT OF MALARIA INFECTION ON MOSQUITO VITELLOGENESIS

A. M. Ahmed[1], R. Maingon[1], P. Romans[2] & H. Hurd[1], 1- Biological Sciences Department. School of Life Sciences, Keele University, Keele, Staffordshire, ST5 5BG, UK. 2- Department of Zoology, University of Toronto, Toronto, Ontario, M5S 3G5, Canada.

Malaria parasites are known to affect the fecundity of several species of mosquito vector. We are investigating the mechanisms underlying this reduction by studying the effect of the rodent malaria, *Plasmodium yoelii nigeriensis*, on vitellogenesis of the major malaria vector in Africa, *Anopheles gambiae*, during the first and second gonotrophic cycles following an infected blood meal. Vitellogenin (Vg) gene transcription was measured using a probe containing the central 3.3Kb Sal I fragment common to all *An. gambiae* Vg genes. We demonstrated that Vg mRNA appeared 1-2h post-blood meal, peaked between 24h and 36h and terminated after 48h post-blood meal. Quantification of Vg mRNA, following Northern blotting, showed no significant differences between non-infected and infected female mosquitoes during the first gonotrophic cycle, when ookinetes were penetrating the mid gut and transforming into oocysts. However, in the second gonotrophic cycle, when oocysts were developing, Vg mRNA transcription was down-regulated in infected mosquitoes at 2h, 8h, 12h and 24h post-blood meal. This suggests that down-regulation of Vg mRNA transcription may contribute to fecundity reduction. Enzyme immunoassay quantification of haemolymph Vg showed that, during the first gonotrophic cycle, there was no significant difference in the concentration between infected and non-infected mosquitoes up to 24h post-blood meal, thus confirming that the synthesis of yolk protein in the fat bodies was initiated normally. However, by 30h there was a significant reduction in the Vg concentration. In the second gonotrophic cycle, initial concentrations of Vg were significantly reduced by infection, as predicted from mRNA measurements but, by 24h Vg was accumulating in infected mosquitoes. This accumulation may be due to impaired uptake in the ovaries of infected mosquitoes. Vitellin (Vt) deposition occurred normally during the first gonotrophic cycle until 30h post-blood meal, after which significantly less Vt was detected. In the second gonotrophic cycle, a significant decrease in the Vt content in the ovaries of infected mosquitoes was detected at all time points examined (4, 8, 12, 18, 24, 36 and 48h). It would appear that the malaria parasite disrupts all stages of vitellogenesis and that the effect is more pronounced when oocysts are developing than when the parasite first invades the vector.

[3219] NUTRITION AND DEVELOPMENT OF THE GLASSY-WINGED SHARPSHOOTER EXAMINED BY TRADITIONAL AND NOVEL NUTRITIONAL INDICES

B. V. Brodbeck[1], P. C. Andersen[1] & R. F. Mizell, III[1], [1]Univ. of FL. NFREC-Quincy, 30 Research Road, Quincy, FL, 32351-9500, USA, E-mail bvb@gnv.ifas.ufl.edu.

Insects that feed on xylem fluid subsist on the plant tissue that contains the lowest nutrient content as well as a nutrient mix that is highly unbalanced. We have previously investigated the host range of the Glassy-winged sharpshooter (GWSS), *Homalodisca coagulata*, and established that host preference changes with insect age. Immature insects have a greatly restricted range compared to adults. In the following rearing experiments, we utilized classical measurements of nutrient utilization (Waldbauer's indices) and the novel geometric framework to examine nutrient utilization and requirements for GWSS at different stages of development. Our objectives were to assess how these different methodologies can be used to quantify utilization of GWSS diets and to identify nutritional requirements. Fertilization and *Rhizobium* inoculation were used to alter the xylem fluid chemistry of the host *Glycine max*. Rearing experiments showed that adult GWSS performed better (higher survivorship, consumption rates) on xylem fluid with disproportionately high concentrations of amides. Conversely, immature insects developed more successfully on xylem fluid that provided more balanced profiles of amino acids, despite this fluid having lower concentrations of total nitrogen and carbon. Immature leafhoppers were comparatively inefficient at assimilating high amide diets. This analysis also established that dietary carbon may be a determinant of consumption rates for xylem feeding insects. Althought classical measurements were of great value in quantifying how GWSS utilized diets, they were less useful in discriminating specific nutrients that may be limiting at specific life stages, as many nutrients (carbon, nitrogen and amino acids) covary in concentration. Analysis of geometric rails may allow further delineation of these covariates. Insects with different body composition (i.e. different feeding history) may alter body chemistry over time towards an idealized composition; plotting of changes in body chemistry may be used to identify this idealized composition and identify how insects utilize nutrients to obtain this composition. Preliminary analysis of GWSS shows that young adults reared on different hosts do have different body compositions. Moreover, GWSS reared on varying hosts responded variably in terms of host selection and consumption rates. Analysis of body compositions (after 6 days of feeding on selected hosts), xylem fluid, and excreta will identify movement towards optimal body compositions, and establish physiological and behavioral processes that allow insects to move towards optimal compositions.

Index terms: *Homalodisca coagulata*, amino acids, geometric rails, leafhoppers.

[3220] WEEDS AS A SOURCE FOR THRIPS VECTORS AND TSWV IN A TOMATO NURSERY, FOR AN ISOLATED WEEDY AREA IN LA PLATA, ARGENTINE

P. I. Carrizo[1] & E. Dal Bó[2], [1,2] Fac. Cs. Agr. y Ftales., Univ. Nac. La Plata. Calle 60 y 119, CC 31. (1900) La Plata. Argentina. e-mail: [1]pcarrizo@mail.agro.uba.ar & [2]elena@nahuel.biol.unlp.edu.ar.

Greenhouse culture deals with continuous seeding, what exposes plants to different vectors pressure. How many of them really come up from weeds? To quantify natural infection by vectors and TSWV from weeds as an inoculum source, infestation level by thrips from weeds was measured on three planting dates. The trial was conducted in 1998 and 1999, in tomato nursery (from seed to 5-leaf stage) since august to january next year, on 3 and 2 seedling dates (1st and 2nd year). Assay was made in an isolated area, 35 km apart from vegetable belt, in an experimental greenhouse in La Plata City. Plants were not sprayed with insecticides. Also, a kind of aluminum screen was tested as repellent for those insects. A randomized complete block design with 5 (1st year) and 4 (2nd year) replications was used. Each block consisted of greenhouse side, and treatment was equally replicated within two randomized blocks. Treatments were black and silver screens put behind every tray, and they were placed blue sticky traps over each one. Visual inspection was made in every single cell and tomato plant in trays, looking for thrips presence and damage on leaves (white spots). Ending all seedling date, ELISA test was performed in 10 randomly selected plants. Flowers on three known reservoir weeds species surrounding greenhouse were taken, in order to measure thrips abundance (6 in 1st, and 20 in 2nd year). All samples were collected twice weekly. They were performed ANOVA test for block and treatment effects, and Pearson correlation test, between trap collections and plants surveys in nursery (α=0.05). ANOVA tests of thrips abundance and damage were not meaningful for blocks or treatment; silver screen had no effect on thrips population. In order to determine presence of thrips, sampling for direct injury was better than sticky traps, and adults sampling were not meaningful. *Thrips tabaci* was the major species present in traps and plants. Damage was not found on tomato leaves before second one emergence. In smaller leaf spots, damage as percentage of plants seemed to decrease between consecutive samplings, because of leaf tissue recovering. Percentage of damaged trays instead of percentage of damaged plants was faster and more accurate measure. Every planting date had a different risk of contamination for thrips, and a different rate of increase as well. The two years, at the end of latest planting date, 100% trays had damage. However, no plant had TSWV symptoms, and no ELISA tests were positive. Abundance thrips on weeds raised along the three planting dates, and it was because of several local *Frankliniella* species, and *Thrips tabaci*. *Frankliniella occidentalis* was detected in weeds, in very low abundance - always less than 10% - only in second year. On first year, it was not detected probably because of smaller sample size.

[3221] THE MEDIAN ACQUISITION AND INOCULATION ACCESS PERIOD OF *THRIPS TABACI* LINDEMAN MALES AND FEMALES IN THE TRANSMISSION OF TOMATO SPOTTED WILT TOSPOVIRUS

E.K. Chatzivassiliou[1], D. Peters[2] & N.I. Katis[1], [1]Aristotle Univ. of Thessaloniki, Plant Pathology Lab, 54 006 Thessaloniki, Greece; [2]Agricultural University of Wageningen, Department of Virology, Binnenhaven 11, 6709 PD, Wageningen, The Netherlands.

The median acquisition (AAP_{50}) and inoculation (IAP_{50}) access period of *Tomato spotted wilt tospovirus* (TSWV) for males and females of a tobacco population of *Thrips tabaci* Lindeman were determined. Larvae, of 0-24 h old, were given AAPs ranging from 5 to 2560 min and tested for their infectivity in three IAPs of two days each on petunia leaf discs, when they were adults. The IAP_{50} was determined in IAPs ranging from 5 to 2560 min using adults that acquired the virus as larvae and transmitted it to petunia. The AAP_{50} of the tobacco population of *T. tabaci* was 41 min, whereas the AAP_{50} for males 65 and for females 35 min. The IAP_{50} of the males was 186 min, whereas IAP_{50} of females was 184 min. Females could acquire and inoculate the virus in periods of 5 min and males of 10 min. Transmission reached an optimum after an AAP of 21.3 h (AAP_{opt}) and the optimum values for inoculation were reached in IAPs of 42.7 h (IAP_{opt}). These results show that the thrips need smaller periods to acquire than to transmit the virus. The transmission of TSWV after acquisition by larvae of different ages showed that TSWV was acquired by both first and second larval stages, however the percentage of thrips that transmitted TSWV decreased with increasing the age of larvae acquiring the virus. The transmission efficiency was the highest when adults had acquired the virus as newborn (0-24h old) larvae (51% for females and 61.1% for males). However, virus could also be transmitted in low percentages when acquired by female larvae of 120-144 h old (1%) and male larvae of 96-120 h old (17.8%).

Index terms: larvae acquisition, tobacco thrips

[3222] PESTICIDE EVALUATION TO CONTROL VECTORS INSECTS OF TOBACCO VIRUS DISEASES

J. A. Chiaradia [1], J. M. Milanez[1], F. Z. da Cruz[2], A. Peretto[3] & J. Milanes[3], [1]CPPP/Epagri, Box 791, CEP 89801-970, Chapecó, SC, BR, E-mails: chiaradi@epagri.rct-sc.br and milanez@epagri.rct-sc.br; [2]Dept. Fitossanidade, UFRGS, Box 776, Porto Alegre, RS, BR; [3]Hokko do Brasil, Box 1.386, CEP 04063-003, São Paulo, SP, BR. E-mail: hokkobr@hokko.com.br

Tobacco is cultivated by 140,000 farmers in the South of Brazil with annual production around 380,000 ton. Cicadas, thrips and other insects transmit virus diseases that cause tree death and low productivity. To study the pesticide effects on these insects it was installed one experiment with randomized blocks and four replicates. The plots, were constituted by 60 trees and were conducted with six lines, and the spacement was 1,15 x 0,45 between lines and trees, respectively. The treatments were constituted by the following commercial products (grams) diluted per 100 liters of water: 1) Orthene 750 BR (acephate 75%) (515) sprayed at the time of transplanting, 10, 20 and 30 day after; 2) Orthene 750 BR (515) sprayed at the time of transplanting, 15 and 30 days after; 3) Evolution (acephate 97%) (340) sprayed at the time transplanting, 10, 20 and 30 day after; 4) Evolution (340) sprayed at the time of transplanting, 15 and 30 days after; 5) Orthene 750 BR (256) + Confidor 700 GRDA (imidacloprid 70%) (154) sprayed at the time of transplanting; 6) Evolution (170) + Confidor 700 GRDA (154) sprayed at the time of transplanting; 7) Confidor 700 GRDA (154) sprayed at the time of transplanting; 8) Orthene 750 BR (1.665) + Confidor 700 GRDA (833) washed the little plant yet in the trays; 9) and control. With treatments one to four were spended 7,8 ml by solution per tree and time, with the treatments five to seven the trees were aspersioned with 13 ml per tree, and with the treatment eigth were used 1,5 ml per little plant. Yellow trays with water and detergent were installed in side the experiment and captured *Sibovia sagata*, *Osbornelus infuscatus*, *Atanus nitidus*, *Agalliopsis vicosa*, *Agalliana sticticolis*, *Agallia* sp. and *Agallia albidula* (Hemiptera, Cicadellidae) insects possibly associated with BCTV (beet curly top virus), the main virouses in the experiment. Evaluation were done at 51 and 71 days after counting cumulatively the trees with virous symptom. The results across of Abbott Test showed prominence for treatment six, Evolution + Confidor 700 GRDA sprayed at the time of transplanting that controlled the virouses at 89,78%.

Index terms: tobacco, virouses, insects vetors, control.

[3223] INTERACTIONS BETWEEN INSECT VECTORS OF PLANT DISEASES IN AUSTRALIA

A. D. Clift [1], L. Tesoriero [3], R. Spooner-Hart [2], H. Rose [1], J. Bowyer [1] & M. Cannard [2,1]
Dept of Crop Sciences, The University of Sydney, NSW 2006, Australia; E-mail clifta@agric.usyd.edu.au; [2] UWS, Hawkesbury Locked Bag 1, Richmond NSW 2753, Australia [3] EMAI, NSW Agriculture, Locked Bag 8, Camden, NSW, 2570, Australia

The main vector transmitted plant diseases in Australia are Tomato Spotted Wilt Virus (TSWV), Big Bud Disease of Tomatoes (BB) and Purple Top Wilt of Potatoes (PTW). TSWV is a tospovirus transmitted by at least four species of thrips in Australia, *Frankliniella schultzei, F. occidentalis, Thrips tabaci* and *Scirtothrips dorsalis*. BB and PTW are phytoplasmas transmitted by the leafhopper *Orosius argentatus*. *F. occidentalis* is, at present, confined to limited areas on the SW coast (Western Australia) and SE coast of Australia, ie South Australia, Victoria, New South Wales and Queensland. *F schultzei* and *T tabaci* are widespread throughout Australia and *S. dorsalis* is present in tropical north Queensland. Based on detailed studies of occurrence of TSWV, a range of situations apply. *F. schultzei* is highly mobile and can move into an area of over 10,000 km^2 within a week, as happened in SE NSW during December 1994/January 1995, resulting in up to 30% infection of sprayed tomato crops and 100% of capsicum crops. *T tabaci* is a major vector of TSWV in coastal and inland irrigation areas of NSW, especially in 1997/98 and 1998/99, but apparently not in highland areas, > 700 m. Interactions occur between vectors, with *T tabaci* bringing TSWV onto a farm and *F occidentalis* effectively spreading the virus within the farm, causing over 80% infection of hydroponic lettuces near Sydney during 1997, 1998 and 1999. *O. argentatus* is also variable in its disease transmission, but capable of causing 60% yield loss in tomatoes, 1994 and 1997 and 30% in seed potatoes, 1994. TSWV probably originated in the Americas, but with two highly mobile introduced thrips vectors, *F schultzei* and *T tabaci* and abundant introduced weed hosts, has thrived in Australia. It is interesting that a detailed survey done in Western Australia indicated negligible infection of Australian native plants, but up to 30% infection of introduced plants including thistles. Similar comments could be made about the establishment of the phytoplasmas, except the vector is an Australian native insect.
Index terms: *Frankliniella*, *Thrips*, *Orosius*, TSWV, phytoplasmas.

[3224] TRANSMISSION OF CITRUS PATHOGENS FOREIGN TO THE U.S. BY ARTHROPODS ENDEMIC TO THE U.S. CONDUCTED UNDER HIGH QUARANTINE CONTAINMENT

V. D. Damsteegt[1], R. H. Brlansky[2], J. Hartung[3] & P. Phillips[4], [1]USDA, ARS, Foreign Disease-Weed Science Research Unit, 1301 Ditto Avenue, Fort detrick, MD 21702-5023, USA, E-mail: damsteeg@nciferf.gov, [2]Univ. of FL, Citrus Research and Education Center, Lake Alfred, FL, USA, [3]USDA, ARS, Fruit Lab., Beltsville, MD, USA, [4]Dept. of Entomology, UC-Davis, Davis, CA, USA.

Transmission characteristics of viral and bacterial pathogens of citrus which have not been reported to occur in the U.S. by arthropod species found in the U.S. are being studied in a BL3-P quarantine facility in Fort Detrick, MD. Citrus variegated chlorosis (CVC), found in Brazil and caused by *Xylella fastidiosa*, transmitted by the sharpshooter *Oncometopia nigricans* species from Florida. Studies are ongoing to determine if the glassy-winged sharpshooter, *Homolodisca coagulata*, a new vector pest of *Xylella* caused diseases in California, can transmit CVC. Transmission studies of Huanglongbing (Citrus greening), a fastidious phloem-limited bacterial disease of citrus found in Asia and Africa, have been initiated by comparing the transmitting ability of psyllids (*Diaphorina citri*) found in Florida with psyllids from Brazil and Taiwan. *Toxoptera citricida*, the brown citrus aphid, has been shown to separate strains of both exotic and endemic strains of citrus tristeza virus from single plants. Evidence of separation of severe decline strains by single aphids from isolates exhibiting only mild symptoms will be presented.
Index terms: Transmission, *Xylella fastidiosa*, *Oncometopia nigricans*, *Homolodisca coagulata*.

[3225] EPIDEMIOLOGY OF "MAL DE RÍO CUARTO" DISEASE AND THE RELATION WITH ITS VECTORS IN ARGENTINA (*)

E.G. Virla [(1)], A.M. Marino de Remes Lenicov [(2)] & I.G. Laguna [(3)], [(1)] CONICET. "INSUE", M. Lillo 205 (4000) S.M. de Tucumán, Argentina. E-mail: evirla@infovia.com.ar; [(2)] Fac. de Cs. Naturales y Museo de La Plata, Paseo del Bosque s/n° (1900) La Plata, Argentina. E-mail: amarino@museo.fcnym.unlp.edu.ar
[(3)] INTA IFFIVE, Camino 60 cuadras km. 5 1/2 (5119) Córdoba, Argentina. E-mail: gracel@iffive.satlink.net.

The "Mal de Río Cuarto Virus" (MRCV) is a very destructive maize disease first reported in Southern Córdoba (Argentina) in 1981. The planthoppers *Delphacodes kuscheli* (Homoptera: Delphacidae), frequently found in oat or wheat crops and wild grasses, is the principal field vector of this virus; *Toya propinqua*, *D. haywardi* and *D. tigrinus* are presumed as vectors. The vectors are widespread in Central Argentina but are particularly abundant in the areas were the disease is present. MRCV is indigenous in Argentina and causes disease outbreaks in maize in the endemic region with yield losses approaching 70-80 % on epidemic years. The research carried out to clarify the epidemiology of this disease has been conducted from 1985. Its includes studies on the ecology and behavior of the vectors and its natural enemies, virus characterization, incidence and severity of the disease in relation to maize varietal susceptibility, distributional patterns of vectors species, and the role of different crops and native grasses as reservoirs of the virus and vectors. Symptomatological rating were taken through 12 years in different localities; fluctuations of planthoppers populations and climatic factors were measured. Pattern of change of insect numbers was positively correlated with the increment in disease incidence. The distribution and severity of the disease are closely associated with the biology of the vectors; they feed and oviposit on oats and various indigenous weeds. Oats and some of these weeds are natural host of MRCV and could act as inoculum sources for primary spread of the disease to corn crops. The studies indicate that there are seasonal differences in inoculum pressure. The data obtained on the distribution of the disease and its vectors suggest a model where MRCV is a disease of annual grasses that pass to crops. The planthoppers had an important parasitoid complex conformed with: 4 species of Dryinidae and 3 Mymaridae (Hymenoptera), 1 Pipunculidae (Diptera), 1 Elenchidae (Strepsiptera). All these studies may be taken into account in designing appropriate MRC disease management strategies. Results of recent studies are presented and discussed.
Index terms: Delphacidae - maize - disease - vectors
(*) FONCyT n° 08-00000-01806

[3226] COMPARISON OF RIBOSOMAL DNA BY PCR-RFLP ANALYSIS AMONG LOCAL CLONES OF FOXGLOBE APHID, *AULACORTHUM SOLANI*, WHICH SHOW DIFFERENT TRANSMISSION EFFICIENCY OF SOYBEAN DWARF LUTEOVIRUS

K. Honda[1], S. Kanematsu[2] & S. Miyai[3], [1]National Agriculture Research Center, Tsukuba, Ibaraki, 305-8666 Japan, E-mail khonda@affrc.go.jp; [2]Tohoku National Agricultural Experiment Station, Morioka, Iwate, 020-0198 Japan, [3]Agriculture, Forestry and Fisheries Research Council Secretariat, Tokyo, 100-0013 Japan.

The foxglobe aphid, *Aulacorthum solani*, transmit soybean dwarf luteovirus (SbDV) in a persistent manner, which is a pathogen of soybean and causes serious yield losses. We found that the transmission efficiency of SbDV varied among 31 local clones of *A. solani* collected from Hokkaido Island and Honshu Island of Japan. A clone from Naganuma in Hokkaido Island transmitted the virus most efficiently (average transmission rate = 0.65). The transmission rate of a clone from Kurosaki in Niigata Prefecture, Honshu Island, was the lowest (average transmission rate = 0.03). This result suggests that aphid local clones are different from each other in physiological or genetic characters relating with virus transmission. To analyze these differences, we compared the two internal transcribed spacer (ITS) regions of ribosomal DNA (rDNA) of aphids by the polymerase chain reaction-restriction fragment length polymorphism (PCR-RFLP) analysis. The primer sets ITS1 and ITS4 (White *et al*, 1990) were used for PCR amplification of the two ITS regions, the 5.8S gene, and small portions of the 18S and 28S genes of the rDNA. Four endonucleases (*Hae*III, *Msp*I, *Sau*3AI, *Taq*I) were used to digest PCR amplified products. Only *Hae*III digested the amplified products and three different patterns (A, B and AB) in the length and number of the restriction fragments were revealed. The restriction patterns A, B and AB were observed on 12, 8 and 11 clones respectively. There was a tendency that aphid clones with restriction pattern B efficiently transmitted SbDV and clones with restriction pattern A could not. For example, 50% of clones with restriction pattern B showed high transmission efficiency of SbDV (the transmission rate was more than 75% of Naganuma clone). High transmission efficiency was obtained from only one (8.3%) clone with restriction pattern A and no clone with pattern AB. On the other hand, 33.3% of aphid clones with restriction pattern A, 12.5% of clones with pattern B and 9.1% of clones with pattern AB showed low transmission efficiency (the transmission rate was less than 25% of Naganuma clone). This result indicates that there is a genetic background under the clonal variation of aphids in virus transmission and more detailed study is necessary.
Index terms: *Aulacorthum solani*, SbDV, PCR-RFLP, rDNA, ITS

[3227] NEW APHID VECTORS OF *ZUCCHINI YELLOW MOSAIC VIRUS* AND THEIR ROLE IN THE EPIDEMIOLOGY OF THE VIRUS IN GREECE

N.I. Katis[1], J. A. Tsitsipis[2], D. P. Lykouressis[3], A. Papapanayotou[1], J. Gargalianou[2], G. M. Kokinis[1], & I. N. Manoussopoulos[2], [1]Aristotle Univ. of Thessaloniki, Plant Pathology Lab, 54 006 Thessaloniki, Greece; [2]Univ. of Thessaly, Faculty of Agriculture, Lab of Entomology and Agricultural Zoology, 383 34, Pedion Areos, Volos, Greece; [3]Agricultural Univ. of Athens, Lab of Agricultural Zoology and Entomology, Iera Odos, 118 55 Athens, Greece.

Zucchini yellow mosaic virus (ZYMV) is a member of family Potyviridae, transmitted non-persistently by aphids. Several aphid species were reared on suitable hosts and tested for virus transmission to zucchini under lab conditions. *Myzus persicae* (Sulzer), was the most efficient vector. It transmitted five isolates of ZYMV with the same efficiency ranging from 38 to 45 % as was used as a reference. Sixteen aphid species, not known previously as ZYMV vectors, were found to transmit the virus. These were: *Aphis craccae* L., *Aphis fabae* Scopoli., *Aphis nerii* Boyer de Fonscolombe., *Aulacorthum solani* (Kaltenbach), *Brachycaudus cardui* (L.), *Brevicoryne brassicae* (L.), *Hyalopterus pruni* (Geoffroy), *Hyperomyzus lactucae* (L.), *Macrosiphoniella sanborni* (Gillette), *Macrosiphum rosae* (L.), *Metopolophium dirhodum* (Walker), *Myzus cerasi* (F.), *Rhopalosiphum maidis* (Fitch), *Rhopalosiphum padi* (L.), *Semiaphis dauci* (F.), and *Sipha (Rungsia) maydis* Passerini. Their transmission efficiency was low, ranging between 0.07 and 3 % on a single aphid basis. Three species, *Hayhurstia atriplicis* (L.), *Myzus ascalonicus* Doncaster and *Sitobion avenae* (F.) were not found to transmit the virus. Six of the reported new vectors were assayed in arena tests for propensity estimation. In all cases, except *A. nerii*, propensity was higher than efficiency. Aphid population monitoring by Rothamsted type suction traps showed that the most abundant new aphid vectors were *R. padi*, *R. maidis*, *H. pruni*, *M. dirhodum*, *A. solani* and *B. cardui*, in the areas of Thessaloniki, Velestino, Voiotia and Koroivos for the years 1996 and 1997. Total number of new and already known vectors ranged between 23 and 63% of the total number of aphids captured, depending on region and year. Among the known vectors the most abundant was *A. gossypii*, whereas, *M. persicae* appeared in all regions although in low numbers. Most of the new vectors tended to appear early in the growing season (March-April), thus, being presumably responsible for early infections. In field experiments carried out in Northern Greece (Thessaloniki), total number of aphids captured by Moericke yellow traps (in week intervals, in experimental plots) was correlated to ZYMV spread. The importance of the new vectors in ZYMV epidemiology is discussed.

Index terms: plant virus, ZYMV, non-persistent transmission, aphid virus-vectors

[3228] OVERWINTERING BIOLOGY OF *CIRCULIFER HAEMATOCEPS* (HOMOPTERA, CICADELLIDAE), A VECTOR OF PROCARYONTS IN CITRUS AND SESAME

U. Kersting[1], S. Satar[2] & N. Uygun[2], [1]Faculty of Agricultural Sciences & Technologies, European University of Lefke, Gemikonagi, Mersin 10, Turkey, E-mail kersting@vuni.lefke.edu.tr, [2]Department of Plant Protection, Faculty of Agriculture, University of Çukurova, 01330 Adana, Turkey, E-mail hserhat@mail.cu.edu.tr, nuygun@mail.cu.edu.tr.

Circulifer haematoceps (Homoptera, Cicadellidae) is a most important vector of *Spiroplasma citri* (Entomoplasmatales, Spiroplasmataceae) in citrus and sesame, and phytoplasmas in sesame and various other field crops in the Mediterranean basin and the Middle East. Very little information on the field biology of this important vector species is available. In particular, knowledge about its mode of hibernation and overwintering biology are completely lacking in the literature. Semi-field experiments using *C. haematoceps* confined to leaf cages and attached to sugar beet plants were established to determine longevity of hibernating females and males, the number of offspring produced, and the development time of offspring at the University of Çukurova located in the east Mediterranean region of Turkey. Furthermore, the minimum time of daylight and the minimum temperature required for oviposition were estimated. The data obtained were used to calculate the degree day requirement of *C. haematoceps* from egg stage to adult eclosion. The average number of eggs deposited per female/day decreased from nine eggs in mid September to five eggs end of October. No eggs were laid after the fourth week of November (min. night Temp. 13 °C) when daylight time dropped below ten hours. Oviposition started again beginning of February (min. night Temp. 8 °C) after hours of daylight increased again to more than ten hours. Hibernating females survived for up to eight months and laid on average 140 eggs between mid September and mid May. Similarly, females transferred from the laboratory culture in long day conditions (16-h light) to short day conditions with 9-h light stopped to lay eggs within two days and oviposited again only when returned to long day conditions. Only low temperatures of less than a constant 5 °C inhibited oviposition of *C. haematoceps* even at long day conditions in the laboratory. Incubation periods of eggs decreased from 38 days, if laid in February, to 13 days for those oviposited in May. In the same way, the developmental time of *C. haematoceps* nymphs fell from 55 days to 20 days in the same period. From these data a degree day requirement of 310 DD for the development time from egg to adult was calculated. Taking into consideration the number surviving females, the number of eggs laid, and the developmental time most *C. haematoceps* adults hatched between end of May and beginning of June, at a time which coincided with the first population peak in the field.

Index terms: Hibernation, *Spiroplasma citri*, phytoplasmas, Turkey

[3229] FIELD INVESTIGATION IN FORENSIC ENTOMOLOGY: TRAINING FORENSIC INVESTIGATORS

K. C. Kim, Department of Entomology, The Pennsylvania State University, University Park, PA 16802 USA; E-mail kck@psu.edu.

Forensic entomology, the application of entomological knowledge to help solve civil and criminal litigation, provides definitive tools for determining " who done it," and makes invaluable contributions to solving the mystery of many homicide cases. In the United States forensic investigation in homicide cases often involves entomological expertise in determining the time of death. In most of forensic investigations however, forensic entomologists are not directly involved in scene investigations. After scene investigation forensic investigators usually seek entomological expertise when insects and related arthropods are found associated with the victim's body at the scene or medical examiner's autopsy. In most cases the samples submitted for entomological analysis are often inadequate and without necessary field data surrounding the victim's body such as site and body temperatures and the pattern of arthropod infestation on the body. Thus, the samples do not represent realistic faunal and developmental profiles. As a result, entomological analysis is often constrained in making the correct estimation of postmortem interval (PMI). To improve the current practice I have conducted an annual training program, Penn State Forensic Entomology Workshop, for forensic investigators since 1993. This course is a 3-day program with hands-on laboratory and field studies using pig models. The course covers an introductory entomology, principles of forensic entomology, taxonomy of the sarcosaprophagous insects and related arthropods, and PMI calculation. Participants of the course include forensic investigators, namely detectives and crime lab scientists, coroner or medical examiner, and fellow entomologists. Forensic investigators who participated in the course develop a better understanding of forensic entomology and submit adequate entomological samples with necessary environmental data at the scene for entomological service. The details of the course instruction will be discussed.

Index terms: Forensic entomology, Workshop, PMI, training, forensic investigators

[3230] PHYTOPLASMA-BEARING LEAFHOPPERS/PLANTHOPPERS, SUSPECTED TO BE VECTORS, IN VINEYARDS IN THE GOLAN HEIGHTS, ISRAEL

M. Klein[3] P.G. Weintraub[1], S. Melamed[2], L. Koznetsova[2], M. Davidovich[3], T. Zahavi[4], A. Pipernos[5], & E. Tanne[3], [1] ARO, Gilat Research Station, D.N. Negev, 85280, Israel e-mail: phyllisw@netvision.net.il, [2] The Hebrew Univ., Faculty of Agricultural, Rehovot, 76100, Israel, [3] ARO, The Volcani Center, Bet Dagan 50250, Israel, [4] Extension Service, Ministry of Agriculture, Kiryat Sh'mona, 10200 [5] Northern R & D, Katzrin, 12900, Israel.

In recent years, symptoms of various phytoplasmas have been observed in several crops in the Golan Heights, particularly wine grapes. Three different phytoplasmas have been identified: Stolbur, Aster Yellows and a Western-X-resembling type. In the course of identifying the vectors of these phytoplasmas, leafhopper and planthopper species were monitored with yellow sticky traps and by vacuum sampling weeds around the vineyards. The planthopper, *Hyalesthes obsoletus*, and the leafhoppers, *Neoaliturus* spp. and *Circulifer* sp. (of the *haematoceps* complex), *Macrosteles sexnotatus*, *Orosius orientalis* (= *albicinctus*), and *Anaceratagallia* (= *Agallia*) *laevis* were found in and around the vineyards at various times throughout the growing season. All are known to be efficient vectors of various phytoplasmas. A method, PCR analysis of DNA in insect saliva, was adapted to survey these insects as potential vectors. All of these insects were determined to have phytoplasmas in their saliva and were able to transmit phytoplasmas to healthy periwinkle and potato plants.

Index terms: PCR, insect saliva, transmission studies

[3231] DIVERSITY OF SHARPSHOOTERS IN COFFEE PLANTATIONS IN PARANÁ STATE, BRAZIL

A. M. Meneguim[1] & R. P. Leite, Jr.[1,2], [1]Inst. Agronômico do Paraná/IAPAR, C. P. 481, 86001-971, Londrina, PR, Brazil, E-mail meneguim@pr.gov.br; [2]Fellow of CNPq.

Sharpshooters of the family Cicadellidae are important vectors of the bacterium *Xylella fastidiosa*. This plant pathogen causes the citrus variegated chlorosis (CVC), an economically important disease of citrus in Brazil. In the 1990's, *X. fastidiosa* was detected in coffee trees throughout the country. The sharpshooters fauna associated with coffee trees is poorly known. Therefore, this work was carried out to identify the species of sharpshooters present on coffee plantations in different regions of the State of Paraná, Brazil, and also to determine their abundance. Sampling was carried out using sweep-net and yellow stick traps twice a month in five different coffee plantations throughout the coffee regions of the State of Paraná from October 1998 to November 1999. In two areas, samples were taken from both, the coffee tree and the natural weeds present in the inter-row of the coffee plantation. The results revealed a large diversity of species of sharpshooters in the coffee plantations, most of them belonging to the family Cicadellidae. However, the majority of the identified species were represented by few individuals. More than 70% of the sharpshooter individuals collected in all coffee areas studied included only 12 species. Among them, the species *Oncometopia fascialis* and *Dilobopterus costalimai* (Hemiptera: Cicadellidae) are vectors of *X. fastidiosa* on citrus in Brazil. Other known vectors of *X. fastidiosa* occurring at lower numbers in the different areas sampled were *Acrogonia terminalis*, *Plesiommata corniculata*, *Sonesimia grossa*, *Ferrariana trivitata*, and *Macugonalia leucomela* (Hemiptera: Cicadellidae). Sharpshooters were usually more abundant during the spring and summer seasons.

Index terms: bacteria, vector, citrus variegated chlorosis, Cicadellidae, *Xylella fastidiosa*.

[3232] OCCURRENCE OF SHARPSHOTER IN CITRUS ORCHARDS AFFECTED BY *CVC* IN NORTH COAST OF BAHIA AND SOUTH OF SERGIPE STATE, BRAZIL

M. P. Miranda[1], A. S. Nascimento [2], H. P. Santos F[o.2], C. J. Barbosa[2], L. M. S. Silva [3] & W. J. R. Matrangolo[4], [1]UFBA-EMBRAPA-EBDA [2]-*Embrapa Mandioca e Fruticultura*, C.P. 007 CEP:44.380-000 Cruz das Almas-BA. E-mail antnasc@cnpmf.embrapa.br; [3] EMDAGRO, [4] EPAMIG/CTNM.

Citrus Variegated Chlorosis (CVC) is spread all over states of São Paulo, Bahia, Sergipe, Minas Gerais, Rio Grande do Sul, Paraná and Rio de Janeiro. In the Northeast Region, the disease was registered in 1996 at Boquim, Sergipe State. CVC is caused by *Xylella fastidiosa*, a xylem-limited bacterium, in which sharpshooters are the main vector that contributes to its natural dissemination. Sharpshooters were collected in orchards with symptoms of CVC, by using a insect net on wild plant and citrus tree; and yellow sticky traps installed at north side of the citrus tree. Ramdomized collections were done at several orchards in the region. Systematic collection were done at an interval of three weeks year in two orchards at Condado of Itapicuru, Bahia state, where strong symptoms of the disease were detected. The following species were registered: *Acrogonia* sp., *Bucephalogonia xanthopis, Cyphonia clavigera, Ceresa ustulata, Deois incompleta, D. schach, D. flavopicta, Diedrocephala continua, Diedrocephala variegata, Eritrogonia sexguttata, Exitianus quadratulas, Exitianus obscurinervis, Ferrariana trivittata, Hortensia similis, Paraceresa bifasciata,, Plesiommata corniculata, Melusinella nervosa, Stirellus bicolo, S. picinus, Scaphitopius* sp *Tapajosa fulvopuncta, Unerus columus, Xerophloea viridis,* and *Zulia entreriana.* From these species, *Acrogonia* sp., *Bucephalogonia xanthopis* and *Plesiomata corniculata* are, for sure, the transmitters of CVC. The collected species from wild plants were similar each other in all sampled condados of Bahia state and were similar those ones from São Paulo state. The species *Hortensia. similis, Plesiommata. corniculata* e *Ferrariana. trivitatta* were captured at higher frequency in grasses. The higher frequency species found in dicotiledoneas belonged to the genero *Diedrocephala, Eritrogonia e Spangbergiella.* By sight, only *Scaphytopium* sp. was found in citrus. In the sticky traps this specie was the most frequent in 12 months of collection.

Index terms: citrus variegated chlorosis, survey, insecta

[3233] THE TRANSMISSION SPECIFICITY AND EFFICIENCY OF BRAZILIAN TOSPOVIRUSES OCCURRING ON TOMATO BY FOUR THRIPS SPECIES

T. Nagata[1], A. C. L. Almeida[1], R. O. Resende[2], F. H. França[1] & A. C. de Ávila[1], [1]Dept. of Virology, EMBRAPA/Hortaliças, C.P. 218, 70359-970, Brasília, DF, Brazil, E-mail tatsuya@cnph.embrapa.br; [2]Dept. of Cellular Biology, Univ. of Brasília, 70970-000, DF, Brazil.

Recent studies revealed a broad diversity of tospoviruses, currently counting more than 13 reported species in this genus. In Brazil, four tospoviruses are well-known pathogens on tomato: *Tomato spotted wilt virus* (TSWV), *Tomato chrolotic spot virus* (TCSV), *Groundnut ringspot virus* (GRSV) and *Chrysanthemum stem necrosis virus* (CSNV). Among over the 5,000 thrips species recorded, only 9 species were reported as vectors of tospoviruses elsewhere. In Brazil, four potential vector species of thrips, *Frankliniella occidentalis, F. schultzei, Thrips tabaci* and *T. palm,* were isolated and identified. These thrips are also important as pests themselves causing serious crop losses in Brazil. Out of the four thrips species, *F. occidentalis* and *T. palmi* are considered as newly invading species in Brazil. In Europe and USA, *F. occidentalis* is recognized as the major vector of TSWV and *Impatiens necrotic spot virus* (INSV). *T. palmi* seems to be an important vector of tospoviruses in Asia. Therefore, the transmission capacity of Brazilian tospoviruses by these two species was of meaningful interest. Laboratory maintained thrips colonies and freshly collected tospoviruses were used to avoid the influence of mutated virus. After 16 h acquisition of virus by first instar larvae, the thrips were maintained on non-infected leaves till the adult stage, and the ability to transmit the virus was evaluated using Wijkamp's leaf disk test combined with ELISA. *F. occidentalis* transmitted all four tospoviruses with varying efficiency according to the virus species from 17.5 % with GRSV to 71.4 % with CSNV. *F. schultzei* transmitted TCSV (69.6%), GRSV (93.1%) and CSNV (66.1%), but did not transmit the TSWV isolate. The recent explosion of GRSV epidemics in Brazil may be related with this high affinity of transmission between GRSV and *F. schultzei.* However, *T. tabaci* which population is the transmitter of *Iris yellow spot virus,* a tospovirus occurring on onion in Brazil, did not transmit any tospovirus species in the condition used. As *T. tabaci, T. palmi* also did not transmit these four tospoviruses at all. The results indicate that *F. occidentalis* and *F. schultzei* are the major tospovirus vectors on tomato, however, *T. tabaci* and *T. palmi* probably do not play an important role on tospovirus distribution in tomato field.

Index terms: *Frankliniella occidentalis, Frankliniella schultzei, Thrips tabaci, Thrips palmi,* tospovirus.

[3234] MIGRATION AS A STRATEGY FOR SURVIVAL OF *DALBULUS MAIDIS* (HEMIPTERA: CICADELLIDAE) DURING CORN OVERSEASON IN CENTRAL BRAZIL

C. M. Oliveira[1], R. M. S. Molina[1], R. S. Albres[2], L. R. Nault[3] & J. R. S. Lopes[1], [1]Dept. Entomologia, Fitopatologia e Zoologia Agrícola, ESALQ/Univ. São Paulo, C.P. 9, Piracicaba, SP 13418-900, Brazil, E-mail cmolivei@carpa.ciagri.usp.br; [2]CEUA/Univ. Federal do Mato Grosso do Sul, C.P. 4, Aquidauana, MS 79200-000, Brazil; [3]Dept. Entomology, OARDC/ Ohio State Univ., Wooster, OH 44691, USA.

The corn leafhopper, *Dalbulus maidis* is a major maize pest in Latin America because it transmits three pathogens (*Spiroplasma kunkelii,* maize bushy stunt phytoplasma and maize rayado fino virus) associated with corn stunt disease. Because only *Zea mays* is known as a host of *D. maidis* in Brazil, this insect has two possible strategies to survive during the overseason: diapause or migration to areas where irrigated corn is grown. To investigate these possibilities, *D. maidis* populations were monitored with yellow sticky cards for 2.5 years (July/97-December/99) in a region (Anastácio) of the State of Mato Grosso do Sul with prevalence of perennial pastures and long corn overseason (>5 months), in two different situations: a) areas (I and II) where maize is grown every spring (October); and b) areas (III, IV, V and VI) of perennial pastures, where maize had not been grown in the previous 10 years. In each area, 16 sticky traps were distributed inside a maize plot, at three different heights (0.5; 1.5 and 2.5 m), and 4 traps were placed in the surrounding vegetation (mostly weedy grasses and shrubs) at the heights of 0.5 and 1.5 m. Cards were replaced every 15 days and evaluated for the number of leafhoppers captured. *D. maidis* individuals were trapped in maize in all areas studied, but not in the adjacent vegetation (even with sweep-net attempts). Population peaks were observed in winter (July-September), when no corn was present in the plots, and occurred simultaneously in most areas. Interestingly, much higher peaks were detected in areas where the soil had been plowed recently (with no weed cover). The absence of *D. maidis* in the adjacent vegetation and the sudden appearance of adults soon after maize planting in all areas, including those (III, IV, V and VI) where corn had not been cultivated for a long time, suggest that these leafhoppers were immigrants from distant locations. The simultaneous capture of a large number of individuals in the experimental plots in midwinter (July-August) is coincident with the end of the second growing season (late summer plantings) in other regions (>100 km away). This supports the hypothesis that populations of *D. maidis* adults migrate long distances, possibly by wind currents, for survival during corn overseason. In addition, the huge numbers of leafhoppers trapped in tilled plots in late winter suggests that bare soil may be used as a cue for selection of landing sites by migrant *D. maidis.*

Index terms: corn leafhopper, vector, *Zea mays*, ecology

[3235] RESOURCE AVAILABILITY AND SPATIAL DISTRIBUTION OF *DELPHACODES KUSCHELI* (FULGOROMORPHA: DELPHACIDAE)*

Ana M.Marino de Remes Lenicov[1], G. Liljesthrom[2], I. Barrios[1], S. Paradell[1], E. Brentassi[1], G.Varela[1]& M. Demaría[1], 1.Dto. Entomología, Fac. Cs.Naturales y Museo de La Plata, Paseo del Bosque s/n° (1900), LaPlata, Argentina, E-mail amarino@museo.fcnym.unlp.edu.ar ; 2.Centro Est. Parasitológicos y deVectores(CEPAVE).Calle 2 N°584 (1900), La Plata, Ana.

Delphacodes kuscheli is the known vector of Mal de Río Cuarto virus (MRCV). Field and laboratory experiments have shown that wheat, barley, *Bromus unio loides*, *Cynodon dactylon* and *Sorghum halepense* are useful hosts, but maize is not. The maximum population density of *D. kuscheli* coincides with the moment of implantation of the maize culture, upon which the vector feeds mainly towards the end of spring when the availability of other hosts (winter cereals and wild grami neae) diminishes and the culture is most susceptible to the disease. Given the epidemiological importance of their winter hosts, the effect of resource availability with respect to the spatial distribution of the vector was studied in the Agronomic Station Sta. Catalina (La Matanza county, province of Buenos Aires, Argentina) during the spring time(1996-1997-1998). The area was divided into 4 strata: Cebadi lla (0.02ha, dominated by *B. unioloides*, *C. dactylon* and *S. halepense*); Barbecho (0.33ha, dominated by *C. dactylon and B. unioloides*), Wheat,*Triticum aestivum* (2.18ha) and Maize, *Zea mays* (0,17ha). The nutritional quality of the i-th host was estimated by performance of *D. kuscheli*: DE(i) = ln [FD(i) LM(i) SH(i) SN(i) P(i)] / T(i); where: FD(daily fecundity); LM(mean longevity of the female adult); SH (egg survivorship); SN(nymph survivorship); P(proportion of females) and T (gene ration time:sum of pre-imaginal development time and TM/2). The resource availa bility of the j-th stratum was: R(j) =(F(i,j) DE(i); where F(i,j) was the area covered by the i-th species. The sample of *D. kuscheli* was stratified at random (mid-Septem ber -end December). The samples (3-7 transects and 50 casts of the net in each one) were taken every fifteen days. N samples in a given stratum were combined to esti mate the relative seasonal density, dR(j)=dE(j)/(dE(j); where dE(j)=ˇ (n(j,t)/N, and n(j,t) was the density of *D. kuscheli* in the j-th stratum and the t-th sample. Accor ding to its nutritional content: *S. alepense* (DE=0,1288), *T. aestivum* (DE=0,1069), *Avena spp.*(DE=0.1021); *B. unioloides* (DE=0,099), *C.dactylon* (DE=0,063) and *Z. mays* (DE =()).The stratum with the highest relative vector density was Wheat, and the stratum with the smallest density was Maize. The relationship between R(j) and dR(j) was found to be significant: y=-0.021+0.051x; r^2=0.63; t(10 df)=4.16 (P<0.001) , suggesting a higher vector density in areas with a greater concentration of resources.

Delphacodes kuscheli- MRCV vector- population density- resources.

*PIP-CONICET N° 4736/96.

[3236] DELPHACID PLANTHOPPERS AND THE "MAL DE RIO CUARTO" IN MAIZE IN THE NORTH OF ARGENTINA (INSECTA - FULGOROMORPHA)

A.M.M. de Remes Lenicov(1), I.G. Laguna(2), R. Mariani(1), E. Virla(3), I. Barrios(1), P. Rodriguez Pardina(2), P. Herrera(2), M.P. Gimenez Pecci(2) & A. Avila(2), (1) Dto. Entomología. Fac. Cs. Naturales y Museo de La Plata, Paseo del Bosque s/n° (1900) La Plata, Argentina, E-mail **Erro! Indicador não definido.**; (2) IFFIVE (Inst. Fitovirología y Fisiol. Vegetal), Camino 60 cuadras km. 5 1/2 (5119) Córdoba, Argentina. E-mail: gracel@iffive.satlink.net; (3) INSUE (Inst. Sup. de Entomología), M. Lillo 205 (4000), S.M. de Tucumán, Argentina, E-mail: evirla@infovia.com.ar. FONCyT n° 08-00000-01806

The "Mal de Río Cuarto"(MRCV) is the more important virus disease that affects the maize crops in Argentina. It provoked annual losses estimated at 120 millions dollars during the ten last years. It is caused by reovirus and has been transmitted by the delphacid *Delphacodes kuscheli*. Former explorations in the main maize growing area link the presence of the disease to the area of distribution of the vector specie. In order to analize the progressive spread of the disease towards other maize growing areas of north of Argentina, in this contribution it is reported the presence of pathogen in the maize crops and it is studied the species of delphacids which lives on it. During the years 1997/98 y 1998/99 the studies were carried out on maize plots in 74 localities in the province of Jujuy, Salta, Tucumán, Chaco, north of Santa Fe, Santiago del Estero, Corrientes and Catamarca. In each locality, the pathogen was detected by DAS-ELISA from 50 plants collected at random and the insects were captured through 4 repetitions of 50 casts of the net in each one, 2 in the maize or oats and 2 in the surrounding wild vegetation. The new localities where MRCV was detected are: Las Lajitas y La Estrella (Salta), Tafí del Valle, La Ovejería y el Mollar (Tucumán), El Jume, Los Romanos, Añatuya (Santiago del Estero) and Corrientes (Corrientes). The sixteen delphacids species more frequently captured are clasified depending its abundance, with notes about its geographical distribution and great vector action. The more important species are: *Toya propinqua*, *Delphacodes axonopus*, *D. tigrinus*, *D. balboae*, *Peregrinus maidis*, *Sogatella kolophon and Togasodes orizicolus*, the majority of them are known pest of tropical Gramineae in America.

Delphacid planthoppers – maize - Mal de Rio Cuarto disease – north of Argentina.

[3237] INTRA-SPECIES VARIATION OF TOMATO SPOTTED WILT TOSPOVIRUS TRANSMISSION BY THE WESTERN FLOWER THRIPS

T. Sakurai[1] & T. Inoue[2], [1]Dept. of Biology and Environmental Sciences, Tohoku National Agricultural Experiment Station, Morioka 020-0198, Japan, E-mail tsakurai@tnaes.affrc.go.jp; [2]Dept. of Bioscience and Technology, Faculty of Agriculture, Iwate University, Morioka 020-8550, Japan.

The western flower thrips, *Frankliniella occidentalis* is an important insect pest of vegetables, ornamentals and wild plant hosts. In addition to causing direct injury to plants throughout its feeding, this thrips species is one of the primary vector of tomato spotted wilt tospovirus (TSWV) which has an extensive host range and causes severe economic losses in many crops all over the world. In order to take measures to prevent plant diseases caused by TSWV, it is indispensable to reveal the relationship between the virus and its insect vectors. An effective method to do so is the detection of intra-species variation and the search of the causes. In the present study, we investigated on the TSWV transmission competence of *F. occidentalis* adults derived from several populations in Japan. The occurrence of *F. occidentalis* in Japan was reported first in Chiba and Saitama Prefs., the central district of the main island of Japan, in 1990. As a rapid expansion of this thrips, epidemics caused by TSWV have become increasingly important in many regions. Although the intrusion of *F. occidentalis* into Japan was only ten years ago, we found that the transmission competence of TSWV was distinct among thrips populations originated from different regions. On one hand almost 50 % of thrips from Aomori population, the northeast district of the main island, transmitted the virus; on the other hand, less than 5 % of thrips from Shimane population, the west district of the main island, did it. In any populations, male thrips transmitted TSWV to the plant leaves with a higher rate than females. The transmission rate has not fluctuated during this experiment of nearly two years in each population. These results show that there are at least two intra-species variations for the TSWV transmission competence of *F. occidentalis*. The stable transmission rate in each population indicates that the variation among populations may be caused by a genetic factor and that the transmission competence may bear little relation to the reproductive and the survival characters. We will also discuss the factor that causes the sexual difference of TSWV transmission.

Index terms: *Frankliniella occidentalis*, TSWV, vector, population, sex.

[3238] THE USE OF LEAF DISC LOCAL LESION TEST ON THE STUDY OF PLANT VIRUS TRANSMISSION

F. J. S. Salas[1], M. V. F. Lopes[2] & M. M. Barradas[1], [1] Lab. de Fitovirologia e Fisiopatologia (LFF), Insituto Biológico (IB), Centro de Sanidade Vegetal (CSV), Scientific Research, E-mail salas@biologico.br, CEP 04014-002; [2]Student CSV/LFF/IB, São Paulo/SP, Brazil.

Plants of *Solanum nigrum* (black nighshade) - Solanaceae, showing virus-like symptoms (mosaic, vein-clearing and leaf distortion) and severe insect infestation, mainly aphids (*Aphis gossypii*), were collected in an experimental field of the "Instituto Biológico", São Paulo, SP, Brazil. Electron microscopic observation of negativelly stained preparations from those plants revelead the presence of Potyvirus-like particles. To start virus identification, mechanical inoculation on test plants (*Chenopodium amaranticolor*, *C. murale*, *C. quinoa* and *Nicotiana rustica*) and *A. gossypii* transmission were performed. For transmission, healthy *C. murale* and foliar discs of same species were used as hosts of viruliferous aphids. Discs were placed on plastic dishes faced with wet filter paper. Aphids had 12h fast before 12h aquisition access period, in which wingless adults were fed with extracts from the original plant containing 0.5% sodium sulfite and sucrose, using the technique of aquisition through Parafilm membrane. An additional transmission experiment was made with aphids from the original *S. nigrum*. In trials with foliar discs, 2 dishes with 24 holes were used and on the filter paper of each a disc with a viruliferous aphid was placed. After sealing dishes with Parafilm, aphids were allowed to have 30 minutes transmission access period under controled conditions before being killed. *C. murale* reacted with chlorotic and necrotic points on inoculated leaves only. *C. amaranticolor* and *C. quinoa* showed local symptoms that developed into systemic chlorothic points. *N. rustica* showed no symptoms. Transmission by *A. gossypii* was positive to *C. murale* plants and discs. In the latter case the virus could be transmitted by both aphids from the original colony (35.4%) and those artificially fed on extracts through membrane (42.1%). The present results show the feasibility of the use of the local lesion test on foliar discs in the transmission tests by aphids. It is a very simple technique with the advantage of economy in the number of host plants and physical space in the laboratories.

Index terms: virus transmission, *Aphis gossypii*, local lesion symptoms, leaf discs

[3239] MAIZE CULTURE AND THE FORCE OF TRANSMISSION OF MALARIA

A. Spielman, School of Public Health and Center for International Development, Harvard University, 665 Huntington Avenue, Boston, MA 02115 USA, E-mail: aspielma@hsph.harvard.edu

Although maize was introduced into Africa during the 1600s, this crop became widespread there only during the 1900s. Malaria outbreaks in these early years appeared to follow the onset of local maize cultivation. *Anopheles arabiensis* and *A. gambiae* ss occur mainly where maize is grown. Larval *A. arabiensis* in Ethiopia mature more rapidly, more efficiently and produce larger adults when breeding in close proximity to flowering maize fields than in more remote sites. Maturation is inhibited when access to maize pollen is denied and rescued when supplementary pollen is provided. These most efficient of African malaria vectors, therefore, appear to flourish largely where maize is cultured.
Index terms: Anopheles, Malaria, Anthropogenic change

[3240] *APHID ALERT*: RESEARCH/OUTREACH ADDRESSING POTATO VIRUS PROBLEMS IN THE NORTH CENTRAL U.S.

R. A. Suranyi[1], E. B. Radcliffe[1], D. W. Ragsdale[1], I. V. MacRae[1] & B. E. L. Lockhart[2], [1]Dept. of Entomology E-mail, radcl001@tc.umn.edu, and [2]Dept. of Plant Pathology, Univ. Minnesota, St. Paul, MN 55108, USA.

We have established an aphid-trapping network to monitor aphid flight activity in the major seed potato producing regions of Minnesota and North Dakota. We operated traps ~70 miles apart at 12 sites in 1998 and at 14 sites in 1999. At each site we used four green pan traps and one 6-ft suction trap. Captures of winged aphids were reported weekly by newsletter, *Aphid Alert*, distributed by U.S. mail, e-mail and the WWW to ~150 growers, crop consultants, and University research and extension personnel. Reports identified captures by species and number and included situation summaries and advisories plus management information. Of the growers and consultants responding to our survey of subscribers, 78% indicated that they used *Aphid Alert* to make management decisions. Aphid species composition, abundance and phenology of flight activity were very different in the two years. In 1998, captures of green peach aphid, *Myzus persicae*, exceeded 0.5 per trap from 15 Aug.-5 Sept. and peaked at 3.2 aphids per trap on 28 Aug. (overall mean = 0.8 aphids per trap per week, 4 Jul.-3 Oct.). In 1999, *M. persicae* captures exceeded 0.7 per trap from 18 Jul.-5 Sept. and peaked at 4.5 per trap on 15 Aug. (overall mean 1.2). In 1998, captures of potential PVY vectors exceeded 25.4 per trap from 25 Jul.-5 Sept. and peaked at 246.0 per trap on 15 Aug. (overall mean 43.0). In 1999, captures of potential PVY vectors exceeded 10.6 per trap from 25 Jul-29 Aug. and peaked at 25.1 per trap on 8 Aug. (overall mean 12.0). 1998 and 1999 were disastrous for Minnesota and North Dakota seed potato growers with approximately half of potato seed lots entered into winter trials rejected for virus (PVY and PLRV). In 1998, 50% of *M. persicae* caught in Aug.-Sept. tested positive by IC-PCR for PLRV, but not a single PLRV-positive was detected in 1999. Much evidence suggests that the winged *M.* persicae captured in our traps in 1998 originated in commercial potato whereas those captured in 1999 originated in canola. Thus, the primary problem in 1999 appeared not to be aphids moving virus into the seed potato fields as occurred in 1998, but the large amount of inoculum present within seed fields. Research in 1999 showed that winged *M. persicae* alight first on the margins of potato fields (at the interface of the crop and the fallow border). Intensive sampling and GIS mapping of the distribution and density of aphids in this invasion in three fields was used to develop site-specific treatment recommendations that provided excellent control, conserved natural enemies and reduced insecticide use by 70%.
Index terms: green peach aphid, *Myzus persicae*, PLRV, PVY, seed potato.

[3241] APHID PROBING EVENTS IN AN ANOMALOUS VIRUS TRANSMISSION

W.F. Tjallingii[1] & R.Z. Zhang[2], [1]Lab. of Entomology, Wageningen-UR, POBox 8031, 6700 EH Wageningen, The Netherlands. E-mail freddy.tjallingii@users.ento.wau.nl; [2]Inst. Zoology, Chinese Academy of Sciences, 19 Zhongguancun, Beijing 100080, PR China. E-mail zhangrz@public2.east.cn.net

Different probing activities have been found responsible for the two main modes of transmission of plant viruses by aphids, (1) persistent transmission of circulative, phloem restricted viruses, and (2) non-persistent, stylet borne transmission of non-circulative viruses that are not restricted to specific plant tissues. There are, however, a number of viruses whose transmission does not follow these main modes. Some are known as semi-persistent and others have an unclear status. Tobacco vein necrosis virus (TVNV), serologically resembling a potyviruses, has such a status. TVNV is transmitted by *Myzus persicae* to various solanaceous plants, such as *Physalus floridana*, used in our experiments because it shows very clear symptoms. Virus acquisition from TVNV source plants and inoculation of test plants was electrical penetration graph (EPG) recorded. In some probes acquisition was as fast as in non-persistent viruses, i.e. within 15 seconds. Also, the occurrence of intracellular stylet punctures was a prerequisite. However, TVNV generally needed longer penetration times for acquisition, and the more intracellular punctures for acquisition. Especially, the cumulative number of archlets (pulses) in the II-3 sub-phases during the cell punctures was important. Reaching and ingestion from phloem was not important. Inoculation required also more cell punctures and longer probing than non-persistently transmitted viruses. It could be related more specifically to the total duration of II-1 sub-phases. The II-3 archlets had no importance now. Thus, the difference between this virus and non-persistently transmitted viruses seems gradual rather than principal. We postulate that the same aphid probing activities are responsible but that the binding properties with the helper components differ. In presence of helper component each successive cell puncture seems to add a few more virions and increases the probability to inoculate test plants subsequently, in the absence of helper component. Thus, during each salivation period a cell puncture a few virions will be released. The cumulative effect might be explained by a the increasing number of cells being inoculated with a few virions, thus raising the probability of virus replication in one of the punctured cells and infection of the whole plant. The underlying salivation and ingestion activity by the aphid and their role during cell punctures in virus transmission and the functional aspects in aphid-plant relationships is discussed.
Index terms: probing, plant penetration, vector, semi-persistent.

[3242] APHID POPULATION FLUCTUATION AND SPREAD OF APHID-BORNE VIRUSES IN TOBACCO CROPS IN GREECE

I.A. Tsitsipis[1], N.I. Katis[2], I. Gargalianou[1], E.K. Chatzivassiliou[2], K. Eythimiou[2], E. Panagiotaki[1] & N. Tomara[1], [1]Univ. of Thessaly, Faculty of Agriculture, Lab of Entomology and Agricultural Zoology, 383 34, Pedion Areos, Volos, Greece; [2]Aristotle Univ. of Thessaloniki, Plant Pathology Lab, 54 006 Thessaloniki, Greece.

The spread of *Cucumber mosaic cucumovirus* (CMV) and *Potato Y potyvirus* (PVY), two aphid-borne viruses, was studied in two tobacco growing areas during 1998 and 1999 in relation to aphid populations. In the first area (Karditsa), the study was performed in a field with a Virginia type (Mc Nair 944), whereas in the other (Katerini) with an oriental type (Basmas) tobacco. In both areas alate aphid populations were monitored weekly by Moericke yellow traps followed by species identification, whereas virus incidence was evaluated biweekly by ELISA, using polyclonal antibodies, of 100 randomly collected tobacco leaf samples, starting one month post transplanting. In Karditsa, in 1998 and 1999, 132 and 117 aphid species were recorded respectively. During the first year the most abundant species captured were *Brevicoryne brassicae, Aphis spiraecola, Phorodon humuli, Aphis gossypii, Myzus persicae* and *Lipaphis erysimi* whereas during the second year *A. gossypii, M. persicae, A. spiraecola, A. craccivora, Chaitophorus populialbae* and *L. erysimi*. In 1998, incidence of both viruses, recorded in different samplings, was relatively low ranging from 8-14% for CMV and 1-8% for PVY. This year the maximum aphid population occurred during the 22nd week (the transplanting week). In 1999, incidence of both viruses was higher ranging from 25-98 % for CMV and 5-63% for PVY and absolute aphid numbers were higher compared to 1998 with their maximum numbers occurring during the 31st week (nine weeks after transplanting) and was relatively high during sampling period. In Katerini, 122 and 117 aphid species were recorded in 1998 and 1999 respectively. In 1998 the most abundant species were *Microlophium* sp., *Tetraneura akinire, P. humuli, A. spiraecola, M. persicae* and *A. fabae* whereas in 1999 *A. gossypii, M. persicae, A. spiraecola, A. craccivora, C. populialbae* and *L. erysimi*. Infection rates of CMV were 2-6% for 1998 and 2-8% for 1999 whereas PVY incidence was even lower ranged from 1-3% for 1998 and 2-4% for 1999. In 1998 and 1999 maximum aphid populations appeared in the 19th (two weeks before transplanting) and 22nd week (the transplanting week) respectively, four to six weeks before first tobacco sampling for evaluation of virus incidence. The importance of these results on CMV and PVY epidemiology will be discussed.
Index terms: aphid population, virus incidence, *Aphis gossypii, Myzus persicae*, PVY, CMV

[3243] HOW AND WHY DO THRIPS TRANSMIT TOSPOVIRUSES, A CELLULAR APPROACH TO UNDERSTANDING

D. E. Ullman[1], M. D. Bandla[1], L. R. Campbell[2] & J. L. Sherwood[2], [1]Dept. of Entomology, Univ. of California, P. O. Box 2324, Davis, CA 12345-3456, USA, E-mail ullmand@davis.ucla.edu; [2]Dept. of Plant Pathology, Oklahoma Sta. University, Stillwater, OK 98765-3210, EUA.

The tospoviruses are important emerging phytopathogens causing severe epidemics worldwide. Among the 5,000 or so known thrips species, only seven transmit tospoviruses. The thrips/tospovirus relationship is unusual in that transmission occurs only when fist instar larvae acquire the virus. There is also apparent specificity between tospovirus species and their thrips vectors. The known vector species represent two of the largest genera of the Thripidae. Although the species involved do not form closely related groups phylogenetically, they do share important ecological characteristics. Recently, the status of several vector species has apparently changed dramatically, i. e. *Thrips tabaci*, once the most important vector species worldwide apparently no longer transmits contemporary isolates and *Thrips palmi*, formerly thought to be a non-vector, transmits at least three important tospoviruses. Close scrutiny of thrips/virus interactions suggests that evolution of tospoviruses and/or selection pressures on both the viruses and vectors contributes to changing vector specificities. On a cellular level evidence from electron microscope studies indicate that acquisition of tomato spotted wilt tospovirus (TSWV) is receptor mediated. The location of the viral glycoproteins (gps) in the virion envelope, presence non-transmissible TSWV deletion mutants support the hypothesis that counterpart cellular receptor site in thrips, reveal an approximately 50 kD thrips protein that binds both TSWV gps, but not TSWV nucleocapsid S RNA. Similar preparations from leafhoppers, aphids and non-vector thrips species did not bind any TSWV proteins. Furthermore, anti-idiotypic antibodies that mimic TSWV gps detected the 50 kD thrips protein. These data suggest the 50 kD thrips protein is a component of the cellular receptor site for the TSWV attachment proteins and may play a critical role in virus acquisition. The relevance of these findings to possible mechanisms underlying emergence of tospovirus/thrips relationships and vector specificity will be discussed.

Index terms: *Thrips tabaci, Thrips palmi*, TSWV, vector, antibody

[3244] EXPERIMENTAL TRANSMISSION OF "STICKY DISEASE" OF PAPAYA BY *BEMISIA ARGENTIFOLLI* BELLOWS & PERRING

C. A. Vidal[1], A. S. Nascimento[2], C. J. Barbosa[2];O. M. Marques[1] & T. C. Habibe[1], [1]Universidade Federal da Bahia; [2] *EMBRAPA Mandioca e Fruticultura*, Caixa Postal 007, CEP.: 44.380-000, Cruz das Almas (BA), E-mail: antnasc@cnpmf.embrapa.br

"Sticky disease" of papaya, restricted to Brazil, was firstly reported in 1987. Currently is the most important disease of papaya, causing 30% of losses in orchards from the most important zones of production: South of Bahia and North of Espirito Santo. Newly the disease was found in the fruit crop region of Juazeiro-BA/Petrolina-PE. Based on its characteristics, there is a consensus that this disease has a viruses etiology. The objective of this paper was to evaluate the transmission of this disease by white-fly. The experiment was carried out from Mar/1999 to Feb/2000 in field cages and laboratory. Cages, containing a papaya plant, were built with non-aphyd net measuring 2.5m x 1.5m x 1.5m, in which white-flies *Bemisia argentifolii* also called *B. tabaci* (Genn.) biotype B were released three times consecutively. Adults of white fly was collected from papaya plants infested by "Sticky disease" in Petrolina-PE, then transferred to orchards cages and kept during 96 hours. Four control plants were kept within net cages. All plants were monthly monitored to detect the symptoms. From these plants were taken samples of leaves to detect viral particles (double-stranded RNA-dsRNA). The extraction of these samples was performed in buffer and phenol, followed by chromatography in cellulose CF-11, washing with buffer 15% ethanol and elution. The presence of dsRNA was evaluated by 1,2% agarose gel eletrophoresis, using a dsRNA-comparative pattern obtained from diseased papaya plants. Six months after first infestation, dsRNA was detected from the test-plants with a same migration from plants mechanically inoculated. In eight months plants showed characteristic symptoms: exudation of latex from the fruits, which become dark; and latex more fluid than health fruits. In the control plants were not detected dsRNA or disease symptoms. These results show that white-fly *B. argentifolii* is probably a vector of "Sticky disease" virus. So, an adequate management of this insect become necessary in and close to papaya orchards.

Index terms: Sticky disease, white-fly, transmission, virus, Carica papaya.

[3245] INSECT TRANSMISSION OF A VASCULAR WILT OF A TROPICAL HARDWOOD IN THE SEYCHELLES

D. Wainhouse[1], J. Webber[2], H. Evans[3] & S. Murphy[3], [1]Entomology Dept. and [2]Pathology Dept., Forest Research, Alice Holt Lodge, Wrecclesham, Farnham, Surrey, GU10 4LH, UK. E-mail d.wainhouse@forestry.gov.uk; [3] CABI Bioscience. Silwood Park, Ascot, Berks., SL5 5TA, UK.

The broadleaved evergreen tree, takamaka, (*Calophyllum inophyllum* (var *takamaka*)) has an extensive range within the Indian Ocean area, commonly occurring as a littoral species. It forms a highly significant part of the tree flora of 60% of the islands in the Seychelles group where it is a dominant component of beach crest woodland along many of the pristine beaches. Significant areas of takamaka woodland also occur inland on the main island of Mahé. On Mahé and some of the surrounding islands, this native tree is suffering from a serious vascular wilt disease, first reported in 1994, that may be of exotic origin. It causes distinctive crown dieback usually resulting in tree death and appears similar to vascular wilt disease reported from Mauritius and El Salvador in the 1940's. The fungus was originally designated as *Verticillium calophylli* but has morphological and physiological characteristics consistent with its transfer to *Leptographium*. Species within this genus occur more commonly on coniferous hosts and are often associated with bark beetles. The bark beetle, *Cryphalus trypanus* breeds in the bark of branches and trunk of *Calophyllum* and is associated with fungus colonised bark. Beetles emerging from branches and trunk bark from diseased trees were plated onto a selective agar medium. The fungus was difficult to detect on whole beetles but readily found in homogenised samples. The largest spore loads were found on beetles emerging from trunk bark. We have shown experimentally that beetle entries in twig bark were concentrated around leaf petiole scars. Some beetles tunnelled within a soft pith central to the leaf scars that traversed the xylem to the centre of the branch. This could provide a novel and possibly highly effective way of introducing fungal spores into active xylem. Current disease control strategies are briefly discussed.

Index terms: Bark beetle, *Calophyllum*, *Cryphalus*, *Leptographium*, *Verticillium*

[3246] THE TAXONOMY OF XYLEM FEEDING HOMOPTERA

M. R. Wilson[1], [1]Department of Biodiversity & Systematic Biology, National Museum of Wales, Cardiff, CF10 3NP, Wales, UK. E-mail: mike.wilson@nmgw.ac.uk.

Xylem fluid is very low in nutrient concentrations, which necessitates very high feeding rates by xylem sap feeders. Moreover, it is difficult to obtain because of negative tension. Only specialized groups of the Auchenorrhyncha (order Hemiptera) can cope these constraints to utilise xylem sap source of food. Among the Hemiptera the Auchenorrhyncha is the name that is most commonly applied to the Cicadelloidea (leafhoppers and membracids), Fulgoroidea (planthoppers), Cercopoidea (spittlebugs) and Cicadoidea (cicadas). Of these, xylem feeding appears universal in the Cercopoidea and the Cicadoidea. In the Cicadelloidea it appears to be found only in the members of the leafhopper subfamily Cicadellinae (often known as sharpshooters). There may be as many as 20,000 species of leafhopper, perhaps many more. Currently there at least 2000 described leafhoppers in the xylem-feeding subfamily Cicadellinae. They are found in all zoogeographical regions. The Neotropics are especially rich in species but relatively poor in species in North America and Africa and with only one genus in Europe. The subfamily is divided into 2 tribes. The Proconiini has about 60 genera and 360 species and is confined to the Western Hemisphere. The Cicadellini has around 1700 species and 250 genera. Around 175 genera (and 1000 species) are recognised in the New World and 85 (580 species) in the Old World, with little overlap in distribution. Reliable host plant data is available for only a few species. Novotny & Wilson (1997, Evolutionary Ecology 11: 419) analysed the body size distribution in xylem feeding insects and showed that xylem feeders tend to be larger than phloem feeders. This may be as a result of larger insects overcoming the energy costs associated with feeding from xylem. These trends can result in large species having a wider range of potential hosts than smaller ones. Xylem feeders tend to be more polyphagous, whereas phloem and mesophyll-feeding species are more host specific. The lack of plant defensive chemicals in xylem sap may promote wide host ranges among xylem sap feeders. Some xylem feeding species such as *Homalodisca coagulata* (Cicadellini) and *Philaenus spumarius* (Aphrophoridae) are known from over 100 host plants. It is possible that having a wide host range is advantageous when feeding on a nutritionally poor diet.

Index terms: cicadellidae, cercopidae.

[3247] DETERMINING THE PROTECTION PERIOD OF DRY BEAN (*PHASEOLUS VULGARIS*.) AGAINST WHITEFLY (*BEMISIA ARGENTIFOLII*), IN FUNCTION OF YIELD LOSS DUE TO BEAN GOLDEN MOSAIC VIRUS INFECTION

M. Yokoyama[1], [1]National Rice and Bean Research Center (Embrapa Arroz e Feijão), Caixa Postal 179, Santo Antônio de Goiás, GO, Brazil, 75375-000. E-mail: massaru@cnpaf.embrapa.br

Whitefly has been among the most serious pests of dry bean, mainly by transmitting the geminivirus *Bean golden mosaic virus* (BGMV), one of the most yield-limiting disease affecting the crop. The objective of this study was to determine the bean yield loss due to BGMV by controlling infestation/infection in different bean growth stages. The varieties Jalo Precoce (cycle 70-75 days), Carioca and Perola (cycle 85-90 days) were used to define the most critical period to protect the crop against whitefly. The experiments were carried out in screenhouse conditions at Embrapa Arroz e Feijão, near Santo Antônio de Goiás, GO, Brazil, from July to October 1999, in a completely randomized design. Each experimental unit was represented by one pot with two bean plants with ten replications. The ten pots were infested with adults of whiteflies 7, 14, 21, 28, 35, 42, 49, and 56 days after plant emergence. Insects used for infesting plants were obtained from a colony established for this purpose and maintained in dry bean, soybean and lima bean plants infected with BGMV. For each infestation, the whiteflies were allowed to stay and feed in the plants for 48 h to increase the chance of virus infection. Expired this time, all whiteflies were removed and plants moved to an insect free screenhouse. The variables evaluated were number of pods (normal and deformed), number of seeds, and seed weight. The percentage of deformed pods for "Jalo Precoce" were 100, 100, 100, and 48% when infestations was done 7, 14, 21, and 28 days after plant emergence. The variety Carioca, showed 100, 100, 100, 95, 45,and 2% of deformed pods when infested at, respectively, 7, 14, 21, 28, 35, and 42 days after plant emergence. For the "Pérola", the percentages of pods deformed were 100, 100, 100, 79, 52, and 3, considering the same infesting dates for "Carioca". The yield losses determined for "Jalo Precoce" were 100, 100, 82, and 56%, respectively, for infestations at 7, 14, 21, and 28 days. For the variety Carioca, the yield losses were 100, 100, 100, 91, 46, 12, 15, and 12%. For the "Perola", losses were 100, 100, 100, 90, 61, 21, 10, and 8% respectively for infestations at 7, 14, 21, 28, 35, 42, 49, and 56 days. The variety to be grown should be considered for establishing the protection period of dry bean against whiteflies. Varieties with short cycle, like "Jalo Precoce", the critical period starts at emergence to 28 days while for varieties with longer cycle, like "Carioca" and "Pérola", the critical period for protection against whiteflies should be extended until 49 days after plant emergence.

Index terms: Silverleaf whitefly, chemical control, geminivirus damage.

[3248] SEROLOGY FOR *BABESIA BOVIS* IN HUMAN PATIENTS WITH LYME-LYKE DISEASE SYNDROME, SYPHILIS, SEPTICEMIA AND AUTOIMMUNE DISEASES

N.H. Yoshinari[1], C.O. Soares[2], A.H. Fonseca[2], A. Scofield[2], V.L.N. Bonoldi[1], M. Abrahão[1], D.M. Barros-Battesti[3] & C.R. Madruga[4], [1]Dept. Clínica Médica, Fac. Med., Univ. São Paulo, Ave. Dr. Arnaldo, 455, 01246-903, São Paulo, SP, BR; [2]Dept. Epidemiologia e Saúde Pública em Doenças Parasitárias, Univ. Fed. Ru. Rio de Janeiro, 23890-000, Seropédica, RJ, BR; [3]Lab. Parasitologia, Inst. Butantan, Ave. Vital Brazil, 1500, 05503-900, São Paulo, SP, BR, E-mail-dbattest@usp.br; [4]EMBRAPA Gado de Corte, Caixa Postal 154, 79002-970, Campo Grande, MS, BR.

Babesiosis is a common parasitic disease, transmitted by ticks, that affects domestic animals. However, little is known about human infection in Brazil. The aim of this study is to verify and compare antibody response against *Babesia bovis* in normal controls, different infectious and autoimmune diseases. Casuistic: normal controls (NC=36), Lyme-like disease (LLD=47), systemic lupus erythematosus (SLE=10), scleroderma (Scl=10), rheumatoid arthritis (RA=10), syphilis (Syp=22) and septicemia (Sep=28). Enzyme-linked immunosorbent assay (ELISA) and western-blotting (WB) were done for IgG and IgM antibody detection using *Babesia bovis* sonicated antigens. Briefly, Immulon 1 plates were sensitized with 7,5 ug/ml antigens diluted in carbonate buffer, ON at 4 °C. After blocking with PBS-rabbit serum 1%, diluted 1/100 (IgM) or 1/400 (IgG) sera with PBS was added in duplicate and incubated for 1h and 30 min. IgM (1/1500) or IgG (1/2000) goat anti human was used, and finally the plate was read by adding pNPP substrate. WB was done electrophoresing 600 ug of antigens, using SDS-poliacrylamide gel (mini Protean II system), during 2 hs at 25mA. Proteins were transferred from gel to NC paper ON, 25V, 4 °C. After blocking with PBS-rabbit serum 1%, each NC strip was incubated during 1h and 30 min. with diluted 1/100 (IgM or IgG) sera. After incubation with conjugates, the assay was revealed using BCIP/NBT substrates. WB confirmed ELISA results, showing 2-4 bands, specially against 21, 45, 52,62 or 94 Kda proteins. Patients with syphilis revealed reactivity against 71 and 80 Kda antigens. The positiveness demonstrated by one of the patients with LLD (one month history), bitten by ticks, was surprisingly high. This patient presented 8,7 times IgG cut off (mean plus three standard deviation) and 25,2 times IgM cut off, suggesting simultaneous infections with *Borrelia* sp. and *Babesia bovis*. The symptoms related to babesiosis in Brazil are still unclear, despite the existence of humoral serum convertion.

Index terms: babesiosis - *Borrelia* sp. - serology - simultaneous infections

3249] MALE-FEMALE DIFFERENCES IN NEUROPEPTIDE PROFILES IN LOCUSTS

A. De Loof, M. Breuer, A. Cerstiaens, E. Clynen, G. Baggerman, L. Schoofs, I. Claeys, T. Janssen, J. Vanden Broeck, Zoological Institute of the University, Naamsestraat 59, 3000 Leuven, Belgium

The problem of how differences in sex-determining genes are translated into differences of signaling molecules that cause the male or female phenotype and physiology is far from solved. There are two opposing views. One says that in insects sex is strictly genetic and that there are no sex hormones. The other view says that gender-related differences in gene expression give rise to differential hormonal balances that contribute to sexual differentiation. In vertebrates, the most critical event is the formation of Sertoli cells, which produce a protein hormone (AMH) that triggers a cascade of male phenotype-inducing hormonal changes. Over 30 years ago, J. Naisse reported the existence of an androgenic hormone, produced by the apical cells in the testis of the firefly *Lampyris*. This hormone has not yet been identified. In crustaceans, there is an androgenic gland which produces an androgenic hormone. In the isopod *Armadillidium*, its sequence was determined by Martin *et al.* (1999) and its cDNA cloned by Okuna *et al.* (1999). In arthropods, gender specific differences become visible at molts, suggesting that some of the hormones controlling molting could be involved in bringing about the gender specific phenotype. Upon a reexamination of numerous data from the literature, De Loof and Huybrechts (1998) forwarded the idea that ecdysone (E) functions both as the physiological counterpart of testosterone of vertebrates and as the precursor of the moulting hormone 20-E, the latter also being the physiological counterpart of estrogens of vertebrates. According to this hypothesis, animals that cannot maintain a high titer of E in their hemolymph during critical stages in development will become males. To our knowledge, differences in neuropeptides between male and female insects were never reported. We cloned the different isoforms of the neuroparsin in *Schistocerca* and studied their expression during development. Of the 4 isoforms, some are differentially expressed in the brain, others in the fat body. The ovary does not express any of the isoforms but the testis does. This is the first indication of a gender specific difference in an insect neuropeptide. The expression pattern of Ovary Maturating Parsin is also under study. By means of direct mass spectrometrical peptidomics of the pars intercerebralis of locusts, no pronounced differences could be found in the profile of the small peptides.
Index terms: gonadotropins, neuroparsin, ecdysone

[3250] TESTIS ECDYSIOTROPIN, AN INSECT GONADOTROPIN THAT INDUCES SYNTHESIS OF ECDYSTEROID

M. J. Loeb[1], A. DeLoof[2], D.B. Gelman[1], R.S. Hakim[3], H. Jaffe[4], J. P. Kochansky[1], S.M. Meola[5], L. Schoofs[2], X. Vafopoulou[6], R.M. Wagner[7] & C.W. Woods[8], 1. U.S. Dept of Agriculture, Beltsville, MD, 20705, USA; 2. Zool. Inst. Leuven, Belgium; 3. Howard Univ. Washington D.C., 20059, USA; 4. N.I.H., Bethesda MD. 20892, USA; 5. U.S.Dept of .Agriculture. College Station TX 77840, USA; 6. York Univ. Toronto, Canada M3JIP3; 7. U.S.Dept. of Agriculture, Columbia MO 65203, USA; 8. Univ. Md, College Park MD 20742, USA

Insect testes can be induced to synthesize ecdysteroid by a brain neuropeptide, testis ecdysiotropin (TE). Although the original evidence for this peptide came from studies on Lepidoptera, TE also induces ecdysteroid synthesis by gonads of Orthopteran and Heteropteran sp. The predominant compound of the several active peptides isolated from *Lymantria dispar* brains was a 21 amino acid peptide (ISDFDEYEPLNDADNNEVLDF-OH), M_r 2472 Da (LTE). This molecular sequence is different from those ecdysiotropins that affect the prothoracic glands; it does not activate prothoracic glands. Furthermore, unlike prothoracicotropins, antibody made against synthetic LTE reacts positively with medial as well as lateral neurosecretory cells in the Lepidopteran brain. It also stains cells in the optic lobes and nerves of presumptive antenna and proboscis of pupal *L. dispar,* and may have a developmental role in addition to its gonadotropic role. Basal ecdysteroid synthesis by *Heliothis virescens* pupal testes is controlled by positive feedback at a narrow range of high exogenous titers of ecdysteroid, suggesting that high titers of this hormone circulating in the hemolymph prior to the final larval molt and early pupal period coordinate the actions of the gonads with metamorphic events in the whole animal. In *L. dispar*, LTE induces ecdysteroid synthesis via G_i protein in the presence of low calcium influx to induce release of the second messenger, diacyl glycerol, which in turn results in activation of phosphokinase C. An opposing system appears to be mediated by a peptide similar to the vertebrate hormone angiotensin II. The inhibitory cascade for LTE involves G_s protein and its resultant messenger, cyclic AMP, and activates phosphokinase A. The interplay of opposing controls serves to fine tune a system essential to gonadal development and function at appropriate times in the insect life cycle. Gonadal ecdysteroid stimulates the release of growth factor(s) from sheaths of *H. virescens* testes. These growth factors are necessary to induce mitosis, growth and maturation of the genital tract in tissue culture conditions. At least one of the growth factors produced by the testis sheaths appears to be very much like the vertebrate factor, alpha-1- glycoprotein.
Index terms: Neurosecretion, Maturation *Heliothis virescens, Lymantria dispar*

[3251] MIMETIC INSECTATACHYKININ ANALOGS: INTERACTION WITH AN EXPRESSED STABLE FLY TACHYKININ-LIKE RECEPTOR AND ACTIVE CONFORMATION

R. J. Nachman[1], J. V. Broeck[2], H. Williams[3] & R. E. Isaac[4], [1]Veterinary Entomology Research Unit, Southern Plains Agricultural Research Center, USDA, ARS, 2881 F&B Road, College Station, TX, USA 77845, E-mail: nachman@acs.tamu.edu; [2]Laboratory for Developmental Physiology & Molecular Biology, Catholic University of Leuven, Naamsestraat 59, Leuven, Belgium, B-3000; [3] Department of Chemistry, Texas A&M University, College Station, TX, USA 77840; [4]Department of Biology, University of Leeds, Leeds, UK LS2 9JT.

A G-protein-coupled receptor, labeled STKR, cloned from the stable fly, *Stomoxys calcitrans*, shows sequence-similarity to vertebrate NK tachykinin receptors and has been functionally expressed in stably transfected *Drosophila* S2 cells. Natural insectatachykinin peptides, including an insectatachykinin recently isolated from the stable fly, activate the expressed receptor system whereas vertebrate tachykinins do not. Fragment analogs of an insectatachykinin nonapeptide demonstrate that receptor activation can be achieved up to and including the pentapeptide fragment FTGMRa. An Ala-replacement series of analogs indicated that receptor activity is retained except when the highly conserved C-terminal pentapeptide residues Phe (-5) and Arg (-1) are replaced by Ala. A comparison of solution conformations of active, analogous analogs of the insectatachykinin and the vertebrate tachykinin substace P, containing the hindered residue block NMeTyr-Aib, demonstrate that they share a very similar turn shape incorporating a *cis* peptide bond between the NMeTyr and Aib residues. The insectachykinin analog demonstrated binding to the expressed stable fly STKR receptor. This and related Aib-containing insectatachykinin analogs demonstrate enhanced resistance to the peptidases ACE and NEP. The very similar solution conformations of the two analogous restricted conformation analogs are consistent with a distant evolutionary relationship between the tachykinins and insectatachykinins, and can be considered along with evidence obtained from comparisons of physiological cross-activity, the shared antagonist response of spantide, sequence similarities and receptor homology.
Index terms: tachykinin, β-turn, *Stomoxys*, homology, peptidase-resistance.

[3252] ACTIVATION OF STEROIDOGENESIS IN FEMALE MOSQUITOES BY OVARY ECDYSTEROIDOGENIC HORMONE AND INSULIN

M. R. Brown, M. A. Riehle, & C. Cao, Department of Entomology, University of Georgia, Athens, GA 30602, USA, Email mbrown@bugs.ent.uga.edu.

In the anautogenous mosquito, *Aedes aegypti*, neuropeptides are released from brain neurosecretory cells shortly after a blood meal and stimulate the ovaries to secrete ecdysteroids. The rising titer of ecdysteroids activates the fat body to synthesize yolk proteins, which are stored in eggs and used during post-embryonic development. One such neuropeptide, ovary ecdysteroidogenic hormone I (OEH I), stimulates egg maturation in blood-fed decapitated females, presumably through its direct activation of steroidogenesis, as demonstrated both *in vivo* and *in vitro*. This peptide occurs in the medial neurosecretory cells (MNC) of the brain, midgut endocrine cells, and the perisympathetic nervous system and is present in hemolymph for more than 12 h after a blood meal. Because bovine insulin mimics the effects of OEH I both *in vivo* and *in vitro*, endogenous insulin-like peptides (ILP's) are thought to play a role in steroidogenesis. Insulins and OEH I share no obvious structural similarities. Two types of ILP's have been identified in brain neurosecretory cells and midgut endocrine cells in female mosquitoes, and efforts to isolate these peptides for structural and functional characterization are in progress.
Both OEH I and bovine insulin stimulate ovary steroidogenesis *in vitro* through the activation of a receptor tyrosine kinase (RTK) and the phosphotidyl inositol 3-kinase (PI3-K)/protein kinase B (PKB) pathway, as indicated by the effects of selected inhibitors and activators. In mammals, insulin and growth factors regulate aspects of metabolism, apoptosis, and immunity through this same pathway. An insulin receptor homologue has been characterized for this mosquito, although its ligand is yet to be identified. The receptor is localized in membranes of ovary follicle cells and fat body, and its expression in ovaries is affected by reproduction and aging. Characterization of mosquito PI3-K and PKB is in progress, but the final steps in this pathway that directly activate ecdysteroid biosynthesis have yet to be elucidated. Steroidogenesis is a fundamental process in every life stage of an insect, and its activation through an RTK/PI3-K/PKB pathway in an adult insect stands in contrast to that demonstrated for prothoracic glands (PTG) in a lepidopteran larva. In the larva, prothoracicotropic hormone is thought to act through a G protein-coupled receptor/adenylate cyclase/cAMP pathway in stimulating steroid synthesis. The existence of two pathways for the activation of this process points to either a redundancy or a reformation in the transition from larva to imago.
Index terms: *Aedes aegypti*, ecdysteroids, oogenesis, signal transduction

[3253] MULTIPLE PEPTIDE FAMILIES ARE INVOLVED IN THE NEURAL CONTROL OF REPRODUCTIVE TISSUES OF THE FEMALE LOCUST

A.B. Lange, J. Clark & A. Donini, Dept. Zoology, Univ. Toronto at Mississauga, 3359 Mississauga Rd., Mississauga, ON, Canada, L5l 1C6. Supported by NSERC

The spermatheca is a structure in the female which acts as a repository for spermatazoa deposited by the male. The spermatheca in *Locusta migratoria* consists of the spermathecal sac and spermathecal duct which are situated dorsal to the lateral and common oviducts. In the locust, eggs mature in the ovaries and are ovulated into the lateral oviducts where they are held till a suitable oviposition site is found. At that time, aided by muscular contractions of the lateral oviducts, the eggs are propelled through the common oviduct and genital chamber and are arranged into an egg pod deposited in the soil. During the passage of eggs through the genital chamber, spermatozoa are deposited onto the micropyle of the egg, and the egg is fertilized. Contractions of the spermathecal sac lead to the spermatozoa release. Coordination of the oviducts and spermatheca is clearly critical to the production of viable eggs, and an understanding of the neural control of both oviducts and spermatheca can aid in illustrating the integrative actions of these two visceral muscles. A combination of neurophysiology, neuroanatomy and immuno-histochemistry illustrates the neural substrate involved in the control of the spermatheca and oviducts. Both structures are under central neuronal control and involve neurons which express an array of peptide and amine phenotypes. A reflex loop, incorporating sensory cells found on the genital chamber, is involved in controlling spermatozoa release during egg-laying. This paper will review our understanding of the neural control of these reproductive tissues and the coordination of events leading to the deposition of a fertilized egg.

Index terms: *Locusta migratoria*, oviducts, spermatheca, neuropeptides, neural circuits

[3254] HORMONAL CONTROL OF BODY-COLOR POLYMORPHISM IN LOCUSTS: [HIS^7]-CORAZONIN AND JH

S. Tanaka, Dept. of Insect Physiology and Behavior, National Institute of Sericultural and Entomological Science, Tsukuba, Ibaraki 305-8634, Japan.

The body-color polymorphism in locusts is controlled by various factors. While the environmental relations are well understood, our knowledge on the hormonal relations is limited in spite of the intensive studies with two major plague locusts, *Locusta migratoria* and *Schistocerca gregaria* during the past half century. In the last 8 years, our laboratory focused mainly on the hormonal control of body-color polymorphism in locusts. The present paper will review our main results showing that this phenomenon may be explained by two hormones in *L. migratoria*. The establishment of an albino mutant strain of *L. migratoria* was the beginning of our study on this subject. Implantation of corpora cardiaca (CC) or brain from normal (pigmented) locusts into albino nymphs caused the latter to develop a dark color. Methanol extracts of CC or brains also induced darkening in albino nymphs when the dried extracts were mixed with oil and injected. A similar phenomenon was also found in *S. gregaria*. Recently, a collaborative study with Belgium and Israel succeeded to isolate the dark-color inducing factors from the two species, and revealed that they are the same peptide, [His^7]-corazonin. By varying the dose and the timing of the injection into albino nymphs, it was found that this peptide induced black, brown, gray and reddish body colors, often manifested by solitary nymphs in the field. Interestingly, the gregarious coloration with black patterns and orange background color was also expressed in albino nymphs when the peptide was injected in the middle of the previous instar. In this case, crowding was not required, and injection of the peptide induced the gregarious coloration even in field-collected solitary nymphs. Injection of juvenile hormone (JH) caused albino nymphs to turn green, as expected from other studies, but they looked different from normal solitary green locusts in which the ventral side of the body and some portions of legs are brown or variously pigmented. Body coloration looking like the latter was obtained when albino nymphs were injected with both JH and [His^7]-corazonin. Therefore, these two hormones appear to control the body-color polymorphism in *L. migratoria*. We discovered that the CC or brain from other insect species such as cockroaches, crickets, katydids, cicadas, dragonflies, moths and butterflies also contain a factor(s) that can induce dark color in locusts. Recently, we isolated another peptide, [Arg^7]-corazonin from a cricket, *Gryllus bimaculatus* and a silkworm, *Bombyx mori*. This peptide is as potent as [His^7]-corazonin in terms of the dark-color inducing action in locusts, but its function in the cricket and silkworm is unknown.

Index terms: *Locusta migratoria*, *Schistocerca gregaria*, corazonins, JH, body color.

[3255] ALLATOSTATINS: DIVERSITY IN STRUCTURES, FUNCTIONS, AND OCCURRENCE

M.W. Lorenz, Department of Animal Ecology 1, University of Bayreuth, 95440 Bayreuth, Germany, E-mail: matthias.lorenz@uni-bayreuth.de.

Allatostatins (ASTs) are neuropeptides that inhibit juvenile hormone biosynthesis by insect corpora allata. To date, they can be divided into three families: the first ASTs have been identified from the brain of the cockroach *Diploptera punctata*. These peptides belong to the so-called cockroach- or Phe-Gly-Leu-AST family. Peptides of this family have been subsequently isolated from other cockroaches as well as from stick insects, locusts, crickets, blowflies, mosquitoes, honey bees, moths, and even from a crustacean. Their allatostatic activity, however, seems to be restricted to cockroaches and crickets. A second "family" of ASTs is represented by a single peptide, the Mas-AST, isolated from the tobacco hornworm *Manduca sexta*. This peptide shows allatostatic activity only in lepidopterans. A third family of ASTs has been isolated from the cricket *Gryllus bimaculatus* and from the stick insect *Carausius morosus*. These peptides belong to the so-called W^{2}W^{9}amide family, previously isolated from the locust *Locusta migratoria* and from *M. sexta*, where they inhibit contractions of smooth muscles. Their allatostatic function seems to be restricted to crickets. Immunohistochemical studies in insects and also in non-insect invertebrates like Hydrozoa, Cestoda, Trematoda, Turbellaria, Nematoda, Oligochaeta, Gastropoda, Cephalopoda, and Crustacea, where Phe-Gly-Leu-AST immunoreactivity has been found not only in the central but also in the stomatogastric nervous system, points towards additional (basic?) functions of these peptides as neurotransmitters/neuromodulators with roles in locomotion, feeding, reproduction, and sensory perception. This assumption is corroborated by several findings on AST action in insects: for both the Phe-Gly-Leu and the W^{2}W^{9}amide family a myoinhibiting role has been established. In addition, the Phe-Gly-Leu-AST inhibit vitellogenin release from the periovaric fat body of the cockroach *Blattella germanica*, whereas the W^{2}W^{9}amide peptides are potent inhibitors of ovarian ecdysteroid biosynthesis in *G. bimaculatus*. Since all these physiological actions directly or indirectly affect developmental and reproductive events, ASTs play a crucial role in insects. On the basis of recent results on allatostatic peptides in crickets and stick insects, the role and function of these multifunctional peptides in insect reproduction and development, the use of ASTs (and analogues thereof) in insect pest control, and possible evolutionary relationships will be discussed.

Index terms: Ensifera, Phasmatodea, Neuropeptides, Juvenile Hormone, Ecdysone

[3256] FMRFAMIDE-LIKE MATERIAL IN THE EARWIG, *EUBORELLIA ANNULIPES*, AND ITS FUNCTIONAL SIGNIFICANCE

S.M. Rankin & S.M. Seymour, Dept Biol, Allegheny Coll, Meadville, PA 16335, U.S.A.

The neurosecretory system of the earwig, *Euborellia annulipes*, contained material similar to that of FMRFamide, as shown by immunocytochemistry. Within the brain were two pairs of darkly staining perikarya in the medial protocerebrum, and up to four pairs of immunoreactive cells in the lateral protocerebrum. The retrocerebral complex appeared lightly immunoreactive in 10-day females, but not in 2-day old adults. Starvation appeared to enhance immunostaining. FMRFamide at 10-7 or 10-9 M did not inhibit juvenile hormone production by earwig corpora allata *in vitro*. This was true of glands of low activity from 2-day fed or starved virgin females, and those of relatively high activity from 10-day old, fed virgin females. In contrast, FMRFamide at 10-7 (but not at 10-9) M was effective in stimulating gut motility *in vitro* in distended guts from 2-day females. Preparations from starved females and those from 10-day fed females (in which feeding behavior is on the decline) did not respond to exogenous FMRFamide with enhanced rates of contraction.

Key words: earwigs, neuropeptides, gut motility, corpora allata

[3257] TOPOCHEMICAL LOCALIZATION OF PERIVISCEROKININS AND PYROKININS IN THE CEPHALIC NERVOUS SYSTEM OF THE AMERICAN COCKROACH

M. Eckert & R. Predel, Inst. für Allg. Zoologie und Tierphysiol., Univ. Jena, Erbertstr. 1, 07743 Jena, Germany; E-mail: b5ecma@pan.zoo.uni-jena.de

Periviscerokinins (PVKs) and pyrokinins (PKs) of the American cockroach were isolated directly from neurohaemal organs by Predel and co-workers. PVK-1, PVK-2, PK-5, and PK-6 were identified from abdominal perisympathetic organs, whereas PK-1 to -4, and PK-6 were found in the retrocerebral complex. In this study, we investigated the distribution of these neuropeptides in the cephalic nervous system. Antisera raised against PVK-1, PVK-2, and PK-5 were purified by affinity chromatography. Additionally, an antiserum against PK-2, which could not distinguish between the different FXPRLamides, was used. In the cephalic nervous system, PVK-1, and PK-5 like immunoreactivity (IR) was found in interneurons only. The retrocerebral complex, which includes the corpora cardiaca/corpora allata, did not reveal any immunoreactivity. Most immunoreactive interneurons are characterized by the co-localization of PVK-1, PVK-2, and PK-5 as revealed by double-immunofluorescence stainings. Using a partially purified anti-PK-5 serum which did cross-react with PK-6 but not PK-1 to -4, we compared the immunostaining with that after preabsorption of the anti-PK-5 serum with PK-6. PK-6 like IR was found mainly in neurosecretory neurons of the tritocerebrum and suboesophageal ganglion which project via the nervi corporis cardiaci-1 and -3, as well as nervi corporis allati-2 into the retrocerebral complex. In these neurons, PK-6 was never found to be co-localized with PVK-1, PVK-2, and PK-5. We are unable to decide if PK-6 is co-expressed together with PK-1 to -4 because our antiserum against PK-2 recognized the C-terminus of all pyrokinins. But, there are numerous neurosecretory neurons with PK-2 like IR in the brain/suboesophageal ganglion which supplied the retrocerebral complex and did not contain PK-6.

Index terms: *Periplaneta americana*, FXPRLamide, insect neuropeptides, immunocytochemistry.

[3258] NEUROPEPTIDES IN LOCUSTS: PROGRESS IN THE SEARCH FOR FUNCTIONS

L. Schoofs[1], M. Breuer[1], A. Cerstiaens[1], G. Baggerman[1], Z. Wei[1], E. Clynen[1], T. Vercammen[1], S. Tanaka[2] & A. De Loof[1], [1]Zoological Inst., K.U.Leuven, Naamsestr. 59, 3000 Leuven, Belgium, E-mail liliane.schoofs@bio.kuleuven.ac.be; [2]NISES, Tsukuba, Ibaraki 305-8634, Japan.

Immunohistochemical results on FMRFamide-related peptides (FaRPs) have been reported extensively in arthropods, suggesting many possible roles for these peptides associated with behavioural and physiological events, including reproduction. Our recent study provides a clear effect for the neuropeptide F (NPF) members of this family. NPF-related peptides act as gonadostimulins in *Locusta migratoria*. Consecutive injections 0.05 µg of peptide into 6-day old virgin females were able to accelerate egg development significantly. In vertebrates, the peptides cholecystokinin (CCK), neuropeptide Y (NPY), galanin, bombesin and orexin are known to be involved in the control of food intake. The locust neuropeptide, locustasulfakinin, as well as other naturally occurring insect sulfakinins, which display substantial sequence similarities with the vertebrate gastrin/CCK peptide family, significantly inhibit food uptake in fifth instar nymphs of the locust, *Schistocerca gregaria* in a dose-dependent manner within a fixed 20 min time period. The induced satiety effect ranged from 13% inhibition (10 pmol of injected peptide) to over 50% inhibition at 1 nmol. Analogous to CCK in vertebrates, the sulfate group is required for activity. In response to crowding, locusts develop characteristic black patterns that are well discernible in the gregarious phase at outbreaks. Using a bioassay with an albino mutant of *L. migratoria*, the responsible dark colour inducing hormone was isolated corpora cardiaca (CC) extracts and identified as [His^7]-corazonin. In isolated (solitary) nymphs of *L. migratoria*, [His^7]-corazonin induces gregarious black patterns. By differential peptide profiling of isolated versus gregarious locust nervous tissue and haemolymph extracts, we now aim at the identification of phase-specific neuropeptides. We conclude that neuropeptides previously identified on the basis of their myotropic activity appear to be regulatory hormones of physiological processes. In order to exert their effect, these peptides have to be released in the haemolymph. Currently, haemolymph titres of the regulatory hormones are being established. In addition, we are studying the release of neuropeptides from the CC using mass spectrometry methodology. We recently found that in addition to the AKIIs, serine protease inhibitors are released into a medium with high potassium concentration. Another small peptide encoded in the B-chains of the AKH precursor was likewise identified in the secretion mixture of peptides from the corpora cardiaca. The application of mass spectrometry in the study of peptide-releasing factors will be discussed.

[3259] TMOF BIOTECHNOLOGY: A NEW BIORATIONAL APPROACH TO CONTROL INSECTS WITH PEPTIDE HORMONES

D. Borovsky, S. Nauwelaers & Y. Schlesinger, University of Florida-IFAS, Florida Medical Entomology Laboratory, 200 9th St SE, Vero Beach, FL32962.USA. E-mail dobo@icon.vero.ufl.edu.

Trypsin Modulating Oostatic Factor (TMOF) is a decapeptide that was isolated from the ovaries of female *Aedes aegypti* and is the physiological signal that terminates trypsin biosynthesis in the mosquito gut. The hormone is secreted into the hemolymph by the mosquito ovary 24 hours after the blood meal, it binds to a gut specific receptor and terminates trypsin biosynthesis by inhibiting the translation of trypsin mRNA. Hormonal titers have been followed in the hemolyph of female *Aedes aegypti* and *Culex quinquefasciatus* indicating that in *Culex*, as well as, in *Aedes* the same hormone regulates trypsin mRNA translation. Feeding female *Aedes aegypti* blood containing TMOF stopped trypsin biosynthesis resulting in the inhibition of blood digestion directly and yolk protein biosynthesis indirectly. These results results indicate that the hormone can penetrate unhindered through the mosquito gut, bind to its receptor on the hemolymph side and stop blood digestion. Since mosquito larvae also synthesize trypsinlike enzymes in their midgut, we adsorbed the hormone unto yeast particles and fed them to three species of mosquito larvae (*Aedes aegypti*, *Culex quinquefasciatus* and *Anopheles quadrimaculatus*) causing inhibition of trypsin biosynthesis and larval death in all three species. Using molecular bioengineering technology the hormone was cloned into *Chlorella* sp. *Chlorella desiccata* and yeast cells (Saccharomyces cereviciae) alone or as a fusion protein with Green Fluorescent Proein (GFP). TMOF and GFP_TMOF were then expressed in *chlorella* and in yeast cells and quantitated by ELISA and RIA. Recombinant cells that produced high quantities of TMOF and GFP_TMOF were then fed to mosquito larvae in microtiter plates and larval mortality was followed and compared to controls that were fed on non-recombinant *Chlorella* and yeast cells. Larvae that were fed on recombinant *Chlorella* or yeast cells producing TMOF or GFP_TMOF did not digest their food and died from starvation, whereas controls that were fed on *Chlorella* and yeast cells that produced GFP but not TMOF developed normally. The relevance of these findings to biotechnological development of TMOF as a future biorational larvicide will be discussed.

Index terms: Mosquito, Cloning, Yeast, *Chlorella*, Biotechnology

[3260] ANATOMY AND FUNCTIONS OF BRAIN NEUROSECRETORY NEURONS WITH REGARD TO REPRODUCTIVE DIAPAUSE IN *PROTOPHORMIA TERRAENOVAE*

S. Shiga & H. Numata, Dept. of Bio- and Geosciences, Grad. Sch. of Sci., Osaka City Univ., Sumiyoshi, Osaka 558-8585, Japan, E-mail shigask@sci.osaka-cu.ac.jp

A key factor in reproductive diapause is the reduction of the corpus allatum (CA) activity to secret juvenile hormone (JH). Surgical manipulations have demonstrated that the brain exerts its control over the CA by both humoral and neural pathways. However, cerebral neurons which actually control the CA for reproductive diapause are not understood well. Neurosecretory neurons terminating the retrocerbral complex including the corpus cardiacum (CC) and CA are of great interest with regard to the physiological mechanism of reproductive diapause. In the present study we did anatomy and micro-lesions of the brain neurosecretory neurons to examine their possible roles in the induction of reproductive diapause of the female blow fly, *Protophormia terraenovae*. Nickel-fills through the cardiac-recurrent nerve labeled three groups of neurons in the brain/subesophageal ganglion: PI (pars intercerebralis) neurons, PL (pars lateralis) neurons and SEG (subesophageal ganglion) neurons. Among these the PL neurons and a few PI neurons send fibers to the CA, but the SEG neurons do not. The PI neurons project primarily to the CC/hypocerebral ganglion complex. The dendritic arborization of the PI and PL neurons was found in the superior protocerebral neuropil. Intact females developed their ovaries under LD 18:6 at 25°C but did not under LD 12:12 at 20°C. When PI cells were removed, the ovaries invariably failed to develop under both conditions. When the PL neurons were removed bilaterally, the ovaries developed in most of the females, irrespective of the rearing conditions. Removal of the PL prevented females from entering reproductive diapause. The results of sham-operation group was not significantly different from those of intact group. The present results show that certain neurosecretory neurons in the PI are necessary for vitellogenesis and that the PL contains inhibitory neurons which suppress vitellogenesis during reproductive diapause.

Index terms: neurosecretory cells, blow fly, pars intercerebralis, pars lateralis.

[3261] ANGIOTENSIN CONVERTING ENZYME-LIKE ACTIVITY IN THE FLESHFLY *NEOBELLIERIA BULLATA*

A.Vandingenen, W. Zhu, K. Hens, I. Janssen, N. Macours, M. Breuer, A. De Loof & R. Huybrechts, Lab. Develop. Physiol. & Mol. Biol., Naamsestraat 59, B-3000 Leuven, Belgium

In insects angiotensin converting enzyme-like or ACE activity is observed in most organs tested and in accordance to the presence of a secretory signaling peptide in the pre-enzyme, ACE is found to be circulating in the hemolymph. Zero-ACE mutants of *Drosophila* underlined the importance of this enzyme for early development and male fertility but direct indications about more concrete involvement of ACE in the insects physiological system are still lacking or remain speculative. Therefore knowledge about naturally occurring endogenous substrates for this enzyme would be very helpful. During our study of the metabolic stability of the fly's oostatic peptide Neb-TMOF within the circulatory system we withhold hemolymph ACE to be the major and only metabolizing enzyme. Indeed only captopril and lisinopril fully inhibited the cleavage of this peptide and recombinant *Drosophila* AnCE resulted in exactly the same cleavage products, as did crude hemolymph of *N.bullata*. In agreement with earlier reports on ovarian Neb-TMOF being responsible for the posttranscriptional downregulation of trypsin activity in the gut we determined the hemolymph ACE activity throughout the entire vitellogenic cycle hoping to observe regulatory changes in the activity profile. Our experiments show the constitutive presence of rather high levels of ACE in the hemolymph of all stages tested. A complete phenotypic knockout of ACE, as realized by continuous feeding of captopril, does not result in an atypical phenotype in terms of observable changes in follicle development. However captopril fed animals show an upregulation of the protein meal induced trypsin activity in their gut and this both in males and females. In additional experiments we tried to confirm in our flies the reported accumulation of ACE activity in developing follicles of mosquitoes: We only detected minute amounts of ACE activity in ovarial extracts of our flies. However, these seemingly conflicting data are explained by the demonstrated simultaneous accumulation of one or more inhibitors. Identification of these endogenous inhibitors is in progress and their role will be discussed at the meeting.

[3262] RECENT PROGRESS IN GENOMIC MAPPING IN *BOMBYX MORI*: WHERE SHOULD WE GO FROM HERE?

M. R. Goldsmith[1], P. Zeng[1], K. Okano[2], S. Marino[1], D. Mills[1], K. Mita[3], T. Sugasaki[4], T. Shimada[4], & Y. Yasukochi[5], [1]Biological Sciences Dept., URI, Kingston, RI, 02881, USA; [2]Lab. of Molec. Entomol. & Baculovirol., RIKEN, 2-1 Hirosawa, Wako-shi, Saitama, 351-0198, Japan; [3]Genome Research Group, NIRS, Anagawa 4-9-1, Inage-ku, Chiba 263-8555, Japan; [4]Lab of Insect Genetics & Bioscience, Dept. of Agricultural & Environmental Biology, Graduate School of Agricultural & Life Sciences, Univ. Tokyo, Yayoi 1-1-1, Bunkyo-ku, Tokyo 113-8657, Japan; [5]Y. Yasukochi, NISES, Owashi 1-2, Tsukuba, Ibaraki 305-8634, Japan.

Molecular linkage maps are being constructed in the domesticated silkworm using a variety of markers, including RFLPs, RAPDS, and STSs. The longterm aims of this work are to provide anchor loci which can serve as frameworks for positional (map-based) cloning of specific genes and mutations, construction of local and long-range physical maps using BAC libraries, analysis of quantitative trait loci (QTL) in inbred stocks, and comparative genomics. Integration of independently constructed molecular maps with each other and with the established maps of visible mutations and biochemical markers has been facilitated by using common inbred reference strains. To enable mapping by PCR and to create a database of universal markers which can be mapped without direct exchange of genetic material, expressed sequence tags (ESTs) and STSs have been determined for many previously mapped anonymous markers. In addition, synteny with provisional and known linkage groups has been established for a number of highly conserved ESTs in order to create a set of markers that can be used to test the degree to which chromosomes or chromosome segments are conserved among different lepidopteran species and other insects. With 22 of 28 established linkage groups now correlated with the molecular maps and a total of more than 200 codominant markers assigned to linkage groups or internal map position, the immediate goal of developing medium-density framework maps of minimally 2 codominant markers per linkage group is nearing completion. In addition to increasing the density and coverage of the molecular maps to reach levels consonant with the original aims of the project, future efforts should be focused on increasing the utility of the silkworm as a model for understanding the genetics and biology of lepidopteran pests, specifically to aid in devising new strategies for pest control. Approaches for doing this will be proposed, including a concerted effort to map genes that control early developmental pathways, the immune response, fertility, fecundity, and known mechanisms of pesticide resistance.

Index terms: molecular linkage map, EST, RFLP, RAPD

[3263] LINKING LEPIDOPTERAN GENOMES WITH ANCHOR LOCI

D. G. Heckel[1], [1]Dep. of Genetics, Univ. of Melbourne, Parkville 3052, Victoria, Australia, Email d.heckel@ genetics.unimelb.edu.au.

Molecular linkage maps have been constructed for four species of Lepidoptera (*Bombyx mori, Heliothis virescens, Helicoverpa armigera, Plutella xylostella*) and others are in progress. Unfortunately the techniques utilized (RAPDs and AFLPs) do not permit ready comparison of markers across species, severely limiting the utility of the model system *Bombyx mori* in understanding the genetics of other Lepidoptera. To solve this problem, we are developing and mapping a set of common anchor loci in several species. To identify suitable candidates, we have used sequence information from the *Bombyx* EST project made available in SilkBase by the *Bombyx* Genome Database Working Group (Dr. Toru Shimada, Dr. Kazuei Mita, and co-workers--http://www.ab.a.u-tokyo.ac.jp/silkbase/). Working with a subset of this collection, we have constructed a "UniGene Database", a partitioning of the EST dataset into a non-redundant set of gene-oriented clusters. Each cluster contains multiple ESTs from the same unique gene. Each cluster for which a meaningful consensus sequence could be constructed was then used in BLAST searches of GenBank, to identify protein sequences conserved in mammals, *C. elegans*, *Drosophila*, and yeast. We discuss the methodological details of constructing the UniGene Database, the set of highly conserved loci that was identified, efficient strategies for using these as anchor loci in interspecific genomic comparisons, and how the results can be used in developmental studies of other species of Lepidoptera as well as in understanding genetic mechanisms of insecticide resistance in pest Lepidopteran species.

Index terms: *Bombyx mori*, genomics, linkage mapping, EST, UniGene

[3264] RELATIONSHIPS BETWEEN THE LOCATION AND THE RADIATION SENSITIVITY OF RETROTRANSPOSONS IN THE GENOME AND THE INSERTION MECHANISM

H. Maekawa[1], H. Fujimoto[1, 2], M. Matsunami[1], K. Tsuchida[1], Y. Hirukawa[1], K. Hashido[1], Y. Matsuura[3], N. Takada[1] and M. Kobayashi[2], [1]Div. of Radiol. Prot. and Biol., Natl. Inst. of Infect. Diseases, Tokyo, Japan, [2]Faculty of Agriculture, The Univ. of Tokyo, Tokyo, Japan, [3]Dept. of Virology II, Natl. Inst. of Infect. Diseases, Tokyo, Japan.

Non-LTR retrotransposons, R1Bm and R2Bm, are well known to be located in 28S rRNA gene of rDNA cluster. These elements are inserted into the specific target sites. For the organism, thus insertion could give rise to a great risk because the insertion into the important housekeeping genes is resulted in making abnormal rRNAs. We have considered the elements must have significant function as a chromosomal component. The first observation regarding this working hypothesis was obtained by FISH analysis using R1Bm probe to the prometaphase chromosomes of the first meiosis of testis. The rRNA transcription still occurs at this stage and we could see FISH signals of R1Bm locating on the condensed region of rDNA cluster but not on chromatin region unwinding and opening for the transcription. R2Bm probe was also hybridized to only non-opening region in the cluster. We can speculate that the condensation of chromatin physically caused the abolish of the transcription and hence the aberrant transcript was not able to be transcribed. And units containing these elements might construct a mini-cluster by several major signals of R1Bm and R2Bm and hence in an rDNA cluster, these mini-clusters might function as holding apparatus at the boundary like a hinge or stopper for opening and unwinding region during the transcription. One more result was obtained regarding characterization of the insertion unit. The result from gamma ray irradiated cultured cells, indicated that the region including retrotransposons was sensitive to radiation and might construct the very complicated structure. We present transposable elements which are major component in genome could be improved for new function in chromosome structures. And we will also present the insertion mechanism of the retrotransposon into the genome.

[3265] RECENT PROGRESS IN THE TRANSGENESIS OF SILKWORM, *BOMBYX MORI* AND APPLICATION TO THE GENOME PROJECT

T. Tamura, T. Kanda, Z. Quan, K. Shimizu, M. Kamba, K.Yukuhiro, N. Kômoto, T., Hasegawa & E. Abraham, Dept. of Insect Genetics and Breeding, National Institute of Sericultural and Entomological Science, Owashi 1-2, Tsukuba, Ibaraki 305-8634, JAPAN, Email ttamura@nises.affrc.go.jp

The transgenesis in the silkworm has been developed by using the transposon *piggyBac* as a vector and GFP gene under the control of the promoter of silkworm cytoplasmic actin gene as a dominant selectable marker(Tamura et al., 2000). The development of the transgenesis encourages the importance of genome analysis in the silkworm as a model organism. However, the frequency to obtain the transformant is much lower compared to the transformation system in *Drosophila*. The life cycle of the silkworm is about 50 days that are much longer than *Drosophila*. It is required for the screening of the transgenic silkworm to rear many GI larvae because the GFP gene using as a marker is expressed rather weakly in the embryonic stage. To circumvent these problems, it is important to increase the efficiency to obtain the transformants and to reduce the works for the screening of the transgenic silkworm. We are studying to improve the promoter and find the more efficient maker gene that can discriminate the transformant at the early stage of embryos. In the silkworms, many egg color mutants are known and most of them is related to the formation of ommochrome pigment. We have working to identify the genes and mutants for the transport and the synthesis of the pigments. We cloned the *Drosophila white* gene homologue from the silkworm, characterized the gene structure and examined the expression pattern. The result suggested that a mutant located on *w3* (*white egg 3*) locus may be caused by the reduced expression of the silkworm *white* gene. We also studied the mutants related to the synthesis of the pigments. We are interesting to use these genes as a dominant selectable maker for the transgenesis of the silkworm. Another aspect of the further study is to construct a system for the analysis of gene regulation and function using transgenic silkworms. The development of the enhancer trap and insertional mutation will be very important in this purpose. To construct such system, we need to use two active transposons: one can be used as a vector for the transgenesis and the other transposon with complete transposase gene fused with a suitable promoter should be inserted into the genome of the silkworm. We recently found that the transposon *Minos* which was found from *Drosophila hydei* and belongs to *Tc /mariner* family works efficiently in the embryos of the silkworm. The combined system using the two transposons *piggyBac* and *Minos* might be possible to develop such system in the silkworm. Index terms: transposon, *piggyBac*, *Minos*, white, ommochrome pigment.

[3266] *BOMBYX* EST DATABASE, SILKBASE, FOR GENOME ANALYSIS OF *BOMBYX MORI*

K. Mita[1], M. Morimyo[1], Y. Koike[1,2], J. Nohata[1,2], M. G. Suzuki[2], T. Shimada[2], K. Okano[3] & S. Maeda[3], [1]Genome Research Group, Natl. Inst. Radiol. Sci., Chiba 263-8555, JAPAN, E-mail kmita@nirs.go.jp; [2]Dept. of Agri. Environ. Biol., Univ. of Tokyo, Tokyo 113-8657, JAPAN; [3]RIKEN, Wako, Saitama 351-0198, JAPAN.

Aiming at the genome analysis of *Bombyx mori*, we are constructing the EST database through the analysis of cDNA libraries. Unlike the case of uni-cellular organisms such as yeast, the gene expression patterns deeply depend on tissues as well as developmental stages in multi-cellular organisms. The cDNAs from which the ESTs are derived are present in libraries in proportion to the level of mRNA in the tissue from which the library was prepared. Therefore, we took the following strategy: cDNA libraries of various tissues (and different developmental stages) are constructed by the directional cloning method. 1,000 cDNA clones are chosen at random from each library and around 700 base nucleotide sequences from the 5' end of the cDNA are determined, followed by gene identification with protein homology search in public databases. Random sequencing of approximately 1,000 cDNA clones is effective to configure the abundantly expressed genes in the tissue from which the cDNA library is constructed, and analyses of various tissues (and different stages) will provide enough amount of ESTs for genome analysis. In addition, this approach explicitly represents the gene expression patterns of all genes identified. Another advantage of the cDNA catalog is to figure up all members of related genes and describe the whole pathway that the cells (or tissues) employ. So far, we determined over 20,000 cDNAs derived from 29 cDNA libraries and identified more than 7,600 independent ESTs that will cover about 40% of total genes of *B. mori*. All ESTs are compiled into 'SilkBase' at the WEB site, http://www.ab.a.u-tokyo.ac.jp/silkbase/. We proceeded to the construction of *Bombyx* BAC contigs by hybridization using independent ESTs as probes.

Index terms: cDNA catalog, cDNA library, gene identification, expression profile, BAC contig.

[3267] GENOMICS OF REPRODUCTION AND DIAPAUSE IN *BOMBYX MORI*

T. Shimada[1], K. Mita[2], K. Okano[3], M. G. Suzuki[1], F. Ohbayashi[1], T. Sugasaki[1,4], T. Kobayashi[1], H. Kawamura[1], M. Ote[1] & K. Nakagawa[1], [1]Dept. of Agric. Environ. Biol., Univ. of Tokyo, Yayoi 1-1-1, Tokyo 113-8657, Japan, E-mail shimada@ss.ab.a.u-tokyo.ac.jp; [2]Natl. Inst. of Radiol. Sci., Anagawa, Inage-ku, Chiba City, Chiba 263-1124, Japan; [3]RIKEN, Hirosawa, Wako, Saitama 351-0198, Japan, [4]Kitamoto High School, Kitamoto, Saitama, Japan.

The EST database for *Bombyx mori* provides powerful tools to analyze regulatory mechanisms in development of lepidopteran insects. We searched candidate genes which control sex determination, circadian rhythm, and embryonic diapause. We found ESTs homologous to *Drosophila* sex determination gene, *doublesex* (*dsx*), *fruitless*, *transformer-2* (*tra-2*), *sans fille*, and *ovarian tumors*. To know whether these candidate genes really act as switches of sex or not, we analyzed expression of their mRNAs and genetically examined whether they were located on a sex chromosome or not. It seems that *dsx* regulates sexual differentiation in *Bombyx* as well (Suzuki *et al.*, Ohbayashi, *et al.*, in this congress). The homologs of *dsx* and *tra-2* were localized on autosomes, suggesting that they are regulated by sex chromosomes. Embryonic diapause of *Bombyx* is primarily determined by temperature and photoperiod in the maternal generation. There are some candidates for circadian clock genes in the EST database. The homologs of *Drosophila clock* and mammalian *cryptochrome* were found. Apart from them, a PCR fragment of *period* (*per*) cDNA has been sequenced by another group. We found that mRNA amount of *per* and *clock* homologs showed circadian oscillation in the brain. The *per* homolog was mapped on the Z chromosome, on where a major gene (*Lm*) controlling diapause has been mapped. On the other hand, we have already found an Ets transcription factor gene, *BmEts*, is activated in the diapause-destined embryos. Genetic relationship between *BmEts* and diapause-defective mutants was analyzed, and a model of diapause signaling was proposed. The interspecific cross between *B. mori* and *B. mandarina* allowed us to analyze species-specific reproductive traits. QTL analyses in the backcross progeny and PCR-RFLPs revealed that the Z chromosome mainly contributes to the oviposition behavior, the number of eggs laid, and embryonic diapause. To further study sex-, tissue- and diapause-dependent gene expression, we are testing a DNA microarray containing 7000 independent cDNAs.

Index terms: *Bombyx mori*, sex determination, diapause, circadian clock, DNA microarray

[3268] MICROSATELLITES DISTRIBUTION IN THE SILKMOTH, *BOMBYX MORI* AND THEIR EVOLUTIONARY CONSERVATION AMONG DIVERSE SPECIES OF SILKMOTHS

J. Nagaraju & M. Muthulakshmi, Molecular Genetics laboratory, Centre for DNA Fingerprinting and Diagnostics (CDFD), ECIL Road, Nacharam, Hyderabad - 500076, INDIA, nagaraju@www.cdfd.org.in ; jnagaraju@mailcity.com

Microsatellites, a unique class of repetitive DNA, have become markers of choice for various genetic analyses. We report here the different classes of microsatellite repeats : di, tri and tetranucleotide repeats in the genome of silkworm, *Bombyx mori*. The distribution of dinucleotide repeat such as $(CA)_n$ compares favourably with that of in human, mouse and honey bee. The microsatellites recovered from the EST database and Genebank searches show that $(ATT)_n$ trinucleotide repeats are the most abundant class of trinucleotide repeats in the silkworm genome. The primers for the flanking regions of 25 microsatellite loci isolated from the silkmoth, *B. mori* were tested on nine diverse species of silk moths which belong to Bombycidae and Saurniidae families. The microsatellite motifs included perfect and imperfect repeats of di (CA and GA); tri (TTA) and tetra (CAGC and GATA) nucleotides. All the primers amplified the homologous microsatellite loci in more than one species. Four loci were amplified in all the nine species. One to four alleles of these four loci from all the nine species were sequenced and microsatellite variability was compared with sequence structure. A few alleles showed size variations both within and between species consistent with the occurrence of stepwise mutations in the repaet array, while others showed complex non-stepwise point mutations involving the flanking regions and microsatellite motif itself. There seems to be no relationship between the phylogenetic distance and the length of the repeat motif.

Index - microsatellites, dinucleotide, allele, saturniidae

[3269] THE BLOW FLY, *CALLIPHORA VICINA*: A CLOCKWORK INSECT

D. S. Saunders, Institute of Cell, Animal and Population Biology, Univ. of Edinburgh, West Mains Road, Edinburgh EH9 3JT, Scotland, United Kingdom

Adult blow flies (*Calliphora vicina*) present robust circadian rhythms of locomotor activity which persist ("free-run") in continuous darkness and constant temperature with an average period (τ) of about 22.5 h. This period is temperature compensated between 15 and 25°C (Q_{10} 0.98 – 1.03) but lengthens in continuous dim light to become overtly arrhythmic in light above about 0.03 $\mu W\ cm^{-2}$. The rhythm becomes entrained to a daily light-dark cycle with locomotor activity confined to the light portion of the cycle. It also entrains to LD cycles with periods from 20 to 30 hours, showing phase relationships dictated by the phase response curve. Entrainable rhythms persist in lobectomised flies indicating that the photoreceptor(s) and the relevant 'clock' are both brain centred. The overt rhythm is a product of several constituent circadian oscillators, probably the coupled output of oscillators in individual clock neurons in the lateral part of the brain. Whilst the circadian clock is in operation, a separate but parallel circadian-based mechanism (the photoperiodic 'clock') is 'measuring' and 'accumulating' successive day lengths to regulate the diapause/non-diapause status of the larval progeny.

Index terms: Circadian rhythms, locomotor activity, photoperiodism

[3270] PHOTIC ENTRAINMENT OF THE DROSOPHILA CIRCADIAN CLOCK

Amita Sehgal, Wei Song, Fang-Ju Lin and Nirinjini Naidoo, Howard Hughes Medical Institute, University of Pennsylvania Medical School, Philadelphia, PA 19104

In the fruit fly, *Drosophila melanogaster*, circadian (~24 hour) rhythms of eclosion and rest:activity are controlled by an endogenous clock that is generated through the coordinated action of specific genes. Dominant among these clock genes are the *period (per)* and *timeless (tim)* genes, both of which encode RNAs and proteins that cycle with a circadian rhythm. The two proteins (PER and TIM) interact directly and feed back to negatively regulate synthesis of their own mRNAs. The feedback loop thus generated is thought to constitute the molecular basis of the clock. Entarinemnt of this molecular clock to the day:night cycle is achieved through light-induced degradation of the TIM protein. We recently showed that TIM is degraded by the proteasome in response to light (1). Prior to its degradation by the proteasome, TIM is phosphorylated on tyrosine residues and ubiquitinated. In order to determine the mechanisms that transduce light to TIM, we investigated the role of cryptochrome (CRY) in TIM degradation. Cryptochrome is a flavin-binding molecule that is thought to function as a circadian photoreceptor in Drosophila. In support of this, flies carrying a mutation in the flavin-binding site of CRY show deficits in entrainment (2). In addition, TIM oscillations in the presence of light:dark cycles are abolished in these flies such that TIM levels remain high during the day (2). This indicates that light-induced TIM degradation is affected. We used a cell culture system to investigate the role of CRY in TIM degradation. We found that CRY, but not CRY^b increases TIM ubiquitination in a dose-dependent manner. Overexpression of CRY, however, downregulates TIM ubiquitination perhaps because CRY acts as a dominanat negative under these conditions. After transducing the photic signal which leads to TIM ubiquitination, CRY itself is degraded by the proteasome. These data and other relevant recent studies will be discussed.

Index terms: *Drosophila melanogaster*, circadian rhythms, TIM, CRY, proteasome.

[3271] CELLULAR CIRCADIAN RHYTHMS IN THE FLY'S VISUAL SYSTEM

E. Pyza[1], [1]Zoological Museum, Inst. of Zoology, Jagiellonian Univ., R. Ingardena 6, 30-060 Kraków, Poland. E-mail: pyza@zuk.iz.uj.edu.pl.

The visual system of the flies *Musca domestica* and *Drosopihla melanogaster* shows circadian rhythms in the structure of its cells and their subcellular organization. These rhythms have been detected in the first optic neuropile, the lamina, in the number of synaptic contacts and the vertical migration of screening pigment in photoreceptor terminals, and in size and shape changes in two of their interneurons, L1 and L2. These are regulated by the lamina's neurotransmitters and controlled by so-called "clock genes", such as the *per* gene. Circadian information from "clock neurons" is transmitted by the neuropeptide pigment dispersing factor (PDF) the effect of which on L1 and L2 also depends on serotonin. Lesioning the optic lobe in *Musca* disrupts L1 and L2's circadian size changes but weak daily oscillations in these cells persist. The input from the clock alone is not sufficient, however, for expression of the lamina's structural circadian rhythms. In the arrhythmic *Drosophila* mutant $per^{0.1}$ insertion of A 7.2: 9 kb fragment of *per* which induces PER expression in the clock neurons and photoreceptors cannot completely rescue rhythms in L1 and L2. This indicates that there are cells in the lamina which participate in L1 and L2's rhythmic changes, for which the lamina epithelial glia are good candidates. These change their sizes too, but in a reversed pattern to L1 and L2, swelling during the night in the housefly's lamina. In *Drosophila* they express PER and changes in their metabolism affect the sizes of L1 and L2. Moreover, closing gap junctions between glia stops rhythmic swelling and shrinking in L1 and L2. The glial cells may generate and/or synchronize the lamina's rhythms or mediate between PDF neurons and cells which show structural circadian rhythms. If the size of L1 and L2 depends on the epithelial glia a mechanism of this process is unknown. Recently, we have detected in the brain of *Musca* and *Drosophila* a proton V-ATPase which is expressed in glia and shows daily oscillations in immunostaining. Blocking the V-ATPase by bafilomycin affects L1 and L2 in *Musca* only when applied during the night when the glial cells are more active than neurons. This suggests that the glial cell proton VATP-ase may participate in the mechanism of L1 and L2's shrinkage during the night.

Index terms: *Musca domestica*, *Drosophila melanogaster*, neuronal plasticity, glial cells

[3272] PROTEIN SYNTHESIS IS A REQUIRED PROCESS FOR THE CIRCADIAN CLOCK IN THE OPTIC LOBE OF THE CRICKET *GRYLLUS BIMACULATUS*

K. Tomioka, Department of Physics, Biology and Informatics, Faculty of Science, Yamaguchi University, Yamaguchi 753-8512, Japan, E-mail tomioka@po.cc.yamaguchi-u.ac.jp.

Circadian rhythms are now considered to be a common biological property in living systems, including insects. The underlying timing machinery, the so-called circadian clock, drives rhythms of a variety of physiological functions such as eclosion, locomotor activity and hormonal secretion. The optic lobe is the locus of the circadian clock that controls the circadian locomotor rhythm in the cricket, *Gryllus bimaculatus*. We found that protein synthesis is required for the movement of the clock. To monitor the movement of the clock, we made longterm records of electrical activity of the optic lamina-medulla compound eye complex which was isolated and cultured *in vitro* in Mitsuhashi and Maramorosh culture medium in a constant darkness at 20°C. The complex showed a clear circadian electrical activity rhythm peaking during the night with a freerunning period of 22.74±0.31 h. We examined the effect of continuous treatment with various concentrations of cycloheximide (CHX), a translation inhibitor, on the rhythm of optic lobe compound eye complex. When 10^{-5} – 10^{-4} M CHX was applied, no clear circadian oscillation was observed. Continuous application of CHX also abolished circadian rhythms of the response evoked by light stimulation. As washed with fresh medium after CHX treatment, the rhythm was soon restored and the subsequent phase was clearly correlated to the termination time of the treatment. At 10^{-6} M the rhythm was often unstable with the freerunning period being significantly lengthened beyond the circadian range (34.25±1.89 h, n=7). The rhythm again clearly persisted when the concentration was lowered to 10^{-7} M, and average freerunning period (22.56±0.56, n=4) was close to that of the control. We then examined the effect of CHX treatment on the phase of the rhythm. When the complex was treated with 10^{-5} M CHX for 6 h, the rhythm exhibited a marked phase shift. The magnitude and direction of the phase shift were dependent on the phase at which the complex was treated with CHX; phase advances occurred around the late subjective night, whereas phase delays occurred during the late subjective day to early subjective night. These results suggest that protein synthesis is also involved in the cricket optic lobe circadian clock, and that the clock-related protein synthesis may be activated during the late subjective day to subjective night. Similar time courses of protein synthesis are known for some clock proteins in *Drosophila* and *Anthraea pernyi*. The abundance of the proteins increases from the late subjective day to the late subjective night. Taken together, these facts suggest that the requirement of nighttime protein synthesis for the circadian clock is common in insects.

[3273] THE USE OF *DROSOPHILA* TO STUDY THE CONTROL PATHWAYS FOR EXOGENOUS AND ENDOGENOUS COMPONENTS OF THE ECDYSIS RHYTHM

J. W. Truman, O. Shafer & S. McNabb, Dept. of Zoology, Univ. of Washington, Box 351800, Seattle, WA 98195-1800, USA, E-mail jwt@u.washington.edu.

The rhythm of adult eclosion in *Drosophila* is one of the most extensively studied rhythms in insects. The final form of the ecdysis rhythm, however, is a product of endogenous time-keeping via the circadian clock and responses to exogenous cues such as the lights-on signal. The latter results in a pronounced skewing of the ecdysis peak just following lights-on. Recent studies in both *Drosophila* and the moth *Manduca* have shown that ecdysis is controlled through a complex hormonal cascade that includes the steroid hormone, 20 hydroxyecdysone (20E), and a series of peptide hormones: eclosion hormone (EH), ecdysis-triggering hormone (ETH), and crustacean cardioactive peptide (CCAP). We have been interested in how endogenous and exogenous timing factors impinge on this endocrine control pathway. Through a series of mutations and genetically engineered flies, we have found that endogenous and exogenous factors act through different portions of the control cascade. Removal of the EH neurons renders the ecdysis system incapable of responding to the lights-on signal. Although we originally though that the lights-on signal acted to induce EH release in *Drosophila*, we now have evidence that this stimulus acts to shorten the delay between EH release and the subsequent release of CCAP. In contrast to the lights-on response, the circadian control of ecdysis in *Drosophila* does not require the EH neurons. Nor does it apparently require ETH. We think that there is a parallel pathway that can also activate the CCAP neurons -- a prerequisite for ecdysis. This pathway likely involves a circadian control over the timing of the 20E decline at the end of metamorphosis. Evidence for this pathway will be discussed.
Index items: *Drosophila melanogaster*, circadian rhythms, photoreception

[3274] FROM SOCIOBIOLOGY TO CHRONOBIOLOGY: DIVISION OF LABOR IN COLONIES OF THE HONEY BEE *APIS MELLIFERA*

G. E. Robinson, Dept. of Entomology and Neuroscience Program, Univ. of Illinois, 320 Morrill Hall, 505 S. Goodwin Ave., Urbana, IL 61801, USA, E-mail generobi@life.uiuc.edu.

Division of labor in insect societies has been studied from diverse perspectives, including some rooted in evolutionary biology, ecology, behavior, genetics, developmental biology, endocrinology, and neuroethology. This talk is based on an analysis of division of labor in honey bee colonies that is inspired by chronobiology. Studies of individually marked bees in observation hives revealed that age-related division of labor in honey bees is associated with changes in activity rhythms. Young adult bees perform hive tasks with no daily rhythms, while older bees forage with strong daily rhythms. These differences between young and old bees were found to be related to an ontogeny of behavioral circadian rhythm for locomotor behavior. Bees reared in social isolation under controlled conditions in the laboratory showed no circadian rhythms for locomotor behavior for about the first week of life and then developed robust rhythms. Hive bees and foragers also differ in brain mRNA levels of *period*, a gene well known for its role in circadian rhythms. The level of *period* mRNA in the brain oscillated in bees of all ages in circadian fashion but was significantly higher at all times in foragers. Results were obtained from colonies maintained under controlled conditions in the laboratory and under more natural conditions in the field. These results constitute the first report of the regulation of a "clock" gene in a social context and suggest that there are connections at the molecular level between division of labor and chronobiology in social insects.
Index terms: behavioral plasticity; *period* gene

[3275] INVOLVEMENT OF CIRCADIAN RHYTHMS IN THE REPRODUCTIVE PHYSIOLOGY OF INSECT MALES

P. Bebas[1], B. Cymborowski[1] & J. M. Giebultowicz[2], [1]Dept. of Invertebrate Physiology, Warsaw University, Zwirki i Wigury 93, 02-089 Warsaw, Poland, E-mail: piotrbe@asp.biogeo.uw.edu.pl; [2]Dept. of Entomology, Oregon Sta. University, Corvallis, OR 97331, USA.

Many events in insect life are controlled by internal circadian clocks and thus limited to a specific time of day. The mechanisms of circadian clocks involve rhythmic expression of the *period* gene, which seem to be conserved in insects and other animals. Recent studies show that the circadian clock mechanism resides not only in the brain but also in non-innervated peripheral tissues. The presence of autonomous and photosensitive circadian clock was demonstrated in the reproductive tract of male gypsy moth; this clock controls the release of sperm bundles from the testes and may also be involed in acquisition of fertilizing capacity by individual spermatozoa. To gain further insight into the role of circadian clocks in sperm release and maturation, we study reproductive physiology of the cotton leafworm, *Spodoptera littoralis*. We demonstrated that this moth produces unusually high number of sperm bundles and releases, on average, 1000 bundles a day during 8 h circadian gate within 16:8 light:dark cycle. Rhythmic release of sperm bundles continues in isolated testes-vasa deferentia complexes demonstarting autonomy of the circadian clock controlling this process. We use *S. littoralis* as a model system to investigate the mechanism of the circadian clock and to identify cellular and molecular rhythms involved in sperm release and maturation. Immunocytochemical studies of PER protein in the genital tract of *S. littoralis* revealed daily rhythm of its expression in the testis base and in the secretory epithelium of the upper vasa deferentia. This suggests that all epithelial cells surrounding vas deferens lumen harbor circadian clocks which are likely to control cellular activities. In search of cellular rhythms, we investigated patterns of glycosylated proteins expression in vas deferens epithelium. Histochemical data demonstrated the existence of circadian rhythm in the accumulation and secretion of glycoproteins from the apical epithelium to the lumen of each vas deferens. Western blot analysis confirmed that several glycoproteins are secreted to the lumen of vas deferens with a daily rhythm. Both rhythmic events, the release of sperm from the testis and the secretion of glycoproteins, are disrupted in males kept under continuous light. Significantly, constant light causes decline in number of sperm bundles released from testes and results in sterility of most males. Thus, circadian system in the male reproductive epithelium may orchestrate a suite of cellular rhythms involved in sperm release and maturation which are necessary for the insect reproductive success
Index terms: *Spodoptera littoralis*, glycoproteins, sperm, circadian clock

[3276] ORGANIZATION OF THE CIRCADIAN SYSTEMS IN INSECTS

J. M. Giebultowicz, Dept. of Entomology, Oregon Sta. University, Corvallis, OR 97331, USA.

Insects display circadian rhythms in all aspects of their lives. The term circadian clock was coined to name a "black box" that generated rhythms in insects and other organisms. Genetic and molecular studies on *Drosophila melanogaster* revealed that this black box contains a suite of rhythmically expressed genes that form feedback loops resulting in a circa 24 h periodicity rhythms. One of the key clock components, the *period (per)* gene, is rhythmically expressed in certain areas of the brain, in photoreceptors, and also in many peripheral tissues For example, Malpighian tubules harbor autonomous and photosensitive circadian clock mechanisms that are independent of the brain and fly hormonal milieu. This suggests that the fly circadian timing system is not organized hierarchically, but rather, may consist of a collection of independently operating clocks, synchronized by external light-dark cycles. The growing evidence for the existence of a multi-oscillatory timing system in insects brings out questions about the ontogenesis of tissue-specific clocks during metamorphosis. Are various clocks turned on in a coordinated fashion at certain developmental stage, or do they start to function independently of each other as dictated by tissue-specific needs for circadian synchronization? We are addressing this question using the onset of *per* gene expression as an indicator of the acquisition of clock function by different organs. We used transgenic flies carrying *per*-LacZ reporter construct to determine that *per* is rhythmically expressed in the midgut, hindgut, rectum, Malpighian tubules, and seminal vesicles of adult flies. We then investigated the activity of *per* in those organs in pupae at different stages of metamorphic development. We found that expression of *per* is developmentally regulated and begins at different times in different tissues. For example, *per* was first detected in the rectal pads two days before adult eclosion; in testes, one day before adult eclosion; and in Malpighian tubules, one day after eclosion. Our results suggest that peripheral circadian clocks are activated on a tissue-by-tissue basis rather than by central neuroendocrine factors. These data lend additional support to the concept of a circadian system consisting of a collection of autonomous and independent clocks.

[3277] A NEW CHALLENGE FOR THE FUTURE MOLECULAR STUDY ON EMBRYONIC DIAPAUSE OF THE SILKWORM, *BOMBYX MORI*

O. Yamashita, Graduate Sch. Bioagric. Sci., Nagoya Univ. Chikusa, Nagoya 464-8601, Japan, E-mail ymstokit@agr.nagoya-u.ac.jp

It has passed a half century since the diapause hormone(DH) has been found by the biological methodology through organ transplantation or removal. The following 40 years were taken for chemical work on DH isolation, and in 1991 DH was eventually described by molecular terms. In the recent decade our interests have been concentrated upon molecular events underlying the DH gene expression, DH dynamics in circulation and DH action. Now, we have clarified some essential factors and reactions: cis-elements, developmental and environmental regulation, target reaction of DH, and so on. These knowledges are reasonably applied to explain the biochemical and physiological events leading to embryonic diapause. In the course of molecular analyses, we have met some unexpected and strange events of which physiological importance was not instantly understood. For examples, DH gene expression in larvae and males, wide distribution of DH gene in non-embryonic diapause insects, DH storage in non-diapause type neurosecretory cells, diapause induction in glycogen-deficient eggs, and expression of some genes by DH. These facts will be discussed as the promising frontier to open the new chapter of insect diapause story.
Index terms: *Bombyx mori*, diapause, hormone, gene.

[3278] DIAPAUSE-SPECIFIC GENE EXPRESSION

D. L. Denlinger, J. P. Rinehart, G. D. Yocum, S. P. Tammariello & T. L. Craig, Dept. of Entomology, Ohio State Univ., 1735 Neil Ave., Columbus, OH 43210-1220, USA, E-mail denlinger.1@osu.edu.

We have isolated several cDNAs from brains of flesh fly (*Sarcophaga crassipalpis*) pupae that show expression patterns unique to diapause. Among the 95 clones screened, 4 were diapause specific or diapause upregulated and 7 were diapause downregulated. These results suggest that insect diapause is not merely a shutdown in gene expression but is a developmental pathway characterized by the expression of a novel set of genes. Among the diapause upregulated genes are genes encoding the stress proteins (hsp23 and hsp70). These stress proteins are rapidly turned on at the onset of pupal diapause, and transcription persists until diapause is terminated. The upregulation of the stress proteins during diapause is not elicited by temperature stress but simply by the entry into diapause. This suggests an important role for these stress proteins during the overwintering developmental arrest. Another gene that is expressed during diapause encodes for a protein that is involved in the response to hypoxia. During diapause the pupae undergo periodic pulses of oxygen consumption, and interestingly, the hypoxia-related gene is expressed during the periods of low oxygen consumption. Thus several of the diapause upregulated genes seem to be linked to adaptations for defense against environmental stress. Yet, not all stress related genes are developmentally upregulated during diapause. The gene encoding sarcotoxin, a protein that functions as an antibacterial agent, is not expressed normally during diapause, but it is quickly upregulated in diapausing pupae in response to injury. The diapausing pupa thus has another set of defense responses that remain intact during diapause and can quickly be invoked in response to external stress. Of equal interest are genes that are downregulated during diapause. One of the prominent genes in this category is Proliferating Cell Nuclear Antigen (PCNA), a cell cycle regulator. The downregulation of PCNA coincides with a cell cycle arrest noted in the brain, suggesting a potential role for PCNA as an important regulator of the cell cycle arrest during diapause. Additional information on PCNA and cell cycle arrest is presented in a related presentation by S. Tammariello. Since the hormonal basis for pupal diapause in flesh flies is an ecdysteroid deficiency, we have also monitored the expression of the ecdysone receptor (EcR) and its dimerization partner, ultraspiracle (USP). The expression patterns of the two clones we have isolated from *S. crassipalpis* are dramatically different during diapause. While EcR is consistently expressed, USP expression begins only late in diapause, suggesting that USP expression may be essential for diapause termination.
Index terms: *Sarcophaga crassipalpis*, diapause, heat shock proteins, cell cycle regulators, EcR, USP

[3279] REGULATION OF CELL CYCLE ARREST IN DIAPAUSE

S.P. Tammariello, Dept. of Biological Sciences, Binghamton Univ. (SUNY), Binghamton, NY, 13902-6000, USA, E-mail tammarie@binghamton.edu

Diapause poses an interesting situation for investigating signal transduction during insect development. The flesh fly, *Sarcophaga crassipalpis*, enters pupal diapause in response to short photoperiod resulting in a developmental arrest at the level of the whole organism. This arrest persists until diapause termination at which time adult development resumes. At the cellular level, brain cells from diapausing pupae enter a Go/G1 cell cycle arrest suggesting a potential molecular mechanism governing the developmental stasis observed during diapause. Brain cells are triggered to re-enter the cell cycle at diapause termination, leading to cell proliferation and adult tissue formation. The examination of four G1 phase-specific genes by Northern blot analysis and RT-PCR reveals that only one gene, Proliferating Cell Nuclear Antigen (PCNA), exhibits differential expression between brain cells from diapausing and nondiapausing flesh flies. *PCNA* is downregulated at the onset of diapause, and transcript levels remain low throughout the entire diapause period. Once diapause is terminated *PCNA* is upregulated, peaking at 72 hours post-diapause in the flesh fly brain. *In situ* hybridization confirms and extends these results by localizing *PCNA* expression to several regions of the pharate adult brain, but not to any region of the diapausing pupal brain. Cell cycle re-entry has been extensively studied at the molecular level during *Drosophila melanogaster* development, and specific signal transduction events are known to trigger cell proliferation. One hallmark of signaling pathways is the activation of specific protein kinases. Western blot analysis and immunofluorescence performed on brain cells from flesh flies reveal that several proteins become tyrosine phosphorylated soon after diapause termination. These results are consistent with events described during *D. melanogaster* development, and suggest an important role for signal transduction during the initiation, maintenance, and termination of insect diapause.
Index terms: *Sarcophaga crassipalpis*, signal transduction, PCNA, RT-PCR

[3280] MOLECULAR ANALYSIS OF THE OVERWINTERING DIAPAUSE IN THE SPRUCE BUDWORM, *CHORISTONEURA FUMIFERANA*

S. R. Palli[1,2], T. R. Ladd[1], Q. L. Feng, W. Tomkins, M. Primavera[1] & A. Retnakaran[1], [1]Great Lakes Forestry Centre, Canadian Forest Service, P. O. Box 490, 1219 Queen Street East, Sault Ste. Marie, Ontario, Canada, P6A 5M7; [2]Rohm and Haas Research Laboratories, 727 Norristown Rd. Spring House, PA 19477, USA. Email: RAHSUB@ROHMHAAS.com.

The Spruce budworm, *Choristoneura fumiferana*, under goes an obligatory overwintering diapause as a second instar larva. The role of proteins and carbohydrates associated with this overwintering diapause was investigated. *C. fumiferana* larva produces large quantities of two hexameric proteins, defensin and glutathione *S*-transferase (GST) during diapause. These larvae also produce large quantities of sugars, trehalose and glycerol during this overwintering diapause. The levels of hexameric proteins, GST and trehalose begin to increase during the first instar larvae in preparation for obligatory diapause. On the other hand, the levels of defensin and glycerol begin to increase only after the second instar larvae were exposed to lower temperatures for at least 10 weeks indicating that these are overwintering related events. Thus, they serve as markers to distinguish between diapause and overwintering phenomena that occur simultaneously in this insect. During all the larval stages except in the second instar stage, the larvae feed as well as grow and 20-hydroxyecdysone (20E) is released at every stage to initiate the molting process. Second instar larvae, on the other hand, neither feed nor grow but enter into an overwintering diapause phase and no 20E is released until diapause is completed. Application of the stable ecdysteroid, tebufenozide, results in the termination of diapause indicating that all the machinery necessary for 20E response is in place. Juvenile hormone esterase (JHE) mRNA is detected as a transient peak in each larval instar on the day it molts into the succeeding instar except from the first to the second instar. These JHE peaks may be involved in reducing the high juvenile hormone (JH) titre at the beginning of each instar to levels that allow the secretion of 20E. Since JHE peak is not detected at the beginning of the 2nd instar, JH levels may not go down and as a result 20E is not secreted. These results indicate that both 20E and JH play critical roles in induction, development and termination of overwintering diapause in the spruce budworm.
Index terms: 20-hydroxyecdysone, juvenile hormone, hexameric proteins, defensin, trehalose, glycerol, glutathione-s-transferase

[3281] STRUCTURE AND FUNCTION OF SPECIFIC PEPTIDES PRODUCED THROUGHOUT DIAPAUSE OF PHARATE FIRST-INSTAR LARVAE AND ADULTS

K. Suzuki, Dept. of Bioscience and Technology, Faculty of Agriculture, Iwate Univ, Morioka 020-8550, Japan, E-mail koichi@iwate-u.ac.jp.

Throughout the periods of obligatory diapause, we have been expecting the production of novel peptides in pharate first-instar larvae of the wild silkmoth *Antheraea yamamai* and in adults of the leaf beetle *Gastrophysa atrocyanea*. In the wild silkmoth, we have predicted the presence of a repressive factor (RF) and a maturation factor (MF). As for MF, it was already reported that peptide-like factor induces some characters occurred in post-diapause development. Recently, we were fortunately successful in the isolation of RF and it's structure has no homology with known peptides. When this antibody was injected into diapausing pharate first-instar larvae, it could break the diapause. The injection of the isolated RF into the individuals destined to break the diapause by an imidazole compound, also expanded days necessary to diapause terminationin. These results suggest that RF acts to maintain the diapause incident in pharate first-instar larvae. From diapausing adults of the leaf beetle, we isolated a novel and diapause-specific peptide, and determined the amino acid sequence. The injection of this antibody into diapausing individuals had no function to break the adult diapause and the isolated peptide also did not inhibit diapause termination which was destined by the continuous application of a juvenile hormone analogue. These evidence indicates that the diapause-specific peptide may be involved with hard environmental tolerance such as temperature and humidity or antibiotic system.
Index term: *Antheraea yamamai*, *Gastrophysa atrocyanea*, RF, MF, diapause-specific

[3282] USING ICE NUCLEATING BACTERIA TO REDUCE WINTER SURVIVAL OF COLORADO POTATO BEETLES: DEVELOPING A NOVEL STRATEGY FOR BIOLOGICAL CONTROL

R. E. Lee, Jr.[1], L. A. Castrillo[1], M. R. Lee[2], J. A. Wyman[3] & J. P. Costanzo[1], Dept. of [1]Zoology and [2]Microbiology, Miami Univ., Oxford, OH 45056, USA, [3]Dept. of Entomology, Univ. of Wisconsin, Madison, WI 53706, USA.

A key factor in the overwintering survival of Colorado potato beetle, *Leptinotarsa decemlineata*, populations is the regulation of the temperature at which the insect freezes. Like most overwintering insects, Colorado potato beetles are unable to survive internal ice formation. Winter survival is enhanced by burrowing in the soil and by lowering their supercooling point, the temperature at which ice formation spontaneously occurs in their body fluids. We have shown that the supercooling capacity, a major factor in winter cold hardening of these beetles, can be regulated by exposure to ice-nucleating active bacteria. These bacteria are potent biological nucleators capable of initiating freezing of aqueous suspensions at temperatures above –10°C. When fed to Colorado potato beetles, ice nucleating bacteria immediately elevate the beetle's supercooling point. Furthermore, recent field and laboratory studies demonstrated that two strains of *Pseudomonas fluorescens* persisted and maintained their ice nucleating activity in the beetle's digestive tract through winter. Beetles recovered from the field seven months after overwintering in the soil had significantly elevated supercooling point values versus control beetles. By exposing Colorado potato beetles to ice nucleating bacteria in late summer to early autumn, prior to their burrowing into the ground, it is possible to reduce beetle survival in winter and, thereby, delay their population build up and reduce crop damage the following summer.
Index terms: *Leptinotarsa decemlineata*, *Pseudomonas fluorescens*, insect cold-hardiness, overwintering insect pests

[3283] WHEN YOU CAN'T FLY TO BRAZIL: SURVIVING WINTER WITH ANTIFREEZE PROTEIN GENES

V. K. Walker[1], D. Doucet[1], M. G. Tyshenko[1], M. J. Kuiper[1], L. A. Graham[2], Y-C. Liou[2], S. P. Graether[2], B.D. Sykes[3], Z. Jia[2] & P. L. Davies[1,2], [1]Dept. of Biology & [2]Dept. of Biochemistry, Queen's University, Kingston, Ontario, Canada, K7L 3N6, [3]Dept. of Bichemistry, University of Alberta, Alta, Canada T6G 2S2 E-mail: walkervk@biology.queensu.ca

Some insects respond to seasonally low temperatures by the production of thermal hysteresis proteins (THP), at times known as antifreeze proteins (AFP). These proteins lower the freezing temperature of the insect by binding to microscopic ice crystals and inhibiting ice growth. The spruce budworm moth (*Choristoneura fumiferana*) and the meal worm beetle (*Tenebrio molitor*) each produce a different, but extremely active, 8-9 kDa AFP in their overwintering stages. Expression studies show that the spruce budworm produces AFP transcripts in the 2mm caterpillar/hibernaculum stage and that these transcripts rapidly decrease about the time of molting to the third instar. In *Tenebrio*, AFP mRNA abundance increases throughout larval development, but declines throughout the pupal and adult stages, consistent again with the observation that it is the larvae that overwinter. In both insects there are multiple copies of these genes, which are distinct for each species. The isolation and sequencing of cDNAs encoding AFP isoforms for both these species' proteins, as well as *in vitro* mutagenesis, has allowed us to identify conserved amino acids. Conserved residues are candidates to confer structural stability as well as for ice binding. In both AFP types, cysteines appear to be important, suggesting that they have been conserved for proper folding of the proteins by disulfide bridge formation. Threonines, often as part of a repetitive motif, are also well conserved and suggest models which could interact with ice. This work, coupled with structural analysis, has lead to the development of two different protein models and their inhibition of ice growth. Thus, although these evolutionary distant species have evolved unique proteins, they share some common features that promise insight into the interaction of ice surfaces with antifreeze proteins, the developmental regulation of AFP genes and an appreciation of the strategies employed by insects to avoid freezing.
Index terms: *Choristoneura fumiferana*, *Tenebrio molitor*, thermal hysteresis proteins, gene expression in development.

[3284] POLYOL ACCUMULATION AS A MECHANISM FOR THERMOTOLERANCE IN HOMOPTERANS

M. E. Salvucci.

ABSTRACT NOT RECEIVED

[3285] INTERACTION OF ENDOCRINE SYSTEM AT LARVAL-PUPAL METAMORPHOSIS

N. A. Granger.

ABSTRACT NOT RECEIVED

[3286] ENDOCRINE CONTROL OF ECDYSTEROID AND JUVENILE HORMONE PRODUCTION.

L. I. Gilbert, Dept. of Biology, Univ. of N. Carolina, Campus Box #3280 Coker Hall, Chapel Hill, NC 27599-3280, USA. E-mail LGILBERT@UNC.EDU

New data will be discussed on the means by which the prothoracicotropic hormone (PTTH) of *Manduca sexta* stimulates the prothoracic glands to synthesize and release 3-dehydroecdysone. The process is initiated by PTTH-opening of a calcium channel leading to an increase in the amount and activity of a number of protein kinases, one of which has the capacity to enter the nucleus. The others, PKA and S6 kinase are utilized to phosphorylate S6 which is a protein constituent of the ribosome and has important roles in modulating protein synthesis, and in this case, for the purpose of stimulating ecdysteroidogenesis. How the prothoracic glands are turned off once the hemolymph ecdysteroid level has reached a peak was answered by demonstrating changes in the isoforms of ultraspiracle (usp) and the ecdysone receptor (EcR) which compose a dimer. The studies reveal changes in particular isoforms when the prothoracic glands are challenged both *in vitro* and *in vivo*. By 20-hydroxyecdysone (20E). Since ecdysteroids may also have a modulating role on the corpus allatum (source of juvenile hormone), a series of studies was conducted with the ecdysone receptor of the corpus allatum *in vitro*. The data showed that the isoform composition was specifically and reproducibly changed in the presence of 20E. There have been many reports in the literature of JH stimulating or inhibiting the prothoracic glands *in vivo* so that the rate of ecdysteroid synthesis is changed. This view, for the most part, was based on experiments in vivo and it was not proven unequivocally that JH affects the prothoracic glands directly. Our studies on the *Manduca* prothoracic glands indicate that it is indeed an indirect effect of JH on the prothoracic glands eliciting the modulation of ecdysteroidogenesis.

Index terms: molting, control of; second messengers; signal transduction; EcR (ecdysteroid receptor).

[3287] ENDOCRINE CONTROL OF PROGRAMMED CELL DEATH OF ANTERIOR SILK GLAND IN *BOMBYX MORI*

J. Terashima, S. Tsuzuki & S. Sakurai, Dept. of Biology, Fac. of Science, Kanazawa Univ. Kanazawa 920-1192, Japan.

Our recent findings will be presented on the means by which 20-hydroxyecdysone□(20E) stimulates the anterior silk glands of *Bombyx mori* to undergo the PCD *in vitro*. The process was initiated by 20E stimulation of gene expressions which complete within 8 h of the culture followed by death protein syntheses that were accomplished in 18 h of the culture. PCR select subtraction of the genes, whose expression were stimulated by 20E in the presence of cycloheximide (CHX), gave 7 novel genes, five of which had obvious open reading frame (ORF). Expression profiles of the genes *in vitro* showed that 5 genes were categorized, as early genes while two were delayed early genes. Some of the genes with ORF showed similarities to the known genes tightly involved in the apoptosis of mammalian cells. The remaining 2 poly(A^+)RNAs had no obvious ORF. The poly(A^+)RNAs bound proteins from anterior silk glands, indicating that these RNAs may function as steroid receptor coactivators. *In vitro* culture of anterior silk glands showed that 20E must be present for 40 hours for the completion of PCD while a-amanitin, an inhibitor of mRNA synthesis, and cycloheximide, a protein synthesis inhibitor, could not suppress the PCD when added to the culture 8 and 18 h after the initiation of 20E challenge, respectively. These results strongly indicated that 20E effects of triggering the PCD were not mediated through nuclear receptors. Determination of the changes in cAMP level during a period from 18 to 40 h showed a sharp peak around 26 h of the culture with 20E. Moreover, dbcAMP evoked the PCD which was suppressed by withdrawal of 20E 24 h after the culture with 20E. These suggest that 20E may act through membrane receptor or cytosolic binding protein, which may mediate the signal transduction pathway leading to the PCD. Our studies on the *Bombyx mori* anterior silk glands indicate that there is indeed an another mechanism, in addition to nuclear receptors, that mediates the action of ecdysteroids.

Index terms: apoptosis, 20-hydroxyecdysone, signal transduction, PCR select subtraction.

[3288] CROSS TALK BETWEEN ECDYSTEROIDS AND JUVENILE HORMONE AT THE CELLULAR LEVEL

L. M. Riddiford, B. Zhou, D. Champlin, & J. W. Truman, Dept. of Zoology, Univ. of Washington, Box 351800, Seattle, WA 98195-1800, USA.

Many of the early ecdysteroid-induced transcription factors appear during both larval molting and metamorphosis, but the Broad Complex (BRC) only appears in most tissues in the absence of juvenile hormone (JH) at metamorphosis in both *Drosophila* and the tobacco hornworm larva, *Manduca sexta*. In *Manduca* abdominal epidermis, pupal commitment occurs at the end of the larval feeding period in response to low 20-hydroxyecdysone (20E) in the absence of JH. At this time 20E activates BRC transcription, but it can be suppressed by JH. Immunocytochemistry shows that BRC expression occurs first in the areas of the segment that first become committed to pupal differentiation and hence will form pupal cuticle in the subsequent molt. Once BRC expression is turned on, its subsequent regulation by ecdysteroids is unaffected by JH and it persists through the pupal molt. Hence, BRC is one of the first molecular markers of pupal commitment in the abdominal epidermis. The wing disc and the eye primordium however respond differently to both 20E and JH in the final instar. The wing disc forms early in larval life and proliferates as the larva grows. It first acquires ecdysone receptors (EcR) at onset of the final instar and becomes able to form pupal cuticle during a larval molt although it continues to proliferate until the onset of pupal development. Coincidentally BRC mRNA appears, but its expression cannot be suppressed, only delayed, by JH given during the fourth instar molt. Preliminary experiments suggest that BRC protein at this time is present only in the peripodial membrane and later appears in the disc cell themselves at the ecdysteroid-induced onset of pupal development. The eye primordium makes larval cuticle through the penultimate molt, then early in the final instar as the JH titer falls, begins to proliferate to form the eye disc. *In vitro* studies show that only the absence of JH is necessary for this proliferation to occur. Once this proliferation has begun, this disc is committed to pupal differentiation. Yet BRC does not appear until the disc is exposed to low ecdysteroid in the absence of JH. In the latter state the eye disc begins organizing its ommatidial clusters, a process dependent on low ecdysteroid and unaffected by JH. Thus, BRC seems to be important in all three tissues for ecdysteroid-induced pupal differentiation, but its role in pupal commitment of imaginal tissues remains to be fully resolved and will be discussed. Supported by NIH and NSF.

Index words: *Manduca sexta*, Broad Complex

[3289] PHOTOAFFINITY LABELED NON-STEROIDAL ECDYSONE AGONIST AS A TOOL TO STUDY LIGAND-ECDYSONE RECEPTOR COMPLEX INTERACTION

T.S. Dhadialla, Le D, T. Pham, G.R. Carlson, R.E. Horman, Z. Jianzhong & S.R. Palli, Rohm and Haas Company, 727 Norristown Road, Spring House, PA 19477. E-mail RSATSD@rohmhaas.com

The discovery of novel non-steroidal ecdysone agonists, belonging to the bisacylhydrazine class of chemistry, as environmentally safe pest selective insecticides has generated a lot of interest in understanding the molecular basis of action of these compounds. While there is substantial evidence that these compounds manifest their toxic effect in susceptible insects (mainly lepidopteran larvae) via interaction with the ecdysone receptor (EcR) protein as a heterodimer with ultraspiracle (USP) protein, it is still not clear where in the ligand binding domain (LBD) of EcR these compounds bind. The interaction of these compounds relative to that of the insect molting hormone, 20-hydroxyecdysone (20E), within the EcR LBD is also unknown. In an attempt to understand the molecular interaction of the lepidopteran active bisacylhydrazine insecticides (tebufenozide and methoxyfenozide) with lepidopteran EcR, we have synthesized a tritiated photoaffinity labelled (PAL) analog of the two insecticidal compounds. In ligand binding assays using tritiated ponasterone A as the radioligand and bacterial fusion proteins of EcR and USP from the spruce budworm, *Choristoneura fumiferana*, the unlabeled PAL displaces tritiated ponasterone A. The tritiated PAL binds to CfEcR/CfUSP in a specific and saturable manner and has been used to demonstrate its binding to CfEcR by analysis of binding reactions by SDS-PAGE followed by fluorography. Experiments are in progress to generate proteolytic fragments of PAL labeled CfEcR LBD for identification of the contact amino acid residues by LC/MS analysis.

Index Terms: Ecdysone receptor, photoaffinity ligand, spruce budworm

[3290] IS JUVENILE HORMONE THE METAMORPHIC HORMONE OF INSECTS?

G. Bhaskaran[1] & J. H. Willis[2], [1]Dept. of Biology, Texas A&M University, College Station, TX 77843 USA, E-mail govindan@bio.tamu.edu; [2]Dept. of Cellular Biology, University of Georgia, Athens, GA 30602, USA.

Insect metamorphosis is regulated principally by two hormones, juvenile hormone (JH) and 20-hydroxyecdysone (20E). The current view is that 20E initiates a molt in any developmental stage and, at the appropriate time, promotes metamorphosis. JH prevents metamorphic changes but not the molting process itself. Recent molecular analysis reveals that 20E binds to its receptor (EcR + USP) and directly activates a set of early genes coding for transcription factors that either activate or repress other genes resulting in metamorphosis and/or molting. Significantly, numerous studies have shown that tissues must first become competent in order to undergo metamorphosis in response to 20E. The first evidence that juvenoid acids may play a role in the induction of metamorphic competence came from studies on vitellogenin synthesis in the tobacco hornworm, *Manduca sexta*. Ismail and Bhaskaran showed that competence of the fat body to synthesize vitellogenin requires exposure to JH acid or methoprene acid plus a low dose of ecdysteroid. Subsequently, these authors demonstrated that juvenoid acids induce metamorphic competence in Verson's gland and crochet epidermis. We have recently examined whether juvenoid acid might cause the acquisition of metamorphic competence in *Drosophila melanogaster*. Two transcripts were chosen as markers for metamorphosis – the alcohol dehydrogenase (ADH) transcript initiated at the distal (adult) promoter and the Broad Complex (BR-C), that codes for transcription factors that first appears in response to ecdysteroids early in the final larval instar. We incubated abdominal rings of first instar larvae in oxygenated Schneider's medium with juvenoid acids (methoprene or JH II or JH III) in the presence or absence of low doses of ecdysteroid (20E or RH5992). We used RT-PCR to identify transcripts. Juvenoid acid (0.5 µg/ml) plus ecdysteroid (0.1 µg/ml) induced both BR-C and use of the adult promoter of ADH. The juvenoid acids alone, or juvenoid alone, or ecdysteroid alone were ineffective. Juvenoid plus juvenoid acid inhibited the response. Thus in three different systems, *Manduca* fat body, *Manduca* Verson's glands and *Drosophila* first instar larvae, juvenoid acid plus a low dose of ecdysteroid induced metamorphic competency. We propose that juvenoid acids are the true metamorphic hormones of insects and that ecdysteroids facilitate their actions on genes involved in metamorphosis.

Index terms: juvenoid acid, ecdysteroid, metamorphosis

[3291] EVOLUTION OF ANTEROPOSTERIOR AXIS FORMATION IN INSECTS: THE ROLE OF *HUNCHBACK* AND *NANOS* IN THE GRASSHOPPER

S. Lall[1], M. Z. Ludwig [1,2] & N. H. Patel[1], [1] Dept Org Bio and Anatomy, Univ. of Chicago, MC1028, N-101, 5841 S. Maryland Ave., Chicago USA [2] Dept of Ecology and Evolution, University of Chicago, 1101 E. 57th St., Chicago USA

Maternally provided *hunchback* (*hb*) and *nanos* have been shown to play an important role in the formation of the anteroposterior axis of *Drosophila melanogaster*. In the syncytial *Drosophila* embryo, maternally provided and posteriorly localized results in the translational repression of uniformly deposited *hb*. Interaction of nanos with the 3' untranslated region of *hb* transcript is mediated by a third factor, pumilio. We are interested in the potential conservation of this mechanism of axis formation during the early embryogenesis of the short germ insect *Schistocerca americana*. In particular, we are interested in whether a localized maternal factor such as *nanos* can be involved in axis formation in a cellular environment, when compared with the early syncytial embryogenesis of *Drosophila melanogaster*. In order to address this issue, we have cloned *hunchback*, *nanos* and *pumilio* from the grasshopper *Schistocerca americana*. Both hb and nanos accumulate to high levels during grasshopper oogenesis, suggesting maternal contribution. Furthermore, during early embryogenesis the expression patterns of hb and nanos are consistent with a role in anteroposterior axis formation.

We propose a model where the *hunchback*/ nanos/ pumilio interaction is a conserved mechanism for generating polarity along the anteroposterior axis.

Index terms: *Schistocerca americana, Drosophila melanogaster*

[3292] EVOLUTION OF INSECT LIMBS, A DEVELOPMENTAL GENETICS PERSPECTIVE

Lisa M. Nagy, Molecular and Cellular Biology, University of Arizona, Tucson, Arizona 85745

Arthropods are made up of serially repeated structures — segments and limbs. The diversification of these repeated structures has been the basis of arthropod evolution. Because segments and limbs are repeated along the body axis, they have been considered a series of structural modules that originally were repeated identically along the body axis and then differentiated through the course of evolution. We have been asking whether this modular morphology is reflected in underlying developmental mechanisms by comparing the molecular basis of segmentation and limb development in various arthropod species (*Limulus polyphemus*, *Triops longicaudatus*, *Artemia fransiscanus*; *Mysidopsis bahia*, *Thermobia domestica*, *Schistocerca gregaria*, *Tribolium castaneum*, *Precis coenia*, *Papilio glaucus*, *Copidosoma floridanum*) to that what is known in *Drosophila*. Superficially, *Drosophila* seems to provide a tidy developmental rationale for the patterns of diversification among arthropods. During embryonic development in *Drosophila*, the body is subdivided into reiterated units by the gradual refinement of spatial gradients. Similarly, limb primordia are set up along the body axis using regulatory signals that are reiterated in each segment. After a number of segments and limbs have been specified similarly, they diverge in character. Axial diversification, resulting in differences to both segment and limb character, is produced in part by the differential activity of "selector" genes —the Hox genes imposed on a series of identical segments. Varying the regulation of Hox genes expressed in different segments could initiate the divergence in character between different segments and different limbs. Through tinkering with the developmental toolbox, evolution could produce endless variation along the A/P axis. Some comparative analyses are consistent with this interpretation, while other results suggest that this model is an oversimplification and modularity itself may be evolving within individual clades. The overall structure of arthropod limbs, whether they are simple rod-shaped structures or multi-branched leaf like shapes, whether they are used for walking, eating, swimming, reproduction or flight, seem to be patterned by a very similar suite of developmental regulatory genes. However, the transition from a singly-branched limb to a limb with two or more branches does not involve a simple reiteration of a patterning module. In addition, the regulatory signals that in *Drosophila* are reiterated in each segment to position limb primordia, that create the top of the genetic hierarchy that controls limb formation, are not conserved in limb patterning in other insects. This contradicts the common expectation that evolutionary changes in developmental pathways are most likely to vary at their terminal points.

[3293] EVOLUTIONARY TRENDS IN MORPHOLOGICAL ADAPTATIONS OF IMMATURE STAGES OF HYDROPHILOIDEA (COLEOPTERA)

M. Archangelsky, CRILAR (CONICET – UNLAR), Entre Ríos y Mendoza s/n (5301) Anillaco, La Rioja Argentina

Hydrophiloids represent an interesting group of beetles which have adapted to live in a wide variety of habitats and environments. They probably originated in a terrestrial (riparian) habitat, from which they have been able to colonize aquatic habitats and, from there, some groups have gone back to terrestrial environments. This has been possible due to several morphological and behavioral adaptations both in adults and larvae. This paper focuses on some adaptations that relate to the preimaginal stages of hydrophiloids; when possible those modifications are viewed in a phylogenetic context. The definition of Hydrophiloidea used here follows that of Hansen (1991) and Archangelsky (1998), excluding Hydraenidae and Histeridae; therefore Hydrophiloidea includes the following families: Helophoridae, Epimetopidae, Georissidae, Hydrochidae, Spercheidae, and Hydrophilidae. Larval characters that define the ancestor of Polyphaga are few, but several of those characters have been modified in at least some hydrophiloids, most of these modifications are correlated with their aquatic and predatory habits. Among the characters of interest are: a- modification of the abdominal segments eight to ten due to the development of a respiratory atrium; apparently this occurs once in the ancestor of Hydrochidae, Spercheidae and Hydrophilidae. b- Reduction of the urogomphi (in number of segments and size). c- Modification of the respiratory system (from 8+1 functional spiracles to 0+1, and in at least one genus, Berosus, 0+0). d- Modifications of the legs in several groups: i) reductions (something that occurred at least 3 times, independently) and, ii) adaptations for swimming. e- Development of directional asymmetries, it occurs in several groups, independently; it involves: mandibles, labium, and labroclypeus. f- Colonization of a variety of habitats (riparian, aquatic, semiaquatic and terrestrial); more information on this subject is needed both from adult and preimaginal stages. g- Feeding habits, hydrophiloids are mostly predatory (generalists), but a few species have been reported to be phytophagous and detritivorous (at least facultatively); only one of the predatory species is known to be a specialist.

Hydrophiloidea, Immature stages, Evolutionary trends.

[3294] EVOLUTION OF A DEVELOPMENTAL THRESHOLD IN ONTHOPHAGUS DUNG BEETLES (COLEOPTERA: SCARABAEIDAE)

D. J. Emlen, Division of Biological Sciences, Univ. Montana, Missoula MT, 59812-1002, U.S.A.

Males in many species of Onthophagus beetle (Coleoptera: Scarabaeidae) wield elaborate horns. Male horn expression is facultative, and regulated by a developmental threshold: males growing larger than a threshold size produce horns, whereas males remaining smaller than this size do not. One major avenue of morphological evolution in this genus involves changes in this developmental threshold. Artificial selection, comparison of allopatric populations, and comparisons of related species all reveal shifts in the critical size for horn expression. I use preliminary knowledge of horn development to suggest how threshold evolution may have occurred. I combine results from several experiments (diet-manipulation, Radioimmune Assay, topical application of methoprene) into a functional model for the endocrine regulation of male horn expression, and identify specific components of this mechanism most relevant to the developmental threshold. I use this information to predict how individuals may vary in horn expression, and to suggest likely avenues by which threshold evolution could have occurred.

Index terms: Onthophagus taurus; male-dimorphism; polyphenism; sexual selection; horns

[3295] SHIFTS IN THE LIFE HISTORY OF PARASITIC WASPS CORRELATE WITH ALTERATIONS IN EARLY DEVELOPMENT

M. R. Strand[1] & M. Grbic[2], [1]Dept. of Entomology, Univ. of Wisconsin, Madison, WI, USA , [2]Dept of Zoology, Univ. W. Ontario, Ontario, Canada.

In insects, the regulation of embryonic development has been intensively studied in model species like *Drosophila melanogaster*. Previous comparative studies have suggested that the developmental processes documented in *Drosophila* well describe embryogenesis of holometabolous insects generally. However, there have been few attempts to take into account how life history has influenced insect embryogenesis or to characterize early development of species with life histories fundamentally different from flies. Our studies of advanced insects in the order Hymenoptera suggest that punctuated shifts in life history can profoundly influence these events. In particular, alterations associated with the evolution of endoparasitism argue that departures from the fly paradigm may occur commonly among insects that develop under conditions different from typical terrestrial species.

[3296] POSSIBLE MOLECULAR STRATEGIES THAT UNDERLIE THE EVOLUTION OF METAMORPHIC DEVELOPMENT

J.W. Truman, M. Schubiger, D. Champlin, & L.M.Riddiford, Dept. of Zoology, Univ. of Washington, Box 351800, Seattle, WA 98195-1800, USA, E-mail jwt@u.washington.edu.

Insects show a wide range life history patterns ranging from insects that lack metamorphosis or undergo only partial metamorphosis (hemimetabolous insects) to those that show complete metamorphosis (the Holometabola). The three life stages that are seen in ancestral insect species -- pronymph, nymph and adult -- are proposed to be equivalent to the larva, pupa, and adult stages of insects with complete metamorphosis. This transition from hemimetabolous to holometabolous development has been accompanied by changes in the endocrine patterns underlying growth and metamorphosis and in the way that tissues respond to these hormonal cues. A key change in endocrine secretion has been a heterochronic advancement in the appearance of juvenile hormone (JH) during embryogenesis. This has been associated with the transformation of the transitional pronymphal stage of hemimetabolous insects into the holometabolous larval stage (Truman & Riddiford, 1999, *Nature* 410,447). The talk will explore implications of the changing pattern of endocrine secretion for postembryonic growth and development of imaginal tissues. An important outcome of metamorphosis has been the shift of the growth and differentiation of the adult form into the postembryonic period. This shift in the timing of imaginal growth is manifest in the formation of imaginal discs in the larva. In the ancestral condition, the formation and growth of imaginal discs appears to have been delayed until the end of larval life. A number of groups, however, now show a derived pattern in which imaginal disc formation and growth has been shifted into the early larval stages. The eye imaginal disc of the moth *Manduca sexta* is an example of an imaginal disc that shows the ancestral pattern of formation because it is delayed until the last larval stage. This delay is due to a tonic inhibition of eye disc formation by JH. Hence, the hormone that maintains the larval form also acts to suppress imaginal growth. In the derived condition, JH still acts to maintain the larval form but its ability to suppress the formation of particular imaginal discs is apparently lost so that they can form and proliferate in the presence of JH. The mechanism of this loss is yet to be determined. Another outcome of metamorphosis is that the patterning processes required for making the adult form have been moved out of the embryonic period into post-embryonic life. In the latter situation, these events have come under the control of ecdysteroids. We will discuss the insights that we have gained from molecular studies in *Drosophila* about how these embryonic patterning systems may have been "captured" by the ecdysone signaling pathway.

[3297] THE ECDYSONE RECEPTOR AND THE PARALLEL EVOLUTION OF PAEDOGENESIS (LARVAL REPRODUCTION) IN TWO SPECIES OF GALL MIDGES (DIPTERA: CECIDOMYIIDAE)

J. Hodin, Seattle Central Community College, Science and Math Dept., 1701 Broadway Ave., Seattle, WA USA 98122.

In general, hormones orchestrate life history transformations in metazoans. Furthermore, the evolution of novel life histories might be generated by alterations in the release of, or in the cellular response to these same hormones. Indeed, the evolution of novel life histories in amphibians (e.g. Frieden 1981; Jennings and Hanken 1998) and sea urchins (e.g. Saito *et al.*1998) seem to follow this pattern. Insect metamorphosis, the major life history transformation among the Holometabola, is largely controlled by two types of hormones, the juvenile hormones (JH) and the ecdysteroids. Among the Holometabola, a novel, facultative life history has evolved several times independently, in which reproduction occurs in the larval stage (paedogenesis), and metamorphosis is skipped entirely. In the paedogenetic life cycle, the ovaries differentiate precociously inside a first instar mother larva, while adult development of other structures is not accelerated. We have previously shown (Hodin and Riddiford 1999) that the timing of ovarian differentiation during metamorphosis in *Drosophila melanogaster* (Diptera: Drosophilidae) is regulated by the timing of expression of the cellular components of the ecdysteroid receptor, the Ecdysone Receptor (EcR) and Ultraspiracle (USP) proteins. Here I show that larval reproduction in two different gall midge (Diptera: Cecidomyiidae) species (*Heteropeza pygmaea* Winnertz and *Mycophila speyeri* Barnes) involves precocious expression of EcR and USP in the ovarian cells of first instar paedogenetic mother larvae. Cladistic analysis (using the phylogeny of Jasch-of 1998) suggests that paedogenesis evolved independently in these two genera, indicating that paedogenesis evolved in parallel (namely, using the same develop-mental mechanisms) in the Cecidomyiidae. I will discuss these results in the context of developmental constraints on the evolution of paedogenesis in the Diptera.

[3298] EXPLORING HOW A BUTTERFLY WING PATTERN CAN EVOLVE

P. M. Brakefield, Inst. of Evolutionary and Ecological Sciences, Leiden Univ.PO Box 9516, 2300 RA Leiden, The Netherlands

An overview will be given of evolutionary and developmental studies of the wing eyespot pattern of African Bicyclus butterflies. Artificial selection experiments are used to produce divergent morphologies, and mutant stocks have also been established. The developmental mechanisms of eyespot formation have been examined by both manipulative experimental procedures and molecular techniques. By combining surveys of genetic variation with investigations of how the genes influence the developmental pathway of eyespot formation, we hope to examine the potentials for evolutionary change of the wing pattern. Each wing eyespot is based on the same developmental pathway with the series of eyespots representing developmental homologues. Current selection experiments are beginning to explore mechanisms of uncoupling among the eyespots in relation to the topic of evolutionary constraints.

[3299] EVOLUTION OF PREY SPECIFICITY IN *CHRYSOPA* (NEUROPTERA: CHRYSOPIDAE): LIFE-HISTORY ADAPTATIONS AND REPRODUCTIVE COSTS

G. S. Albuquerque[1], M. J. Tauber[2] & C. A. Tauber[2], [1]Lab. Protecao de Plantas, Univ. Est. do Norte Fluminense, Ave. Alberto Lamego, 2000, Campos dos Goytacazes, RJ, 28015-620, Brazil, E-mail: gsa@uenf.br. [2] Dept. Entomology, Cornell University, Ithaca, NY, USA.

Many predacious insects have evolved restricted associations with their prey, but life-history traits involved in prey specialization were studied in very few species. This comparative experimental study with a pair of generalist and specialist sister-species of *Chrysopa* showed that they differ greatly in their diets and in their developmental and reproductive responses to each other's prey. Such results reveal evolutionary adaptations and trade-offs associated with predator-prey specialization. First, hatchlings of the generalist, *Chrysopa quadripunctata*, suffered very high mortality on a diet of the robust woolly alder aphids, the usual prey of the specialist, *Chrysopa slossonae*. In contrast, specialist hatchlings, which are considerably larger than those of the generalist, and older larvae of both species, had high survival on this prey. Thus, it appears that the evolution of large hatchlings and an associated set of other life-history traits (e.g. large adults, reduced fecundity, large eggs, reduced developmental rates) underlies the specialized prey association between *C. slossonae* and the woolly alder aphid. Second, the specialist's prey induced changes in a set of the generalist's life history traits that resembles the genetically based suite of differences between the two predators: the rates of oviposition and preimaginal development decreased, whereas the size of adults and eggs increased. This diet-based phenotypic plasticity in the sister-species' ancestor could have helped facilitate the early evolutionary stages of *C. slossonae's* association with the woolly alder aphid. Third, a diet of the generalist's usual prey did not have negative effects on the survival or development of specialist's immatures, but the resulting adults had significant reductions in body size, survival, oviposition, and egg fertility. We conclude that the specialist's adaptation to the woolly alder aphid caused a drastic diminution in its ability to reproduce on the presumed ancestral-like prey. Although the physiological basis for the specialist's reduced ability to use the generalist's prey
is unknown, it may contribute to a very stable dietary association with the woolly alder aphid.

Index terms: *Chrysopa quadripunctata*, *Chrysopa slossonae*, development and reproduction, phenotypic plasticity, predator-prey association

[3300] CONTROL OF DROSOPHILA REPRODUCTION BY MALE-DERIVED PROTEINS IN THE SEMINAL FLUID

M.F. Wolfner[1,3], O. Lung[1], Y. Heifetz[1], W.J. Swanson[1], S.N. Albright[1], C.F. Aquadro[1], A.G. Clark[2], U. Tram[1] & D.M. Neubaum[1], [1]Dept. of Molecular Biology and Genetics, Cornell Univ., Ithaca NY USA and [2]Dept. of Biology, Penn State Univ., University Park, PA USA;. [3]E-mail: mfw5@cornell.edu.

During mating, proteins and peptides from secretory tissues in the male's reproductive tract are transferred to his mate in the seminal fluid, along with sperm. In *Drosophila melanogaster*, seminal fluid proteins derived from the male's accessory gland (Accessory gland proteins, or Acps) trigger an increase in oogenesis, ovulation and egg deposition, and avoidance of remating. They also cause sperm to be stored, and were shown by Harshman & Prout to be players in sperm competition between males. Additionally, Acps include proteins with antibacterial activity, and molecules that contribute to the formation of the mating plug. Acps also decrease the life span of the mated female, presumably as a negative side-effect of an otherwise beneficial and essential function. To gain a comprehensive molecular understanding of how behavioral, reproductive and physiological changes are mediated by seminal fluid proteins, we are undertaking a genomic approach involving an EST project to identify all the secreted molecules made by male accessory glands. We will describe Acps detected by this method, their possible functions predicted from their sequences, and their evolutionary conservation. To identify the function of individual Acps, we use genetic (knockout) and transgenic (ectopic expression) approaches, in conjunction with immunolocalization to identify the sites to which Acps bind in mated females. Three Acps whose functions we have characterized will be described: (1) a prohormone-like molecule that is required to stimulate ovulation, (2) a glycoprotein that binds to sperm and mediates sperm storage, and (3) a protease inhibitor whose action may decrease the mated female's life span. We will discuss our progress in identifying binding proteins or receptors for these Acps using two-hybrid and protein biochemical methods, as a first step in defining the molecular pathways through which the Acps act. Further understanding of Acp action is gained by examining the levels of signaling molecules in response to mating and Acps, and our results in this area will also be presented.

Index terms: *Drosophila melanogaster*, male accessory gland, ovulation, sperm storage, life span, genomics

[3301] ECDYSTEROID-TRIGGERED REGULATORY HIERARCHIES IN INSECT REPRODUCTION

W. A. Segraves[1], M. Buszczak[1], S. Ayer[1], L. Cooley[2], S.F. Wang[3], J. Zhu[3], C. Li[3], G. Sun[3] & A. S. Raikhel[3], [1]Dept. of Molecular, Cellular and Developmental Biology, Yale Univ., P. O. Box 208103, New Haven, CT 06520-8103, USA, E-mail william.segraves@yale.edu; [2]Depts. of Genetics and Cell Biology, Yale Medical School, New Haven, CT 06520, USA, [3]Program in Genetics and Dept. Entomology, Michigan State Univ., East Lansing, Michigan 48824, USA.

The steroid hormone 20-hydroxyecdysone (20E) plays a critical role in the reproduction of Diptera and some other insects. However, the genetic regulatory mechanisms underlying reproductive ecdysteroid response remain largely unknown. To address these questions, we have investigated ecdysteroid-regulated gene expression in two Diptera, *Aedes aegypti* and *Drosophila melanogaster*. In the mosquito, vitellogenesis and the progression of oogenesis are induced in response to a regulatory cascade triggered by a blood meal. Examination of the expression of known 20E response genes has shown remarkable similarity between previously characterized regulatory hierarchies in insect metamorphosis and the blood meal-induced expression of genes at several levels in these hierarchies, including ecdysteroid receptor (EcR) and its heterodimeric partner *Ultraspiracle* (USP) and the early genes E74 and E75, in fat body and ovary. We have characterized involvement of this regulatory hierarchy in the regulation of vitellogenic genes in the mosquito fat body. Similarly, in *Drosophila*, we see induction of 20E-regulated genes E75, E74 and BR-C during mid oogenesis, and demonstrate that this expression is reduced in ecdysteroid-deficient mutants. Genetic analysis of mutations affecting *EcR* and the early gene *E75* indicates that these genes are required in the germ line for the sequential progression of egg chambers from the previtellogenic to vitellogenic stage of *Drosophila* oogenesis, in a manner similar to the blood-meal stimulated progression of oogenesis in the mosquito. These findings suggest that there is an evolutionarily conserved ecdysteroid-dependent checkpoint controlling the progression of Dipteran oogenesis.

Index terms: *Aedes aegypti*, *Drosophila melanogaster*, ecdysone, oogenesis, vitellogenesis.

[3302] MOLECULAR ASPECTS OF JUVENILE HORMONE ACTION UPON VITELLOGENIN PRODUCTION IN INSECTS

X. Bellés, D. Comas, D. Martín & M. D. Piulachs, Department of Physiology and Molecular Biodiversity, Instituto de Biología Molecular de Barcelona (CID, CSIC), Jordi Girona 18, 08034 Barcelona, Spain, E-mail: xbragr@cid.csic.es.

Juvenile hormone (JH) is the master vitellogenic and gonadotrophic factor in many insect orders. However, molecular aspects of JH action upon vitellogenesis have been mainly studied in less modified insect groups, like locusts or cockroaches. Cloning of the complete or partial cDNA for vitellogenin in the locust *Locusta migratoria* and the cockroach *Blattella germanica* has facilitated molecular analysis of the vitellogenic action of JH. In *L. migratoria*, most of the results available have been described by G. R. Wyatt and associates. For example, they have shown that this species requires quite a high doses of JH III (higher than 100 µg) or JH analog (10 µg of pyriproxyfen) to stimulate vitellogenin production in allatectomized females. In addition, the same authors have shown that induction of vitellogenin transcription by JH or JH analog administered to allatectomized locusts is delayed about 24 hours In contrast, results obtained in our laboratory with *B. germanica*, indicate that a dose as low as 0.1 µg of JH III induces clearly detectable amounts of vitellogenin mRNA in the fat body of allatectomized females as early as 2 hours after the administration of the hormone. Experiments carried out on fat body tissue of *B. germanica* incubated in vitro also show the high sensitivity and rapidity of response of this species to the vitellogenic action of JH. The gene or the cDNA for vitellogenin has been cloned in other insect species in which vitellogenesis is apparently governed by JH, like the cockroach *Periplaneta americana*, the hemipterans *Riptortus clavatus*, *Plautia stali* and *Graptopsaltria nigrofuscata*, the coleopteran *Anthonomus grandis* or the hymenopterans *Athalia rosae* and *Pimpla nipponica*. However, the hormonal control of vitellogenin expression in these species has not yet been reported. In any case, the substantial differences encountered when comparing two relatively close related species, such as the orthopteran *L. migratoria* and the dictyopteran *B. germanica*, promises a great diversity of vitellogenin regulation modes within the insect class.

Acknowledgements: Financial support from the DGICYT, Spain (project No PB98-0472) and from the CIRIT, Catalonia (1999 SGR 00186) is gratefully acknowledged.

Index terms: *Blattella germanica*, *Locusta migratoria*, vitellogenesis.

[3303] SOMATIC-GERM LINE CELL INTERACTION IN OOGENESIS AND SPERMATOGENESIS

M. Bownes.

ABSTRACT NOT RECEIVED

[3304] GENE REGULATION DURING OVARIAN DEVELOPMENT IN THE SILKMOTH

L. Swevers[1,2], K. Ito[1], M. Glushek[1], T. Eystathioy[1], M. Lunke[1], F. Kendirgi[1] & K. Iatrou[1,2], [1]Department of Biochemistry and Molecular Biology, Univ. of Calgary, 3330 Hospital Dr. NW, Calgary, AB T2N 4N1, Canada, E-mail iatrou@ucalgary.ca; [2]Institute of Biology, National Centre for Scientific Research "Demokritos", 153 10 Aghia Paraskevi Attikis, Greece.

In the domesticated silkmoth *Bombyx mori*, oogenesis occurs over a period of 9 days during pharate adult development. Each ovariole of the pharate adult contains more than 100 follicles organized in a linear array, with each follicle representing a unique stage that differs from its immediate neighbours by 2 hours of developmental distance. The program of follicle development (assessed through the differentiation state of the cells of the epithelium that surrounds the oocyte), becomes independent of exogenous factors during mid-vitellogenesis (follicle stage -35 that is reached on day 2.5 of pharate adult development), and can be implemented *in vitro* with the same kinetics as *in vivo*. On day 4.5 of pharate adult development (terminal follicles at stage -1), the cells of the follicular epithelium initiate choriogenesis, the program of sequential activation of more than 120 genes whose products constitute the eggshell or chorion. The objective of our work is to deduce how follicular cells become committed to their terminal differentiation path and how the choriogenic program is executed. Our latest studies focus on the characterization of regulatory factors whose interplay determines the execution of the differentiation program. Having shown that 20-hydroxy-ecdysone (20E), the master regulator of oogenesis, mediates its effects in follicular cells by activating, via its receptor, a small set of early response genes, including those encoding the nuclear receptors E75 and HR3, we have found that certain isoforms of E75 and HR3 behave as late response genes in the 20E-induced cascade and may have specific functions during the transition from late vitellogenesis to early choriogenesis. We have deduced that E75 and HR3 interact functionally with each other and that E75 acts as a suppressor of the HR3-mediated transcriptional induction of target genes. Studies on the identification of factors interacting with BmGATA□, **a transcriptional** regulator of chorion genes whose activity is thought to be regulated by phosphorylation-mediated partitioning between the cytoplasm and the nucleus of follicular cells, have shown the existence of at least 6 interacting proteins in follicular cells. While some of them have no known homologs, one of them, expressed in the ovary during a narrow time window (stages -5 to +5) is homologous to a serine/threonine protein kinase. Additional results from the characterization of genes that are expressed in the context of the follicular cell differentiation program, will be presented which suggest that strategies of insect pest control, based on concepts of genetic interference with the reproductive capacity of female insects, are feasible.

[3305] OOCYTE RECEPTORS FOR THE SPECIFIC ACCUMULATION OF YOLK PROTEINS

A. S. Raikhel[1], S. J. Seo[2], H. M. Cheon[2], J. Sun[1], K. H. Cho[1], & C. Y. Yun[1], [1]Dept. Entomology, Michigan State Univ., East Lansing MI, USA, E-mail: araikhel@pilot.msu.edu; [2]Dept. Biology, Gyeonsang Natl. Univ., Chinju Gyeongnam, South Korea

Our ultimate goal is the elucidation of the molecular mechanisms underlying the specific accumulation of yolk protein precursors (YPP) in mosquito oocytes. We have previously characterized the vitellogenin receptor (VgR) as being responsible for specific internalization of the major yolk protein, vitellogenin (Vg). The mosquito VgR has been identified as a 205-kDa protein. Cloning of the cDNA encoding VgR has shown that it is a member of the low-density lipoprotein receptor (LDLR) family, sharing significant homology with the *Drosophila* yolk protein receptor. Insect Vg/YP receptors are unique in that they are twice as big as vertebrate VgR or VLDLR, carrying two clusters of cysteine-rich complement-type repeats (implicated in ligand recognition) instead of one as found in vertebrate VgR and LDLR. In the mosquito *Aedes aegypti*, several other YPP are synthesized in addition to Vg, in the vitellogenic fat body which are specifically accumulated by oocytes and deposited in mature yolk granules. These include two pro-enzymes, vitellogenic carboxypeptidase (VCP) and vitellogenic cathepsin B (VCB), and lipophorin (Lp). A specific Lp receptor (LpR) exists in the mosquito oocytes which is distinct from the Vg receptor and is homologous to the *Locusta* fat body LpR and to the vertebrate VLDL receptor. The cDNA encoding a putative ovarian mosquito lipophorin receptor (LpR) was cloned by a combination of PCR and cDNA library cloning. The deduced amino acid sequence has 64.3% homology with the locust fat body LpR and the structure of a receptor belonging to the LDL receptor family. The receptor consists of a typical cysteine-rich complement domain containing eight modules, an EGF homologous domain, a transmembrane domain and a cytoplasmic tail with a tyrosine internalization motif. Northern blot analysis revealed that the 4.1-kb transcript for this ovarian receptor is expressed at the previtellogenic and vitellogenic stages. *In situ* hybridization showed that LpR mRNA was present in the nurse cells and oocyte of developing primary follicles starting from early previtellogenic stages. We are presently investigating whether this newly discovered oocyte receptor is responsible for internalization of only Lp or if it serves as a multifunctional receptor binding, VCP and VCB as well.
Index terms: *Aedes aegypti*, vitellogenin receptor, lipophorin receptor, LDL receptor family.

[3306] A MALE VIEW ON REPRODUCTIVE DIAPAUSE, OR COADAPTATION OF MALE REPRODUCTIVE STRATEGIES TO DIAPAUSE IN FEMALE INSECTS

M. P. Pener, Dept. of Cell and Animal Biology, The Hebrew Univ., 91904 Jerusalem, Israel, E-mail pener@vms.huji.ac.il

Reproductive adult diapause (including quiescence) in male insects has been characterized by many different traits in different species, but it should be defined as a reversible state of inability of the male to inseminate receptive females. Male reproductive strategy is under selection pressure towards a balance between maximum chances of fertilization of the females' eggs and minimum waste of energy, as well as minimum predation risk. Therefore, in species with a female reproductive diapause, male reproductive strategy must be adapted to female diapause and diapause-related female and male strategies must be coadapted. In a previous review (Pener, 1992, Chronobiology International, 9:102-113) three types of such coadapted reproductive strategies were recognized: (1). The female is receptive in the early part of her diapause when copulation occurs. The male dies shortly after mating and the female stores the sperm to fertilize the eggs that develop after female diapause is terminated. (2). The female is receptive during diapause; oocyte development is arrested, but mating occurs and the stored sperm fertilizes the eggs after female diapause is ended. Reproductive diapause may not occur in the male, or it may exist in a portion of the males, and the actual situation in a species may reflect some balance in sperm precedence in that species. (3). The female is refractory during diapause and the male exhibits reproductive diapause. The diapause is controlled by similar environmental cues and the same endocrine mechanism in both sexes, but male diapause usually terminates before female diapause. Recent data in the literature indicate that strategy no. 3 may be quite widespread and there are intermediate cases between strategies no. 2 and no. 3. Moreover, some further strategies may exist. Male diapause is under two antagonistic selection pressure; a male should not waste energy to court refractory females, but should be ready to mate as soon as the female becomes receptive.
Index terms: reproductive diapause, male, coadaptations, environmental cues.

[3307] THE PHOTOPERIODIC RESPONSE IN APHIDS

J. Hardie, Aphid Biology Group, Dept. of Biology, Imperial College at Silwood Park, Ascot, Berks SL5 7PY, UK, E-mail j.hardie@ic.ac.uk.

It has been known for some time that the photoperiodic photoreceptor of the vetch aphid, *Megoura viciae* is located in the brain with a patch of relatively transparent cuticle allowing light to penetrate into the brain tissue. We have used immunocytochemical techniques to reveal the putative photoreceptor region. It is located in the neuropile of the anterior protocerebrum and there is the distinct possibility that the protein moiety is an opsin. For many years it appeared that the aphid photoperiodic clock showed classic features that could be modelled by an hour-glass or damped oscillator mechanism. In *M. viciae*, Nanda-Hamner protocols did not reveal the peaks and troughs with *c.* 24-h periodicity seemingly characteristic of an underlying circadian mechanism. The black bean aphid, *Aphis fabae*, however showed exactly this result when the experiments were run at 20 but not at 15 °C. More recent studies using a Veerman-Vaz Nunes protocol has shown that for both species the observed data more closely correlate with a clock mechanism that is underpinned by a circadian oscillator. Experimental regimes designed to examine the photoperiodic counter showed that, in both species, the accumulation of long nights is temperature compensated while short-night accumulation is temperature sensitive. This has led to the idea that there are separate long-night and short-night measuring mechanisms. At the endocrine level we have investigated the possible role of melatonin in the photoperiodic response of the pea aphid, *Acyrthosiphon pisum*. Melatonin is known to be a transducer of day length effects in mammals. When fed to long-day, female pea aphids in an artificial diet, it induced the appearance of asexual/sexual intermediate females in the following generation and increased the proportion of males born. Both observations were consistent with a short-day (long-night) affect. Melatonin was identified in the pea aphid and whilst titres were generally higher at night than during the day, the results were not statistically different. A role for melatonin in aphid photoperiodism requires verification.
Index terms: *Acyrthosiphon pisum*, *Aphis fabae*, *Megoura viciae*, melatonin, photoreceptors, temperature

[3308] EVOLUTIONARY ASPECTS OF PHOTOPERIODISM IN *DROSOPHILA*.

M. T. Kimura, Graduate School of Environmental Earth Science, Hokkaido Univ., Sapporo, Hokkaido 060-0810, Japan, E-mail mtk@ees.hokudai.ac.jp.

Most insects from temperate areas regulate their life cycles using photoperiod as an environmental cue. However, insects from tropics usually have no photoperiodism and some of insects adapted to arctic or alpine environments do not respond to photoperiod under usual conditions. Here I report the evolution of photoperiodism in temperate, arctic and alpine drosophilids. In the *Drosophila montium* species subgroup of the *melanogaster* species group, the temperate species with photoperiodic reproductive diapause were suggested to have derived from subtropical highland species which have no photoperiodism. Accordingly, photoperiodism is considered to have evolved in accordance with the colonization of a subtropical highland species in temperate areas. In the temperate species, photoperiodic response was distinct in populations from localities where mean temperature of the coldest month is 11 °C or lower, but was not in those from warmer localities, suggesting that this condition is critical for the evolution of photoperiodic diapause in this subgroup. However, our preliminary observation suggests that the subtropical highland species make seasonal migration between highlands and lowlands. Therefore, there is also a possibility that photoperiodism has already evolved in drosophilids inhabiting subtropical highlands to control seasonal migration. On the other hand, *D. moriwakii*, *D. alpina* and *Chymomyza costata* have evolved univoltine life cycles in accordance with adaptations to specific, alpine or arctic environments. These species entered diapause irrespective of photoperiod under usual conditions, but they showed photoperiodic responses when they were retained under unusual conditions; i.e., *D. moriwakii* and *C. costata* did not enter diapause at a long daylength when flight was suppressed or reared at high temperature, and *D. alpina* terminated diapause at a long daylength when maintained for very long period. These conditions are also known to affect the expression of photoperiodism in multivoltine temperate species. It is therefore assumed that their ancestors had multivoltine life cycles and they evolved univoltine life cycles by changing sensitivity to factors that affect the expression of photoperiodism.
Index terms: the *montium* subgroup, *D. moriwakii*, *D. alpina*, *Chymomyza costata*

[3309] PHOTOPERIOD IN EARLY DEVELOPMENT MODIFIES THE CRITICAL PHOTOPERIOD IN LATE DEVELOPMENT FOR PUPAL DIAPAUSE INDUCTION IN A MOTH

S. Masaki[1]& Y. Kimura[2], [1]12-13 Matsubara Higashi-1, Hirosaki 036-8141; [2]1-1 Sakaimatsu, Kuroishi 036-0389, Japan

The cabbage moth *Mamestra brassicae* can take one of three different types of pupal development: long winter diapause in short days, a short summer diapause in long days, nondiapause in intermediate days. Experiments with Bünsow and Nanda-Hamner protocols suggested that the larva measures scotophase by an hourglass mechanism, but a circadian oscillator component is involved in the final expression of the response (frequencies of the different developmental types) which is affected by temperature. A bistability phenomenon occurs in the response to skeleton photoperiods, i.e. the diapause incidence depends on the phase of a previously entraining light-dark cycle, again suggesting the involvement of a circadian system. Thus, this moth shares the basic formal properties of the photoperiodic response with many other species of arthropods. However, we have found an important novel aspect of the photoperiodic response in this moth. The inductive effect of photoperiod can be drastically modified by the interacton between photoperiods in the early and late sensitive stages. Previously reported response models, i.e. two step response requiring a combination of two different ranges of photoperiods and a response to the direction (increase or decrease) of photoperiodic change, can not explain our results, which can be understood if the critical photoperiod for determination of the of pupal development patterns changes with the photoperiod in the early (the late egg and early larval) stages of development.

Index terms: *Mamestra brassicae*, diapause, photoperiod, hourglass, circadian rhythm.

[3310] GEOGRAPHICAL STRAINS AND SELECTION FOR THE DIAPAUSE TRAIT IN *CALLIPHORA VICINA*

D. S. Saunders, Institute of Cell, Animal and Population Biology, Univ. of Edinburgh, West Mains Road, Edinburgh EH9 3JT, Scotland, United Kingdom

The blow fly, *Calliphora vicina*, exhibits a larval diapause which is regulated by a maternally-operating photoperiodic 'clock'. Adult female flies exposed to the long days of summer produce successive generations of non-diapausing larvae that promptly form puparia, whereas those exposed to autumnal short days produce larvae that enter diapause after the end of the feeding phase because of low titres of circulating ecdysteroids and the non-release of the cerebral neuropeptide, PTTH. Diapausing larvae are morphologically identical to non-diapausing larvae, but the latter are recognised by their greatly delayed pupariation, those not forming puparia after 30 days in culture being considered to be in diapause. Strains of *C. vicina* from northern Finland (65°N), south-eastern Scotland (55°N), southern England (50°N), central Italy (46°N) and North Carolina (36°N) present diapause and photoperiodic characteristics that are typical for an insect from a large north-south cline, with a longer critical day length (CDL), a longer-lasting or more intense diapause, and enhanced cold tolerances to the north. Reciprocal crosses between flies from Finland and southern England demonstrate the maternal inheritance of CDL, but not diapause intensity. Using the Scottish strain, selection for and against larval pupariation time led to the rapid isolation of high and low diapause strains resembling the extremes of north and south in the natural cline.

Index terms: Larval diapause, photoperiodism, latitudinal cline, reciprocal crosses, selection.

[3311] CIRCANNUAL RHYTHM IN *ANTHRENUS VERBASCI:* A RE-EVALUATION OF BLAKE'S RESULTS

H. Numata & T. Nisimura, Dept. of Bio- and Geosciences, Grad. Sch. of Sci., Osaka City Univ., Sumiyoshi, Osaka 558-8585, Japan, E-mail numata@sci.osaka-cu.ac.jp.

Blake (1959) reported circannual rhythm in pupation of *Anthrenus verbasci* (Coleoptera: Dermestidae). These results have not been verified for 40 years, even though this has been regarded as a typical example of circannual rhythm in insects (Saunders, 1982). In the present study, we examined whether this mechanism exists in the Japanese population of *A. verbasci* also, and described the characteristics of the rhythm in more detail. First, we reared larvae of *A. verbasci* under LD 12:12 at various constant temperatures. At 17.5, 20, 22.5, 25 and 27.5 °C, some larvae pupated 25-30 weeks after hatching (the first group) and most of the remaining larvae pupated about 40 weeks later than those of the first group (the second group). Next, we performed the experiment under LD 12:12 at 20 °C beginning at various times throughout the year. Although the proportion of the two pupation groups differed among experimental series, the duration of larval period in each group was similar. In one series, a third group was also observed, in which larvae pupated about 40 weeks later than those of the second group. We confirmed that pupation of this insect is regulated by an endogenous clock mechanism. To determine the Zeitgeber for this rhythm, larvae were transferred from LD 16:8 to LD 12:12 or *vice versa* at 20 °C at various ages. In most cases, pupation occurred about 23 weeks after transfer from LD 16:8 to LD 12:12. The change in photoperiod from long to short day probably entrains the rhythm. Then we reared larvae under varoius photoperiods at 20 °C. The results under LD 13:11 were similar to those under LD 12:12. Under LD 14:10, LD 15:19 and LD 16:8, however, only a small proportion of larvae sporadically pupated later than under short-day conditions. Therefore, there is a distinctive critical daylength between 13 and 14 h in the clock mechanism controlling pupation. Moreover, we detected two discrete groups in pupation even under long-day conditions.

Index terms: *Anthrenus verbasci*, circannual rhythm, photoperiod

[3312] MOLECULAR BIOLOGY OF INSECT CLOCKS FOR PHOTOPERIODISM

M. Takeda[1], N. Ichihara[1], J.Bembenek [1],E.P. Markova[1], Y. Watari[2], T. Arai [2], H.Ueda[3], K. Mita[4], & M. Okada[6], [1]Grad.Sch.Sci.Tech, Kobe Univ., Kobe 657-8501,E-mail: mtakeda@kobe-u.ac.jp, [2] Ashiya Univ., [3] Nat. Inst. Genet. & [4] Inst. Rad. Med.,[5] Osaka Univ. Japan

Core mechanism of photoperiodism is circadian oscillation. Photoperiodism is a complex phenomenon and physiological reality of the photoperiodic clocks are not well understood. Now molecular biology of circadian oscillation is burgeoning which provides a powerful tool for the analyses of photoperiodic clocks. We challenge this task using 1) *Antheraea pernyi* where circadian clock genes have been cloned and the endocrine regulation of diapause has been studied, 2) *Bombyx mori* where EST database is available and neuroendocrine mechanism for diapause has been analyzed and 3) a photoperiodic strain of *Acheta domesticus* where concurrent analyses for behavioral rhythms and developmental determination is possible. We investigated temporal behaviors of clock gene products, PER, DBT, CYC and CRY and the neuronal architecture expressing these. Diversity is apparent in the neuronal architecture and probably in the mechanism among these systems but many clock gene products are colocalized in the same cells or in their vicinity. For the output pathway we focus on melatonin and indoleamine pathways. We measured melatonin contents and activity of *N*-acetyltransferases in circadian and photoperiodic contexts. The results suggest the indolamine pathway is an essential component for both circadian and photoperiodic time measurement.

Index words: circadian clock genes, melatonin, *N*-acetyltransferases

[3313] ECDYSTEROID CONTROL OF WING MORPHOGENESIS DURING METAMORPHOSIS AND PUPAL DEVELOPMENT

H. Fujiwara, T. Matsuoka, S. Ogai & S. Uchida, Dept. of Integrated Biosciences, Graduate School of Frontier Sciences, Univ. of Tokyo, Hongo 7-3-1, Bunkyo-ku, Tokyo113-0033, Japan, E-mail haruh@k.s.u-tokyo.ac.jp.

Holometabolous insects dynamically reconstruct their body pattern during larval-pupal development. Wing imaginal discs and pupal wings, in particular, undergo striking morphological changes. To understand the molecular mechanisms of ecdysteroid-mediated wing differentiation, we have studied developmental systems of two "wingless" moths, a wing-deficient mutant fl of *B.mori*, and a tussock moth *O. recens* whose female loses wings. . Previous studies have suggested that the *fl* wing discs lose responsiveness to ecdysteroid during metamorphosis. To demonstrate this hypothesis at the molecular level, we compared the expression of 12 genes between the wild type (WT) and *fl* wing discs cultured in the presence or absence of 20-hydroxyecdysone (20E). Most of the genes tested were normally expressed in the *fl* wing discs, although the amounts of mRNAs of two ecdysteroid-inducible genes, *BHR3* and *Urbain* (wing-specific late gene), were reduced in the *fl* discs. The *BHR3* reduction in the *fl* mutant was observed only in the wing disc, but not in the testis and fatbody. These results imply that the aberrant expression of the *fl* gene affects the downstream pathway of ecdysteroid signaling specifically in the wing discs and thus leads to a deficiency in wing formation. The second model, female wings of *Orgya* seem to shrink during the pupal stage, although they develop normally until pupation as same as male wings. To test the effects of ecdysteroid on pupal wing development, we cultured the wings from females and males just after pupal ecdysis (stage P0) with or without 20E. After 2 days of exposure to 20E, only female wings dramatically shrunk in a whole area, while male wings did not show such a change. The DAPI staining revealed that cells in whole area of female wings disappeared, while cells only outside of bordering lacuna (BL) was lost in male wings. The TUNEL method demonstrated that this ecdysteroid-induced cell death in wings was caused by apoptosis. The present study suggests that ecdysteroid triggers the extensive cell death in pupal female wings and produce the wingless female moth of *Orgya*. These two "wingless moths" are very useful and effective tools to understand morphogenesis, cell differentiation and signaling pathways induced by ecdysteroid during wing development.

[3314] BIOLOGY OF *SEPEDONEA*, A NEOTROPICAL GENUS OF SNAIL-KILLING FLIES (DIPTERA: SCIOMYZIDAE)

J. Abercrombie, Davey Resource Group, P.O. Box 5193, Kent, OH 44240, USA, E-mail jabercrombie@davey.com.

The biology of the Neotropical genus *Sepedonea* (Diptera: Sciomyzidae) is reviewed, including observations on geographical distribution, seasonal occurrence, life histories, mating behavior of adults, and feeding behavior of larvae. The review concentrates on six of the twelve species that occur mainly in South America and whose life histories and immature stages are known: *S. guianica, S. incipiens, S. lagoa, S. lindneri, S. telson,* and *S. trichotypa*. These data are compared with two other species (*S. guatemalana* and *S. isthmi*) that are found mainly in Central America and whose life histories have been published previously. The species of *Sepedonea* form a biologically homogenous group. Larvae are active, aggressive predators, killing and devouring many freshwater, non-operculate gastropods during their three stadia. The total duration of larval life ranges from nine to 44 days in the laboratory.

Index terms: *Sepedonea guianica,* snail, aquatic, life history

[3315] A SURVEY OF THE SEXUALLY DIMORPHIC CHARACTERS IN THE CERATOCANTHINAE (COLEOPTERA: SCARABAEOIDEA: CERATOCANTHIDAE)

A. Ballerio, Viale Venezia 45, I-25123 Brescia, Italy, e-mail: ballerio@numerica.it.

The Ceratocanthinae are the largest subfamily of Ceratocanthidae, numbering about 350 described species. The majority of the known genera of the Ceratocanthinae shows a series of distinctive patterns of sexual dimorphism. Existing literature has never emphasized the sexually dimorphic characters in the family, and in many genera the sexual dimorphism, although conspicuous, has never been described. Various parts of the body of males and, in few instances, of females are affected by sexual dimorphism. In particular these body parts are: the shape of male protarsi (*Eusphaeropeltis*), the shape of the apical teeths of male and female protibiae (*Ebbrittoniella, Paulianostes, Cyphopisthes*), the shape of female protibiae (*Melanophilharmostes, Goudotostes, Callophilharmostes, Carinophilharmostes, Petrovitzostes*), the shape of male apical spur of protibiae (many genera), the shape of male inner apical spur of mesotibiae (the majority of genera), the shape of the apical portion of metatibiae (some species of *Haroldostes*), the shape of inner apical spur of metatibiae (*Pterorthochaetes*), the shape of head (*Melanophilharmostes, Goudotostes*, one so far undescribed Oriental genus), and the punctures of pronotum (one so far undescribed Oriental genus). The functional meaning of these structures, in the lack of any observation on the mating behaviour and oviposition, can only be hypothesized, while the usefulness of these charcters in reconstructing the phylogeny and in evaluating natural groups within the subfamily, is still not clear. Nevertheless a preliminary analysis suggests that homogeneous groups of species usually show the same sexual dimorphism and that generic groups often exhibit the same sexually dimorphic pattern.

[3316] JUVENILE HORMONE PROMOTES VITELLOGENIN EXPRESSION IN POSTEMBRYONIC STAGES OF *APIS MELLIFERA* FEMALES

A.R. Barchuk[1], M.M.G. Bitondi[2] & Z.L.P. Simões[2], [1]Depto. Genética FMRP-Universidade de São Paulo Av Bandeirantes 3900, 14049-900 Ribeirão Preto, SP, Brazil, E-mail: barchuk@rgm.fmrp.usp.br, [2]Depto. Biologia FFCLRP, Universidade de São Paulo

Vitellogenin (Vg) synthesis by the fat body is normally restricted to females and is especially intense in queens (only very little quantities of this protein are detected in drones). The Vg synthesis program of adults queens cannot be modified by juvenile hormone (JH) applications, in contrast to workers, in which low concentrations of JH are permissive to Vg synthesis, but high concentrations are repressive. Little is known on the mechanisms that regulate the initial expression of this protein in *Apis mellifera*. Our recent studies indicate that Vg synthesis starts during the pupal period, where it initiates distinctly earlier in queens than in workers. In addition, our results suggest that the initiatiation of Vg expression in *Apis mellifera* is more related to JH than previously thought. To determine the participation of this hormone in pupal Vg expression, we tested the effects of topical JH applications on different postembryonic stages of *Apis mellifera*. JH-III (10 µg in 2 µl of acetone) was administered to pink- and brown-eyed pupae (controls were treated with the respective solvent). The hemolymph of subsequent stages was collected and analyzed for vitellogenin presence. Western blots of conventional SDS-PAGE were assayed utilizing a rabbit antiserum raised against honeybee egg proteins. Rocket immunoelectrophoresis was employed for the quantitative determination of the Vg fraction in hemolymph. The clearest effect of exogenous JH was the anticipation of Vg expression in both castes. While in control groups Vg appeared only in pupae with a strongly melanized thorax, in JH treated groups it already appeared in pupae with a medium pigmented thorax. The caste-specific regulatory mechanism, however appears to persist also in the presence of artificially elevated JH titers, since JH advanced Vg expression in queens to earlier stages than in workers. Most importantly, our results suggest that the initiation of Vg synthesis in the pupal stages is governed by other factors than those maintaining Vg synthesis, particularly in adult queens. During the late pupal stages, as well as in the first days after emergence, ecdysteroid titers are relatively low in queens and workers, but differences are observed in the JH titer, which is already higher in queens. It is quite possible that the initiation of Vg synthesis in *Apis mellifera* could be determined by a combination of these two hormones, resulting in the caste-specific program of Vg synthesis in the adults.

Index terms: honey bee, fat body, pupal development, JH, yolk

[3317] ACARICIDE ACTION OF ROPE TOBACCO (*NICOTINA TABACUM*) OVER LARVAE OF *BOOPHILUS MICROPLUS* UNDER LABORATORY CONDITIONS

L. A. G Barci[1], C. J. Veríssimo[2], A. H. C. Nogueira*[1] , M. C. Mendes[1], [1]Lab. Parasitologia Animal, .Instituto Biológico, CP 12898, CEP 04010-970, Br., E-mail leilabarci@ig.com..br; [2] Lab. Ambiência e Sanidade Animal, Instituto de Zootecnia CEP 13460-000 CP 60

The control of the *Boophilus. microplus* in our country is essentially accomplished in the parasitic phase of the tick using many kinds of chemical groups. The indiscriminate and wrong use of the acaricides is carrying serious problems of resistance and implications on the pollution of the soil and also causing residues in milk products. It is necessary to find new proposals that, associated with the chemical control, minimize the problems caused by the ticks. In this case, the employment of vegetable extracts may be an alternative to make possible the integrated control of the tick. In this work the acaricide action of different concentrations of aqueous extracts of rope tobacco was evaluated. The diluitions were prepared from rolls of tobacco acquired at trade stores. Eleven concentrations were evaluated: 100%, 50%, 25%, 12%, 6%, 3%, 1,6%, 0,8%, 0,4%, 0,2% and 0,1%. All the concentrations were prepared from a stock solution obtained through infusion of the tobacco in hot water at 96ºC in the proportion of 25g to 100mL. The activity of the tobacco was tested over unfed larvae of *B. microplus* obtained from females from experimentally infested bovine. The activity of the tobacco was tested over unfed larvae of *B. microplus* obtained from females from experimentally infested bovine The assay used was the immersion test according to laboratory method employed as an indication of chemical compounds efficacy. Each treatment consisted of 10 repeatitions with 20 larvae. The control group received deionized water. The immersion period was 10 minutes. The assessment of the results was made by counting the dead and live larvae. The mean larval mortality in treated groups ranged from 9,0 to 100% depending upon the concentration. Larval mortality in the control group ranged from 2 to 6% . The results suggest that there is significant difference between the treated and control groups with concentrations among 1,6 and 100%. It seems that the rope fume has acaricide effect on larvae of *B. microplus* in acordance to the popular belief.

[3318] EFFECT OF THE TEMPERATURE AND LIGHT REGIME ON THE PRODUCTION AND STORAGE OF *SPOROTHRIX INSECTORUM*

A. Batista Filho[1], E.S. Loureiro[1], J.E.M. Almeida[1], L.G. Leite[1], C. Lamas[1], [1] Lab. Controle Biológico, C. Exp. Inst. Biológico, P.O. Box 70, Campinas, SP 13001-970, Brazil, E-mail batistaf@dglnet.com.br

The fungus *Sporothrix insectorum* has been used in Brazil for the control of the lace bug *Leptopharsa heveae* in rubber plantations. *L. heveae* was first found in São Paulo State in 1995 and since them, its population has grown progressively reaching levels which of recent causes economic damage to the rubber crop. This research was conducted in the laboratory of biological control, at the Centro Experimental do Instituto Biológico to access a system that allows the maximization of the fungus production. Four temperatures (22, 25, 28 and 31°C) and 3 light regimes (24 and 12 hours of lightness, and 24 hours of darkness) were investigated with respect to the growth, production and viability of *S. insectorum*. Colony diameter, concentration and viability of conidia were the parameters considered regarded for the evaluation. The viability of conidia produced on solid (cooked rice) and liquid medium (yeast extract) was also evaluated 120 days post storage under different temperatures (25, 5 and –25 °C). The growth and viability of the fungus were highly affected at 31°C, however there was no statistical difference among the other temperature regimes. Conidia production was higher at 25 and 28°C. There was no statistical difference among the light patterns, although the conidia production dropped when the pathogen was kept under 24 hours of darkness. Viability of the fungus stored under room temperature decreased 50% after 40 days, for each preparation (liquid or solid). The viability of the conidia produced on solid medium with a 60 days post storage either in a fridge or a freezer was 81 and 92 percent respectively, whereas those produced in liquid medium and store in a fridge was 76 percent. The fungus produced in liquid medium and stored in a fridge had a viability of more than 50% after 120 days in storage.

Index terms: *Sporothrix insectorum*, *Leptopharsa heveae*, entomopathogenic fungi.

[3319] OOGENESIS IN *DROSOPHILA*

M. Bownes[1], D. Zhao[2], W.-M. Deng[3], S. Pathirana[1], G. Tzolovsky[1] & K. Leaper[1], [1]Inst. of Cell and Molecular Biology, Univ. of Edinburgh, Darwin Building, King's Buildings, Mayfield Road, Edinburgh EH9 3JR, UK, Email Mary.Bownes@ed.ac.uk; [2]Roslin Inst., Univ. of Edinburgh, Roslin, Midlothian EH25 9PS, UK; [3]Dept. of Biochemistry, Univ. of Washington, PO Box 357350, Seattle, WA 98195, USA.

Drosophila is a powerful model organism in which we can elucidate the complex mechanisms controlling the development of the oocyte and egg. There are two key cell types involved, the germ line cells and somatic follicle cells. A germ line stem cell produces a cluster of 16 cells which remain together throughout oogenesis. One of them is determined to become an oocyte and the other 15 supply the oocyte with materials and positional information needed for oocyte and embryo polarity and development. Each cluster of cells is surrounded by somatic follicle cells. These undergo complex morphogenetic movement and supply components of the egg, secrete the egg membrane and eggshell and respond to signals from the oocyte, instructing the development of the egg chamber and oocyte. Thus the development of a mature egg requires constant interactions between these two cell types. The cell-cell signalling pathways involved are used at many stages in development. Thus mutations in the genes responsible for controlling these process are often lethal. We used an "enhancer trap" method that enabled us to clone genes expressed in subsets of follicle cells in *Drosophila* which are activated in response to a TGFα-like signal from the oocyte. We have identified transcription factors (eg, the *Broad-Complex*), secreted signalling molecules (eg, *fringe*) and genes involved in cell morphology (eg, an unconventional myosin VI encoded by *jar*). Since mutations in most of these genes are lethal, we determined their function in specific cells at defined stages of oogenesis using *in vivo* induced antisense RNA to "silence" the genes. The position of these genes in the genetic hierarchies controlling morphogenesis and patterning in the egg chamber will also be described.

Index terms: cell signalling, morphogenesis, eggshell, follicle cells

[3320] INVASION OF THE TEMPERATE ZONE AND THE EVOLUTION OF PHOTOPERIODIC TIME MEASUREMENT

W. E. Bradshaw & C. M. Holzapfel[1], [1]Dept. of Biology, Univ. of Oregon, Eugene, OR 97403-1210, USA, E-mail: bradshaw@darkwing.uoregon.edu

As in a wide variety of other arthropods, the median or critical photoperiod mediating the onset and maintenance of larval diapause increases with latitude in the pitcher-plant mosquito, *Wyeomyia smithii*. Photoperiodic response does not exist in isolation from other traits in the life cycle. Within populations, there are underlying genetic correlations between critical photoperiod and depth of diapause, required day number, larval stage of diapause, and preadult development time under optimal, non-diapause conditions. The first three genetic correlations are coordinated along an axis of tendency to diapause: Individuals with longer critical photoperiods are also genetically programmed to require more long days to avert diapause, to enter diapause at an earlier stage, and to enter a deeper diapause. The last genetic correlation means that, within populations, faster developing larvae are able to develop longer in the growing season and still achieve the diapausing stage before the onset of winter. There is, however, a cost of this latter genetic correlation: diapause-prone genotypes take longer to develop under optimal conditions and, consequently, achieve lower fitness during periods of population growth during the summer. Adaptation of photoperiodic time measurement to the climatic, geographic gradient of North America has therefore involved pervasive reorganization of pleiotropic relationships throughout the genome, affecting not only those traits involved with seasonality and the mitigation of winter, but also those affecting continuous development and the exploitation of the summer growing season.

Index terms: Culicidae, mosquitoes, diapause, biogeography

[3321] THE RELATIONSHIP BETWEEN LOCOMOTOR PACEMAKER AND CIRCADIAN RHYTHM OF ERG IN THE GERMAN COCKROACH, *BLATTELLA GERMMANICA*

H. W. Chang & H. J. Lee, Dept. of Entomology, National Taiwan Univ. No. 1 Roosevelt Rd., Sec. 4, Taipai 106, Taiwan. E-mail: m480@ccms.ntu.edu.tw.

The expression of locomotor circadian rhythm in male German cockroach is controlled by the pacemakers which is located in the optic lobes of brain. This pacemaker can be entrained by light through visual pathway to synchronize with environmental cycles. The compound eyes can receive light signals and convey the information to the pacemaker. In the electroretinography (ERG) recording, the amplitude of light-evoked responses has shown circadian rhythmicity. This rhythmitity is coincided with the locomotor circadian rhythm. Female German cockroaches don't express locomotor, although their daily locomotor patterns were coincided with their ovarian development cycles. The female's locomotor circadian rhythm was masked by the development of ovaries. This masking effect was also shown in the female's ERG. This finding implys that the development of ovaries can mask the expression of circadian rhythm in the input pathway. An *in situ* hybridization of the clock gene, *per*, was employed to identify the pacemakers of locomotion and visual sensitivity.
Index terms: *Blattella germmanica*, ERG, circadian rhythm

[3322] NESTMATE RECOGNITION IN *SCAPTOTRIGONA BIPUNCTATA* (HYMENOPTERA, APIDAE, MELIPONINAE)

A. J. S. Costa[1, 2] & V. L. Imperatriz-Fonseca[2], [1]Univ. Fed. do Amapá, Rod. Juscelino Kubitscheck de Oliveira km-02, 68902-280, Macapá – AP, Brasil, E-mail ajscosta@usp.br; [2]Dept. de Ecologia Geral, Univ. de São Paulo, Rua do Matão, Tv. 14, no. 321, 05508-900, São Paulo – SP, Brasil.

Stingless bees, their brood, food and material of the nest are potential resources to many organisms. Nest defense against natural enemies or even conspecifics is, therefore, very important in Meliponinae. To avoid attack or theft, stingless bees must discriminate intruders from nestmates. In this study we verified the occurrence of nestmate discrimination in workers of *Scaptotrigona bipunctata*. Bees on the nests entrance were used to test discrimination. The bees were collected using an insect aspirator. Then a pair of bees was inserted into a test tube and their behavior was recorded for 5 minutes or until an agonistic interaction occurred. Twenty five pairs of bees were used. Fifteen pairs were composed by bees from different nests (non-nestmates) and 10 by bees from same nest (nestmates). During encounters the bees touched each other using the antennae. They touched each other on the body surface or the antennae. After these contacts bees could attack each other biting different parts of the body, solicit or offer trophallaxis or even not show any differential behavior. Aggressions resulted in injuries and sometimes caused death. Non-nestmate workers were significantly more attacked than nestmates (Table 1). Workers of *S. bipunctata* treated differentially the conspecifics according to their nests of origin showing nestmate recognition and discrimination. The genus *Scaptotrigona* has a well-developed nestmate discrimination ability. Species of this genus, as *S. bipunctata, S. postica* e *S. barrocoloradensis* recognize the intruders and use similar agonistic interactions. The defensive behavior of *S. bipunctata*, biting included, may lead to serious injuries and is among the most aggressive within the Meliponinae. Nestmate discrimination involving attacks against intruders minimizes the possibility of invasions by intruders and it is important to the maintenance of colonial integrity.
Table 1: Occurrence of aggression between nestmates and non-nestmates workers of *Scaptotrigona bipunctata*.

	Agression		
	Present	Absent	*p**
Nestmate	0	10	0.0001
Non-nestmate	12	3	

*Non-parametric Fisher exact test
Index terms: stingless bees, nestmate recognition, behavior, agonistic interactions.

[3323] BIOLOGICAL INFORMATIONS ABOUT THE DEVELOPMENT OF *URBANUS ACAWOIOS* (LEPIDOPTERA: HESPERIIDAE)

Manoel Dias Nogueira[1] & Mohamed E. M. Habib[2], 1National Institute of Amazon Research (INPA).2Dept. Zoology, IB, University of Campinas (UNICAMP), SP, 13083-970. E-mail: mohamed@reitoria.unicamp.br

Due to the lack of informations concerning *Urbanus acawoios* (Lepidoptera: Hesperiidae), and the severe damage caused by it in *Clitoria racemosa* trees in Manaus, AM, the present research was conducted, under semi-natural conditions, in order to obtain data about its biology and development. The occurrence of phytophagous pests in urban environments, in addition to causing troubles and problems, it needs special control methods, at least safety for the public health. Three consecutive generations were studied in he present work. As a multivoltine insect, the whole life cycle was observed to vary between 36 and 50 days, with an average of 41.89 ± 0.98 days. The oviposition behaviour, as well as the egg morphology were described. The embryonic development lasted between 3 and 4 days. External and internal alterations during the egg development were determined. The initial larval instars showed to be aggregated, while the others were solitary. The larval stage, consisting of 5 instars, lasted an average of 18.46 ± 1.28 days, with a minimum of 19 and a maximum of 26 days. The biology of each instar and its duration time were also determined. The mid-gut pH of the larval stage varied between 8.4 and 9.2, with an average of 8,7. The pupal stage lasted an average of 9.96 ± 1.05 , with a minimum of 8 and a maximum of 12 days for its development. The mated adult longevity varied between 9 and 22 days, with an average of 13.47 ± 0.27 days. The climatic conditions of 30.35° C , 85 % RH, the high availability of its host plant foliage, and a possible absence of efficient natural enemies during such a period, could be responsible for the population outbreaks which sporadically occur in Manaus City. These basic data about the biology of *Urbanos acawoios*, were considered to be essential to develop the second part of the present project, related to the pathology study and the investigation of *Bacillus thuringiensis* var. *kurstaki* (H-3A:3b) capacity, to microbially control this insect pest.
Index terms: biology, outbreaks.

[3324] REPRODUCTIVE CAPACITY OF *Diachasmimorpha longicaudata* (Ashmed) (Hymenoptera: Braconidae) BY FACULTATIVE ARRHENOTOKY PARTHENOGESIS REARED ON PRE-PUPAE OF *Ceratitis capitata* (Wied) (Diptera: Tephritidae)

J.A. Duarte Aguilar[1,2], J.M.M. Walder[1], [1] Entomology Section, CENA-USP - C.P. 96 - 13400-970 Piracicaba, SP Brazil, [2] Supported by FAPESP-SP.

One studied the reproductive capacity of *Diachasmimorpha longicaudata*, a larval parasitoid of fruit flies, Mediterranean fruit flies, *Ceratitis capitata*, in a climatized chamber at 25 ± 2°C, relative humidity of 60 ± 10%. Three treatments were performed with three replications, each replication with five virgin females newly emerged from *D. longicaudata*, with no males, inside plastic bag cages with capacity of five kilos. An agar tablet with bee honey was placed onto a Petri dish as food. Twenty five pre-pupae of *C. capitata* were exposed for 14 days in parasitism units (PVC rings with 60mm Ø x 3mm height) with one end screened and the other sealed, daily exposed to the parasitoid's adults for 40 minutes. Next, the pre-pupae were removed and transferred to test tubes of 2-cm Ø x 2cm height with one third of vermiculite and sealed with film. Following the emergence, counting and sex separation were performed. According to the observations, the parasitoid's adults had a good ability to search the parasitism units and aggressiveness when ovipositor was introduced for parasitizing, with a two-day pre-oviposition period until the 14th day, with a good production period from the 5th through the 11th days, and mean parasitism of 27.33%. Once shown that the virgin females of the parasitoid reproduced by facultative arrhenotoky parthenogesis, beginning a progeny of haploid males only, care should be take in massal parasitoid rearing in order to keep a proportion of 3 females per male; when more virgin females were introduced into the cage they parasitized and as a result a progeny with more males was found, which is interesting for copulation and thus providing the continuation of quality rearing and parasitoid release.
Index terms: Fruit flies, Tephritidae parasitoid, Reproductive capacity, Arrenotic partenogenesis

[3325] GLUTATHIONE *S*-TRANSFERASE FROM THE SPRUCE BUDWORM, *CHORISTONEURA FUMIFERANA*: IDENTIFICATION, CHARACTERIZATION, LOCALIZATION, cDNA CLONING, DEVELOPMENTAL EXPRESSION AND INDUCTION BY VARIOUS FACTORS

Q.L. Feng [1], S. R. Palli [1], K. G. Davey [2], A. S. D. Pang [1], M. Primavera [1], T. R. Ladd [1], S.-C. Zheng [1], B. L. Tomkins[1], S. S. Sohi [1], & A. Retnakaran [1], [1] Great Lakes Forestry Centre, Canadian Forest Service, P. O. Box 490, 1219 Queen Street East, Sault Ste. Marie, Ontario, Canada, P6A 5M7. E-mail: qfeng@nrcan.gc.ca; [2] Dept. of Biol., York Univ. 4700 Keele Street, North York, Ontario, Canada, M3J 1P3.

A 23-kDa protein that was present at higher levels in diapausing 2nd instar larvae than in feeding 2nd instar larvae of the spruce budworm, *Choristoneura fumiferana*, was purified. Antibodies raised against the purified protein were used to screen a cDNA library made using RNA from 2nd instar larvae. Eight identical cDNA clones were 665 nucleotides in length and the longest open reading frame coded for a 203-amino acid protein with a predicted molecular mass of 23.37 kDa. The deduced amino acid sequence showed high similarity to glutathione *S*-transferases (GST) isolated from several species of insects and therefore, it was named *C. fumiferana* GST (*Cf*GST). Identity of *Cf*GST was confirmed by using affinity-chromatography and GST assay. The apparent V_{max} of the purified *Cf*GST towards the substrates glutathione and 1-chloro-2,4-dinitrobenezene (CDNB) were similar. However, the enzyme had a three-fold higher affinity towards CDNB than glutathione. Analyses using Northern blot, immunoblot and immunocytochemistry showed that the fat body was the major tissue where the enzyme was synthesized and stored. The *Cf*GST cDNA was expressed in a recombinant baculovirus expression system into an active enzyme. High levels of *Cf*GST mRNA and protein were detected in 1st and diapausing 2nd instar larvae. Expression of *Cf*GST gradually decreased during the development from 3rd to 5th instar, after which the expression increased once again, reaching peak levels in the 6th instar. The developmental expression pattern suggests that in addition to detoxification, *Cf*GST might be involved in other functions in this insect. Low temperature did not induce an increase in *Cf*GST expression. Feeding on balsam fir foliage resulted in an increase in the expression of *Cf*GST as compared to larvae that fed on artificial diet. *Bacillus thuringiensis* delta-endotoxin (*Bt*), tebufenozide and permethrin induced the expression of *Cf*GST mRNA in 5th instar larvae, whereas diflubenzuron did not have any such effect. These results suggest that *Cf*GST play an important role in detoxifying various allelochemicals and insecticides.

Index terms: insecticide resistance, detoxification, lepidoptera, mRNA, protein

[3326] STORAGE OF EGGS, LARVAE AND PUPAE OF *CHRYSOPERLA EXTERNA* IN DIFFERENTS PERIODS OF TIME AND TEMPERTURES

R. J. Ferreira[1] & S. de Freitas[2], [1]Depto. de Biologia, Univ. de São Paulo, CEP 14040-901, Ribeirão Preto, SP, Brasil (Fapesp Felowship), E-mail: raimundo@usp.br; [2]Depto. de Fitossanidade, Univ. Estadual Paulista, CEP 14870-000, Jaboticabal, SP, Brasil.

The mass rearing and the natural enemies liberation a lot of times it is not synchronous, became necessary a storage period. We studied the effect of different periods of time and temperatures on the viability of eggs, larvae and pupae of *Chrysoperla externa* (Hagen). The results indicated that eggs showed higher viability when stored under temperatures of 5 and 10° C for periods of 5 and 10 days. The larvae survival was higher when stored for 5 and 10 days under temeratures of 0° C and 5° C. Pupae stored for 5, 10, 15 and 20 days under temperatures of 5° C and 10° C, showed higher rates of adults emergence. Therefore, the viability of any of the stages of development was inversely related to the storage period and directly related to temperature.

Index terms: Chrysopidae, mass rearing ,biological control, predator.

[3327] THE EFFECTS OF EGG AND ADULT TEMPERATURES ON INDUCTION OF EMBRYONIC DIAPAUSE IN *DIANEMOBIUS NIGROFASCIATUS* (ORTHOPTERA: GRYLLIDAE)

E. Fukumoto, H. Numata & S. Shiga, Dept. of Bio- and Geosciences, Grad. Sch. of Sci., Osaka City Univ., Sumiyoshi, Osaka 558-8585, Japan, E-mail: fukumoto@sci.osaka-cu.ac.jp.

Embryonic diapause of the band-legged ground cricket, *Dianemobius nigrofasciatus* with a bivoltine life cycle is mainly controlled by maternal photoperiod. In this study, we examined the effects of temperature during the egg or adult stage on induction of embryonic diapause in this cricket. In all experiments, nymphs were reared under LD 16:8 or LD 12:12 at 25°C. First, to examine the effect of egg temperature, eggs laid by adults reared under LD 16:8 (long-day eggs) and eggs laid by adults reared under LD 12:12 (short-day eggs) at 25°C were transferred to different temperatures ranging from 5 to 30°C. At 5 to 20°C, all of the long- and short-day eggs entered diapause. At 22.5 to 30°C, the incidence of diapause in short-day eggs was higher than that in long-day eggs. In both long- and short-day eggs, the higher the temperature at which eggs were kept, the lower the incidence of diapause. When long-day eggs were exposed to a low temperature pulse (10°C, 24 hours) shortly after oviposition, the incidence of diapause increased. On the other hand, when the short-day eggs were exposed to a high temperature pulse (35°C, 24 hours) shortly after oviposition, the incidence of diapause decreased. In both long- and short-day eggs, the effect of thermal pulses on day 0 was greater than that on day 1. Next, to examine the effect of adult temperature, insects were transferred to 20, 25 or 30°C on the day of adult emergence. Their eggs were transferred to 20, 25 or 30°C. In eggs laid by adults at 25 or 30°C, the incidence of diapause in short-day eggs was higher than that in long-day eggs. The higher the temperature at the adult stage, the lower the incidence of diapause in their eggs. In eggs laid by adults at 20°C, most eggs entered diapause irrespective of the adult photoperiod and egg temperature. Long-day eggs laid by adults at 30°C did not enter diapause even when eggs were kept at 20°C. Feulgen-Rossenbeck staining, which is used for nuclear staining, of the whole-mount eggs revealed that *D. nigrofasciatus* enters diapause at the stage before germ-band formation. In summary, 1) the incidence of embryonic diapause in *D. nigrofasciatus* is influenced by egg and adult temperatures in addition to the photoperiod experienced by adults, 2) there is a sensitive period to temperature in eggs within 24 hours after oviposition.

Index terms: cricket, maternal effect

[3328] FECUNDITY OF *TRICHOGRAMMA CORDUBENSIS* FEMALES FROM SEXUAL AND ASEXUAL LINES

P. Garcia[1], L. Oliveira[1] & J. Tavares[1], [1]Univ. dos Açores, Deptº. de Biologia, Rua da Mãe de Deus 58, P-9500 Ponta Delgada, Açores, Portugal. e-mail: patriciag@notes.uac.pt.

Trichogramma cordubensis (Hymenoptera: Trichogrammatidae) is a native thelytokous species of São Miguel island (Azores). Reversible parthenogenetic reproduction in *T. cordubensis* is related to the presence of Rickettsia of the genus *Wolbachia* (Pintureau *et al.*, 1993). According to Stouthamer (1993) the presence of both modes of reproduction in the same species allows a choice of which form to use in a biological control release. The fecundity of *T. cordubensis* females from sexual and asexual lines was compared during 4 consecutive generations. Arrhenotokous line derived from the thelytokous line using termoterapy (Pintureau *et al.*, 1993). Parasitoids (a single female for asexual line and a couple for sexual line) with less than 24h old were isolated in glass tubes (7x1 cm) containing 200 *Ephestia kuehniella* (Lepidoptera: Pyralidae) eggs and a drop of honey. Thirty-five replicates were made for each line and each generation. Eggs of *E. kuehniella* were less than 24h and ultra-violet irradiated for 20 minutes. The wasps were left to parasitize the hosts for 48h and then removed. The experiments were run in an environmental chamber at 20 ± 0.5°C (asexual line) or 30 ± 0.5°C (sexual line), 75 ± 5% r.h. and L16:D8. Cards with parasitized eggs were maintained under the same parental conditions for offspring development. The fecundity was determined by counting the host eggs that turned black. Analyses of variance (ANOVA) were conducted on all data. Where statistical differences existed between data sets ($P<0.05$), Fisher's Protected Least Significant Difference tests (PLSD) were used to separate differing means. Fecundity of the thelytokous line showed no significant differences between wasp generations but for the arrhenotokous line declined with the generation succession, but differences were only significant between the first generation and the other three. Mean fecundity of the females from the sexual line was significantly lower than the asexual line, except for the first generation that showed no significant differences. These results show that it may be advisable to contemplate the separation of *T. cordubensis* lines according with two distinct objectives: 1) thelytokous lines, for mass production and inundative/inoculative releases; 2) arrhenotokous lines, for additional releases to restore some genetic variability in the populations.

[3329] *IN VITRO* DEVELOPMENT OF COFFEE BERRY BORER (*HYPOTHENEMUS HAMPEI*) IN AN FREEZE DRY DIET

M.T.G. González[1], A.E.P. Bustillo[1] & A.J. Valencia[2], [1]Centro Nal. de Investigaciones de Café, Cenicafé, A.A 2427, Manizales, Colombia; [2] Depto. de Química, Univ. de Caldas, Calle 65# 26-10, Manizales-Colombia. A.A 275, E-mail: arnubio@emtelsa.multi.net.co.

The diets for the rearing of insects have been used for over 100 years with variable results. It is known that drying processes of diets may lead to denaturalization of several compounds such as ascorbic acid. In these conditions, the freeze-drying is a useful alternative for preparation and conservation of the meridic diet used for laboratory rearing of *Hypothenemus hampei*. This process allows preparation of diets for insect rearing without altering sensory and physicochemical characteristics of the final product, than with traditional stove drying. Humidities of the freeze-dried and stove dried diets for *H. hampei*, were evaluated during 20 days of storage at 27±2°C. Decrease in humidity in the freeze-dried diet was 10% and in the stove dried diet was 34%. The freeze-dried diet remained stable when stored during 20 days at –15°C (frozen) and at 4°C (refrigerated). Forty days after infestation, the average of biological stages in the freeze-dried diet was 48,3 stages/borer, significantly higher (Tukey 5%) than that found in the stove dried diet (15,3). Development of the coffee berry borer from egg to adult was completed in 24 days with 94% efficiency. The development of the different biological stages produced in this diet is similar in aspect, color and shape, but exceeds the number of stages produced in stove diet, after 40 days of infestation. The use of a freeze-dried diet will facilitate the study of protein fractions with toxic activity against digestive enzymes of various insects, which could further be used in plant breeding through molecular biology techniques.

Index terms: Coffee berry borer, *Hypothenemus hampei*, freeze-dried, meridic diet.

[3330] CONTROL OF JUVENILE HORMONE SYNTHESIS BY THE CORPUS ALLATUM

N.A. Granger[1], R. Rybczynski[2] & L.I. Gilbert[2], [1]Dept. of Cell Biology and Anatomy, CB #7090; [2]Dept. of Biology, CB #3280, Univ. of North Carolina, Chapel Hill, NC 27599, USA, E-mail: noelle@med.unc.edu.

Changes in the hemolymph titer of juvenile hormone (JH), which regulates growth, development, and reproduction in insects, are precisely controlled by various physiological and biochemical processes. Of these, regulation of synthesis is generally considered the most important, and both neuropeptides, termed allatotropins (stimulatory) and allatostatins (inhibitory), and neurotransmitters have been demonstrated to modulate JH synthesis by the corpora allata (CA). The one allatotropin that has been isolated and sequenced (from *Manduca sexta*: Mas-AT) appears to be a functional moiety in other Lepidoptera as well. Mas-AT can either directly affect the CA in these other species or oppose the action of the *Manduca sexta* allatostatin (Mas-AS), although it has no effect on *Manduca* larval CA. The apparently ubiquitous nature of Mas-AT is thus similar to that of the allatostatin of *Diploptera punctata* (Dip-AS), 13 different forms of which exist in this species, each with a similar C-terminus (Y/F-X-F-G-L/I-NH_2). More than 30 different peptides belonging to this allatostatin family have been identified in a number of different insect species, as well as in Crustacea. Mas-AS bears no homology to the YXFGLamide family of allatostatins but inhibits JH biosynthesis reversibly in *Manduca* and other Lepidoptera. Mas-AT has functions other than the stimulation of JH production, much as the YXFGLamide allatostatins have been found to have other physiological roles. Similarly, neurotransmitters have been shown to affect JH synthesis in both *Manduca* and *Diploptera* (dopamine and octopamine, respectively), mimicking effects of the neuropeptides. In *Diploptera*, octopamine inhibits JH biosynthesis, while in *Manduca* larvae, dopamine either stimulates or inhibits, depending on the developmental stage. The interactions between and among allatostatins, allatotropins, and neurotransmitters are fertile but unexplored territory, and should lead to studies of the control of their titers, their receptors, and downstream events controlled via the ligand-receptor interactions; studies of degradative mechanisms and receptors for the YXFGLamide allatostatins have already begun. The stage is also set for the investigation of the possible control of JH biosynthesis by ecdysteroids at the genomic level. Both ecdysteroid receptor protein (EcR) and ultraspiracle protein (USP), which together form the heterodimeric ecdysteroid receptor, are expressed in the CA of *Manduca*, and there is preliminary evidence that 20-hydroxyecdysone affects the expression of dopamine receptors in *Manduca* larval CA.

Index terms: allatotropins, allatostatins, neurotransmitters, ecdysteroid receptor

[3331] MULTIPLE PATERNITY, DISPERSAL MODES AND GENETIC STRUCTURE ASSOCIATED WITH DIFFERENT REPRODUCTIVE STRATEGIES IN *FORFICULA AURICULARIA* (DERMAPTERA)

S. Guillet, M. Vancassel & J. Deunff, Univ. Rennes1, UMR CNRS 6553, Campus de Beaulieu, 35042 Rennes, France, E-mail stephanie.guillet@univ-rennes1.fr.

The univoltine earwig *F.auricularia* presents two reproductive strategies. Under Mediterranean climate females produce two clutches a year with a rapid dispersion of the first cohort larvae while under subalpine climate females realize only one reproductive cycle with a limited nymph dispersal. This reproductive variability offers the rare opportunity to study the consequences of behaviour (dispersal, promiscuity) on populations genetics at the intraspecific level. These questions were investigated using four polymorphic microsatellite loci. Higher structuration and lower gene flow were expected in populations with restricted dispersal. But the same genetic structure was observed in both cases: no fine-scale structuration and an isolation by distance, even if males seem to disperse more than females. Furthermore, the first study of mating systems revealed multiple paternity. This phenomenon can increase gene flow and may compensate the effects of low dispersal.

Index terms: Earwig, Forficulidae, microsatellites.

[3332] INGESTION AND DIGESTION OF GREEN FLUORESCENT PROTEIN BY THE WESTERN TARNISHED PLANT BUG, *Lygus hesperus*

J. Habibi[1], T. A. Coudron[2], E. A. Backus[1], S. L. Brandt[2], R. M. Wagner[2] & J. E. Huesing[3], [1]Department of Entomology, University of Missouri, Columbia, MO 65211, USA; [2]USDA-ARS, BCIRL, 1503 S. Providence Rd, Columbia, MO 65203, USA; [3]Monsanto Co., 700 Chesterfield Parkway North, St. Louis, MO 63198, USA.

We investigated the ingestion, absorption, degradation, excretion, and salivation of green fluorescent protein (GFP) by the western tarnished plant bug, *Lygus Hesperus*. Analysis of GFP, administered through the diet, indicated that *L. Hesperus* is a discrete intermittent feeder, with a maximum volume of ca. 3 µl for each meal. The time from ingestion to presence in the hemolymph was ca. 2-4 h. Brightfield and fluorescence microscopy showed that GFP bound to the anterior part of the midgut and posterior part of the hindgut and caused disruption of epithelial cells in second instar nymphs. In adult females GFP bound to brush-border microvilli of midgut epithelial cells. Also, the holoprotein of GFP, ingested *per os* was found associated with fat body and hemolymph. Changes were noted in the composition of the acidic and basic proteins in the hemolymph with the addition of GFP to the diet. Electrophoretic analysis revealed that fecal material from insects fed diet containing GFP had a protein profile different than that of fecal material from insects fed control diet. Hence, incorporation of GFP in the diet may affect the digestion and absorption of dietary proteins.

Index terms: Uptake, metabolism, digestive physiology, histology

[3333] DEVELOPMENT AND EVOLUTION OF EGGS IN TRUE BUGS (HEMIPTERA: HETEROPTERA)

M. Javahery, Lyman Entomological Museum and Research Laboratory, Macdonald Campus of McGill University, PO Box 140, 21111 Lakeshore, Quebec, Canada H9X 3V9

Embryogenesis; embryonic orientation; characteristics of chorion; shape, size, and number of micropyle; shape, size, and location of egg-burster; mechanisms of hatching; form, size and color of eggs have been studied in representatives of five families in CIMICOMORPHA and 11 families in PENTATOMOMORPHA. The eggs or bugs were collected from their natural habitats and fertilized females were cultured in the field or laboratory. They are from the following families: Miridae, Nabidae, Phymatidae, Reduviidae and Tingidae (Cimicomorpha); as well as, Acanthosomatidae, Alydidae, Aradidae, Cydnidae, Coreidae, Lygaeidae, Pentatomidae, Pyrrhocoridae, Rhopalidae, Scutelleridae and Thyreocoridae (Pentatomomorpha). The studies are based on fundamental characters of eggs that have true phylogenetic value. So far, 34 genera and 65 species from the Nearctic and Palearctic region have been investigated. It is concluded that several genera such as *Elasmucha* and *Sehirus* are primitive and are considered the probable outgroups. This study also shows that various shaped eggs; cylindrical, spherical, elongated or curved tubes and those with narrow-rounded ends have evolved independently, and along different pathways from an ovoid ancestral egg.
Key words: Development and Characteristics of Eggs, Evolution.

[3334] THE STRUCTURE AND GENESIS OF TELOTROPHIC OVARIES IN RAPHIDIOPTERANS

I Jędrzejowska[1] & J. Kubrakiewicz[2]., [1] Dept. of Histology and Embryology, **Agricultural University, 51-631 Wroclaw, Kożuchowska 5, Poland;** [2] Zoological **Inst., Univ. of Wroclaw, 50-335 Wroclaw, Sienkiewicza 21, Poland, E-mail:** jkubrak@biol.uni.wroc.pl

The ovaries of raphidiopterans are of distinct telotrophic type like those of Megaloptera (Sialidae) or some Coleoptera (Myxophaga). Mature ovarioles of raphidiopterans are subdivided into the anteriorly located terminal filament, tube-shaped tropharium, the vitellarium and the ovariole stalk. The tropharium consists of a central multinuclear syncytium surrounded by a monolayer of tapetum cells. Early previtellogenic oocytes differentiate in the basal region of tropharium where they are invested by prefollicular cells. In the early stages of previtellogenesis the oocytes do not differ in structure from the tapetum cells, thus indicating their common origin. Both types of cells remain connected with the central syncytium by intercellular bridges. At the onset of previtellogenic growth the anterior parts of oocytes are significantly extended, forming long cytoplasmic projections - trophic cords. The trophic cords contain several microtubules exhibiting no regular orientation but diminishing tropharium-ooplasm gradient of distribution The stability of trophic cords is maintained till late vitellogenesis by the presence of membrane foldings lined with microfilaments that encompass the trophic cord periphery in the form of submembrane rims. Early larval ovaries are lens-shaped. Their midline parts are attached to the oviduct primordium. Each ovary is composed of several dozen of densely packed, slightly elongated ovarioles separated by intervening somatic tissue. By this time only 3 distinct regions can be distinguished within each ovariole. Elongated terminal filament forms the anteriormost part, gonial cells fill the midpart of the ovarian tube while a compact ovariole stalk constitutes the most posterior region. Early in the development only a few gonial cells undergo divisions. At least some of these divisions are followed by incomplete cytokineses, so that the daughter cells remain connected by intercellular bridges. Intercellular bridges are elongated and filled with fine fibrillar material (fusome). Later in the development the gonial cells divide more intensely so that in the advanced larval stages the ovarioles are filled with several germ cell clusters. Their position within the ovariole is by no means defined. Germ cells within particular clusters develop synchronously while clusters within the same ovariole are at various stages of development. In the pupal ovaries disintegration and fusion of cellular membranes lead to the formation of the central syncytium. The formation of germ cell clusters, their fusion and meiotic prophase are independent events overlapping in time.
Index terms: tropharium, trophic cords, germ cell clusters, syncytium

[3335] REPRODUCTIVE POTENTIAL AND RHYTHMS OF THE BLACK-LYRE LEAFROLLER *CNEPHASIA JACTATANA* (LEPIDOPTERA: TORTRICIDAE), AN IMPORTANT PEST OF KIWIFRUIT IN NEW ZEALAND

A. Jiménez-Pérez[1, 2] Q. Wang[1] & M. O. Harris[3], [1]Entomology and IPM Laboratories, Plant Protection, Institute of Natural Resources, Massey University, Private Bag 11222, Palmerston North, New Zealand. E-mail: A.J.Jimenez@massey.ac.nz or Q.Wang@massey.ac.nz; [2]Centro de Desarrollo de Productos Bióticos-IPN. Apto. Postal 24, Yautepec, Morelos, 62730, México. E-mail: Ceprobi@redipn.ipn.mx; [3]HortResearch, Mt Albert, Private Bag 92169, Auckland, New Zealand.

The black-lyre leafroller (*Cnephasia jactatana* Walker) is a native species in New Zealand. It has now become an important pest of kiwifruit, damaging both leaves and fruit. Prior to this study, little is known about its biology, making its effective and ecologically based control difficult. Lifespan reproductive activities, daily reproductive rhythms and the effect of body weight on fecundity were investigated in the present study. Sixty five pairs were studied at 20 ± 1°C, 70 ± 10% RH and a photoperiod of 16:8 (L:D) h, with lighting provided by biolux lights. Courtship display by males started 2 d after emergence. Mean pre-mating and pre-oviposition periods were 3.95 ± 0.24 d and 6.39 ± 0.10 d, respectively. Mean oviposition period was 5.62 ± 0.38 d, with 90% of eggs laid during the first 5 d of the oviposition period. Over 50% of pairs mated between 3 and 5 d after emergence. Feeding took place throughout the lifespan, and 24-h on the daily basis. Reproductive activities occurred only during the scotophase. Mating took place from 4 to 6 h into the scotophase while oviposition mainly occurred in the first 2 h of the scotophase. Mean female's longevity (mean ± SEM = 13.5 ± 0.45 d) was significantly shorter than male's (15 ± 0.43 d). Mean longevity of fertile egg laying females was significantly longer (14.42 ± 0.48) than that of unfertile egg laying females (12.75 ± 0.77). Fecundity was significantly greater in small and average-weighted females than in heavy ones. Male body weight had no significantly effect on fecundity.
Index terms: Tortricidae, *Cnephasia jactatana*, reproductive rhythms, fecundity, kiwifruit.

[3336] JH APPLICATION MODIFIES THE ADULT DEVELOPMENT PROGRAM AND ECDYSONE RECEPTOR EXPRESSION IN THE TOBACCO HORNWORM, *MANDUCA SEXTA*

T. Kamito[1], F. Malone[2] & L. M. Riddiford[2], [1]Dept. of Biology, International Christian Univ., 3-10-2 Osawa, Mitaka, Tokyo 181-8585, Japan, E-mail kamito@icu.ac.jp; [2] Dept. Zoology, Univ. Washington, Seattle, WA 98195-1800,USA.

The application of juvenile hormone (JH) or its analogues to pupae of lepidopteran insects modulates adult development and generates pupa-adult mosaic animals. Recently, two isoforms of ecdysone receptors (EcRs), A and B1, and their heterodimeric partners, Ultraspiracle (USP) 1 and 2, have been found in the tobacco hornworm, *Manduca sexta*. The expression pattern of each particular isoforms of these molecules appears to be correlated with the developmental state of the cell. To determine how these isoforms might be modulated by JH, we injected the JH analogue, pyriproxifen, into *Manduca* pupae at the outset of adult development, then analysed the changes with both immunocytochemistry and immunoblotting of epidermis. Monoclonal antibodies for *Manduca* EcR-B1 and a common region of *Drosophila* USP and polyclonal antiserum for the EcR-A-specific domain were used. Judging from the observation of many morphological markers, the injection of pyriproxifen accelerated the adult developmental program. Development resulting in the formation of a second pupa or a pupa-adult mosaic animal ended in about 12 days after pupation, whereas development of a normal adult takes 20 days. Pupae given more than 0.1 µg pyriproxifen per animal, showed abnormal development in many tissues, e.g. eyes, wings, genitalia etc. Radioimmunoassay of the hemolymph showed that the pyriproxifen accelerated the ecdysteroid surge with peak levels occurring at 4-5 days after pupation instead of 8-9 days in the normal pupa. The expression of EcR A, B1 and USP were accelerated about 2 days as compared to normal animals; however, the patterns of change were similar to vehicle-injected controls. The patterns of USP-1 and USP-2 RNAs however were shifted with USP-2 mRNA peaking with the ecdysteroid peak rather than earlier as in normal developing adults. Thus, the high exogenous JH given to the early pupa induces precocious 20E production and accelerates the appearance of the EcR/USP complex and cuticle deposition. Also, it modifies the timing of the USP isoform switch possibly leading to the prevention of adult cuticle production. Supported by NSF IBN98-17339.
Index terms: *Manduca sexta*, juvenile hormone, pyriproxifen, Ultraspiracle

[3337] COLONY DEVELOPMENT OF *ATTA* LEAFCUTTING ANTS UNDER LABORATORY AND FIELD CONDITIONS

C. Klingenberg[1,2], L.C. Forti[1] & W. Engels[2], [1]Depto. de Produção Vegetal, Defesa Fitossanitária, FCA, UNESP, Cx.p. 237, 18603-970 Botucatu, SP, Brazil; [2]Zool. Inst., Uni. Tübingen, Auf der Morgenstelle 28, 72076 Tübingen, Germany, e-mail christiana.klingenberg@student.uni-tuebingen.de

In the Neotropics, leafcutting ants of the genera *Atta* and *Acromyrmex* cause severe problems in rural areas by damaging agricultural crops. Every year, from September to December, when nuptial flights of the alates occur, a huge number of young inseminated queens try to found a new colony. Despite the great economic importance of these ants, little is known of the development of incipient colonies. There are a few important factors required by a young founding queen for success: appropriate environmental conditions, escape from the numerous predators and, most importantly, a piece of fungus mycelium carried in the infrabuccal cavity. In laboratory experiments, we recorded data on survival of young queens and colonies during the first three months. For *Atta sexdens rubropilosa* and *A. laevigata*, the percentage of queens successfully inseminated was determined. In field experiments, we marked the nest entrance of newly founded colonies. The entrance is closed by the queen for some time after nest initiation. We opened a number of nests to obtain information about the rate of survival. The data from laboratory and field experiments are compared with respects to the population dynamics of the species.
Index terms: leafcutting ants, nuptial flight, predation, colony foundation, survival.

[3338] ASPARTIC PROTEASES FROM *LEPTINOTARSA DECEMLINEATA* AND THEIR INHIBITORS

P. Krecek[1] & M. Mares[1], [1] Inst. of Org. Chemistry and Biochemistry, Flemingovo nam. 2, Prague, 160 00, Czech Republic, E-mail: sysa@uochb.cas.cz.

Inhibitors of insect digestive proteases are recently thoroughly studied, because they can be employed for construction of genetically modified crop plants. Addition of protease inhibitors in food of herbivores can cause various changes, both ecological (changes of fitness) and physiological (changes of rate of growth and of proteolytical activities; synthesis of novel proteases insensitive to the inhibitor).Plants from family Solanaceae contain numerous and diverse protease inhibitors from several families. This diversity is claimed to be an evidence of defensive purpose of the inhibitors, because the plant cannot have a physiological need contain hundreds of inhibitors with only small difference in specificity. Kunitz-family contains protease inhibitors of serine, cysteine and aspartic proteases; some inhibitors are active against proteases from several classes. Our investigation was focused on aspartic proteases from Colorado potato beetle (*Leptinotarsa decemlineata*) and on inhibitors of aspartic proteases (both synthetic and isolated from plants). Inhibitors from plants were isolated from potato (*Solanum tuberosum*) and tomato (*Lycopersicon esculentum*). Proteases were isolated by the method of affinity chromatography and characterized by sequencing and determination of molecular weight and isoelectric focusation. Inhibitory effect on single protease was determined in *in vitro* assay. Inhibitors were added to the food of the larvae and were measured changes of concentrations of proteases, growth rate and fitness. Inhibitors were added either as single isoform or as a mixture of several isoforms. During the investigation, we looked for answers to following main questions:
1. What is the extent and specificity of physiological reaction to inhibition of protease? The reaction can be an increase of synthesis of proteolytic enzyme or synthesis of protease insensitive to the inhibitor.
2. What effect has the presence of a group of closely related inhibitors in the food on an individual?
3. What is the relationship between the growth rate and the fitness?
Index terms: cathepsin D, cathepsin D inhibitor, digestion.

[3339] THE FIRST ADIPOKINETIC HORMONE ISOLATED FROM A DERMAPTERAN INSECT

M.W. Lorenz, Department of Animal Ecology 1, University of Bayreuth, 95440 Bayreuth, Germany, E-mail: matthias.lorenz@uni-bayreuth.de.

The adipokinetic/red pigment-concentrating hormone family (AKH/RPCH) of neuropeptides represents one of the largest peptide families in arthropods. In insects, where more than 30 members of this peptide family are known from about 70 species, representing 11 of the 27 extant pterygote orders, they are mainly involved in the release of lipids, carbohydrates and amino acids from the fat body, inhibition of lipid, protein and RNA biosynthesis and in neuromodulation/myoregulation. Although the Deramaptera are one of the commonly known and relatively conspicous insect orders, no information on their AKH is available. Therefore, we choose the common earwig *Forficula auricularia* for the first study on dermapteran AKHs. Paired corpora cardiaca (pCC) were dissected (from animals that had been collected in the vicinity of Bayreuth), immediately transferred into ice-cold acidic methanol and extracted twice. The crude extract (equivalent to 214 pCC) was purified by high-performance liquid chromatography (HPLC) on a C_{18} reversed phase column using a gradient of acetonitrile in water, containing 0.1% trifluoro-acetic acid. Only one prominent peak with a retention time similar to synthetic *Gryllus bimaculatus*-AKH (Grb-AKH) showed strong adipokinetic activity when injected into earwigs at a concentration of 1 pCC equivalent. Equal amounts of the native *Forficula*-AKH and synthetic Grb-AKH were co-chromatographed on the HPLC using four solvent systems with different selectivities. In each run, the two peptides eluted as a single pure peak, confirming the identity of the *Forficula*-AKH with Grb-AKH (pQVNFSTGWamide), which had previously been found only in ensiferan species and recently in wasps. Upon injection of synthetic Grb-AKH, haemolymph (HL) lipid titres (control level: 17 mg lipids/ml HL as measured with the sulphophosphovanillin method) rose in a dose-dependent manner (threshold concentration of 0.05 pmol Grb-AKH, maximum increase 152% at 10 pmol injected). Haemolymph carbohydrates (control levels: ca. 4 mg total carbohydrates/ml HL as measured with the anthrone method; 65% trehalose, 35% glucose as determined by HPLC) did not change significantly at up to 10 pmol Grb-AKH injected, however, some increase of HL carbohydrates occurred due to the handling of the animals. Only at the highest dose injected (50 pmol) a significant increase in HL carbohydrates was observed. These results suggest, that *F. auricularia*, although not a flying insect, uses mainly lipids as a fuel.
Index terms: *Forficula auricularia*, *Gryllus bimaculatus*, AKH, lipid mobilisation

[3340] A FACTOR FROM THE CRICKET TESTIS THAT INHIBITS OVARIAN ECDYSTEROID BIOSYNTHESIS

M.W. Lorenz[1], J.L Lorenz[1], K. Seifert[2] & K.H. Hoffmann[1], [1]Dept. of Animal Ecology 1 and [2]Dept. of Organic Chemistry I/2, Univ. of Bayreuth, 95440 Bayreuth, Germany, E-mail: matthias.lorenz@uni-bayreuth.de.

Ecdysteroids and juvenile hormones play a central role in the regulation of insect development and reproduction. In the larval stages they control moulting and metamorphosis whereas, in the adult insect, they regulate the biosynthesis of yolk proteins in females and spermatogenesis and growth of the accessory reproductive glands in males. Only very few factors that regulate ecdysteroid biosynthesis have been identified from animal tissues, all of them being peptides: two ecdysiotropins, the prothoracicotropic hormone from the silkworm *Bombyx mori* and the testis ecdysiotropin from the gypsy moth *Lymantria dispar* as well as two ecdysiostatins, trypsin-modulating oostatic factor from *Neobellieria bullata* and *Calliphora vicina*, and the W^2W^9amide peptide family (type B allatostatins) from *Gryllus bimaculatus*. Our screening for factors that regulate juvenile hormone and ecdysteroid biosynthesis in the Mediterranean field cricket, *G. bimaculatus*, led to the finding that the testes of adult males contain an extractable factor that inhibits ovarian ecdysteroid biosynthesis in females. Crude acidic methanol extracts from testes, dissected from 4-6 day-old adult males, were prepurified by C_{18} Seppak fractionation using a stepwise gradient of acetonitrile in water, containing 0.1% trifluoroacetic acid. The 16% acetonitrile fraction showed marked ecdysiostatic activity when tested on ovaries of 4 day-old adult females and was subjected to further purification by high-performance liquid chromatography. Upon a three-step purification using C_8 and C_{18} reversed-phase columns and water/acetonitrile gradients with pentafluoropropionic acid and heptafluorobutyric acid, respectively, as ion-pairing reagents in the first two steps, and no ion-pairing reagent in the third step, a single uv-absorbance peak was obtained. Analysis by gas chromatography-mass spectrometry revealed that this peak contained indole-2-carboxylic acid (I2C) as the major component (ca. 50%), along with lauric, myristic and palmitic acid. Tests with the synthetic compounds identified I2C as an ecdysiostatic factor, acting in a dose-dependent manner with 50% inhibition of ecdysteroid biosynthesis at 10^{-6}-10^{-5}M I2C and a maximum inhibition of 60-70% at 10^{-4}-10^{-3}M I2C. No effect of I2C on juvenile hormone biosynthesis by corpora allata from 5 day-old adult females could be observed, even at the highest concentration (10^{-4}M) tested. The role of I2C in the regulation of development and reproduction and the possibility that I2C is transferred via the spermatophore during copulation are dicussed.
Index terms: *Gryllus bimaculatus*, Ecdysiostatin, Indole-2-carboxylic acid

[3341] THERMAL REQUIREMENTS AND NUMBER OF GENERATIONS OF *Selenaspidus articulatus* (MORGAN, 1889) (HEMIPTERA: DIASPIDIDAE) DURING THE YEAR IN THE STATE OF SÃO PAULO, BRAZIL.

R. Marin ,L[1] & J. R. P. Parra[2], [1]Universidad Nacional Agraria La Molina, Apdo. 456, Lima, Perú, E-mail rmarin@lamolina.edu.pe; [2]Dep. Entomol., Fitop. e Zool. Agrícola, ESALQ-USP, 13418-900, Piracicaba-SP, Brasil.

The life cycle of *S. articulatus* was studied under laboratory conditions determining its thermal requirements. Incubators were set at 18, 20, 22, 25, 28, 30 and 32 °C; 60 ± 10% RH and 14 hour photophase. *Citrus limonia* was used as host plant. Viability and duration of each developmental phase, and adult longevity were determined for males and females. In addition, pre-oviposition and oviposition periods were determined for females. Rate of development agreed with the linear model of an hiperbolic equation. Development of *S. articulatus* occurred between 18 and 30 °C, but not at 32 °C. Highest fecundity occurred at 25 and 28 °C and adults lived longer at 18 °C. Thermal requirements varied with sex and developmental phase. Threshold of temperature and thermal constant values were 11.87 °C and 453.17 dd (days degree) for females (from crawler to adult); 14.08 °C and 165.74 dd for nymph I; 16.80 °C and 326.36 dd for nymph II. For males nymph I, 14.21 °C and 153.30 dd; for nymph II, 10.22 °C and 144.31 dd; "pre-pupoid" 16.72 °C and 63.30 dd; and for "pupoid", 15.25 °C and 68.34 dd. It is estimated to occur 6 to 10 generations of males and 6 to 9 generations of females in the main citrus areas of São Paulo.
Index terms: citrus pest, citrus scale, biology, temperature

[3342] FERTILITY LIFE TABLES OF *SELENASPIDUS ARTICULATUS* (HEMIPTERA: DIASPIDIDAE) REARED UNDER DIFFERENT TEMPERATURES AND RELATIVE HUMIDITIES

R. Marin L.[1] & J. R. P. Parra[2], [1]Universidad Nacional Agraria La Molina, Apdo. 456, Lima, Perú, E-mail rmarin@lamolina.edu.pe; [2]Dep. Entomol., Fitop. e Zool. Agrícola, ESALQ-USP, 13418-900, Piracicaba-SP, Brasil.

This work was carried out to evaluate the development of *S. articulatus* at different temperatures (18, 20, 22, 25, 28, 30 and 32 °C) and relative humidities (30, 50, 70 and 90%) in order to prepare a fertility life table and determine the parameters: net reproductive rate (Ro); finite increase rate (λ); mean generation time (T) and increase infinitesimal rate (rm). The scales were reared in *Citrus limonia* plants, cultivated in small black rigid plastic tubes, 20 cm height per 1.5 cm diameter, maintained in incubator, kept at different temperatures and relative humidities as above mentioned. The highest net reproductive rate (Ro) and finite increase rate (c) were observed at 25 and 28 °C and the highest *S. articulatus* fecundity occurred between 25 and 28 °C. The scale mean generation time (T) was inversely correlated with temperature in the range of 18-30 °C and the rm increased with the temperature in the same range. The highest fecundity of *S. articulatus* occurred from 50 to 70% RH. The most suitable RH was 70% and in this condition occurred the highest fecundity, highest net reproductive rate (Ro) and finite increase rate (λ). Lower RH values do difficult the fixation of crawler nymphs of *S. articulatus*, and the first instar is critical because of the highest mortality, regardless temperature or RH.
Index terms: citrus pest, citrus scale, biology

[3343] A NEW ARTIFICIAL DIET REDUCES THE DEVELOPMENTAL TIME OF *HYLOBIUS TRANSVERSOVITTATUS* BY A FACTOR OF FIVE

L. F. Matos & J. J. Brown, Washington State Univ., PO Box 646382, Pullman WA, 99164-6382, USA. E-mail: Lmatos@wsu.edu.

Purple loosestrife (*Lythrum salicaria* L.) is an exotic wetland weed that overtakes the habitat it enters and reduces plant and animal biodiversity. Loosestrife infests lands that are not highly productive and therefore it is not cost effective to use herbicides to kill this weed. There are several effective biocontrol agents against purple loosestrife but mass rearing methods have only been developed for two of them. *Hylobius transversovittatus* Goeze (Curculionidae) adults feed on the leaves of the plant causing some damage. The larvae of *Hylobius* feed within the roots and are capable of killing the plant. Hylobius takes from one to two years to complete its development. We have Developed an artificial diet which enables us to rear *Hylobius transversovittatus* from egg to adult in an average of only 78 days.
Purple loosestrife, *Lythrum salicaria* L.

[3344] INTERCELLULAR CYTOPLASMIC TRANSPORT DURING OOGENESIS OF A MOTH MIDGE, *TINEARIA ALTERNATA* (DIPTERA: PSYCHODIDAE)

M. Mazurkiewicz & J. Kubrakiewicz, Zoological Inst., Univ. of Wroc law, 50-335 Wroc law, Sienkiewicza 21, Poland, E-mail: jkubrak@biol.uni.wroc.pl

Ovary of a psychodid, *Tinearia alternata* consists of several dozen (50-70), developmentally synchronized, polytrophic ovarioles, each containing one functional egg chamber. The egg chamber is composed of a cluster of 16 germ cells (cystocytes) interconnected by cytoplasmic bridges and invested by the layer of somatic follicular cells. In the pupal ovary the cystocytes forming particular egg chambers are of more or less equal size but they show clearly noticeable morphological differentiation. The most basally located cystocyte within the cluster becomes the oocyte and initiates vitellogenesis while all the remaining cells differentiate into nurse cells. The nucleus of each nurse cell contains one centrally located, prominent nucleolus and more peripherally disposed polytene chromosomes. Fine granular nuage material accumulates in close vicinity of the nucleus while other regions of cytoplasm are filled with densly packed ribosomes. Primary function of the nurse cells is to supply the growing oocyte with macromolecules (mainly RNPs) and organelles which are transported to the oocyte through intercellular bridges. Polarized nurse cell-oocyte transport proceeds in two distinct phases. Slower phase during early stages of oogenesis is followed by a massive and rapid flow of the nurse cell cytoplasmic content into the oocyte during the advanced stages of vitellogenesis In the ovaries of mature females the egg chambers grow considerably. Vitellogenic oocytes comprise an increasingly greater proportion of the egg chamber volume. Initially this growth is mainly due to yolk accumulation but later it depends also on the transport of nurse cell cytoplasm. During the final stages of oogenesis the nurse cells are almost devoid of cytoplasm and degenerate. Like in most other dipterans the contraction of nurse cells in *Tinearia* is mediated by actin cytoskeleton. Contrary to the situation found in the ovaries of brachyceran flies the nurse cells of *Tinearia* seem to lack extensive cytoskeletal networks. They contain only two populations of filamentous actin: subcortical actin and microfilaments associated with intercellular bridges. Thus the way the nurse cell nuclei are anchored in place during the rapid movement of cytoplasm remains unclear.
Index terms: nurse cells, oocyte, flow of cytoplasm, Nematocera

[3345] MORPHOLOGICAL ASPECTS OF THE EGG, 1st and 5th NYMPHAL INSTARS OF THE BURROWING BUG, *Atarsocoris brachiariae* Becker, 1996 (HEMIPTERA: CYDNIDAE)

M. O. Medeiros[1] & O. Sales Jr. [1], [1]Centro de Controle Biológico, Univ. Federal de Mato Grosso, Av. Fernando Corrêa, s/n, Cuiabá, MT 78060-900, BR, ccb@cpd.ufmt.br.

This research was aimed at morphologically characterizing the egg and the 1st and 5th nymphal instars of the burrowing bug, *Atarsocoris brachiariae*. Observations were made under a stereomicroscope. Measurements were taken from 100 individuals for each development stage, with a sliding caliper. The egg stage showed lengths ranging from 0.8 through 2.7 mm and widths from 0.6 through 2.4 mm, respectively with or without the effect of humidity. The egg is ovoid, almost cylindrical, whitish, whitish-yellow or light yellow depending on the development of the embryo. When freshly laid it is bright, humid and slightly viscous. The chorion is firm, with a laced, irregular surface. The 1st instar nymph is very distinct morphologically from the other instars, measuring 2.30x±0.460 length and 1.74±0.393 width, on average. It is egg-shaped, milky white to pale yellow, ventrally depressed and has the body covered with light-colored bristles. The head is not distinct, with 8-segmented antennae. The forelegs are well developed, with robust tibiae adapted for excavating. The middle and hind legs are ambulatorial, with no special modifications. The body is flexible and wrinkled. The abdomen is 10-segmented, uniform in width from the 1st through the 5th segment, the first being larger than the others. The remaining abdominal segments taper off toward the end of the body. The 5th instar nymph is on average 5.15x±0.340 mm in length and 3.23±0.299 mm in width. The head is amber-yellow on its dorsal surface, with seven bristles along each anteocular margin, brown in color; the ventral surface, antennal segments and rostrum are yellow-white. The thorax has an amber-yellow notum with a series of bristles along the external margins of the pronotum and the mesothoracic wing buds, which extend over the 3rd abdominal segment; the ventral surface (sternum and pleura) and femurs are yellowish; the tibiae are yellowish with brown spines; tarsi lacking. The abdomen has a milky white-yellow dorsum; tergum 4 with a fine and narrow middle plate on the posterior margin; tergum 5 with a wider middle plate; tergum 6 with middle plate a little smaller than the previous; all plates amber-yellow; sternal plate bright white-yellow and milky. The female has a small biconcave marking above the anal opening, lacking in the male.
Index terms: description, morphology, *Brachiaria*, pest

[3346] DETECTION OF *WOLBACHIA* IN A LINE WITH FEMALE-BIASED SEX RATIO OF A BUTTERFLY, *HYPOLIMNAS BOLINA*

W. Mitsuhashi[1], H. Fukuda[2] & M. Sato[1], [1]Natl. Inst. Seric. Entomol. Sci., Tsukuba, Ibaraki 305-8634, Japan, E-mail mitsuhas@nises.affrc.go.jp; [2]Meiwa 4-5-32, Kagoshima, Kagoshima 890-0024, Japan.

It has well been known that there are lines characterized by their female-biased sex ratio in a famous butterfly, *Hypolimnas bolina* (Lepidoptera: Nymphalidae). However, the cause of the distortion of sex ratio is unknown. We tried to detect *Wolbachia* in a female-biased line in the butterflies, since the symbiosis of bacteria belonging to genus *Wolbachia* in arthropods has been reported to be a cause of the distortion of sex ratio toward the females. We performed PCR using a primer set specific to 16S rDNA in *Wolbachia* (O'Neill *et al.*, 1992), after the extraction of DNA from the genital organs of larvae or pupa in a female-biased line or a normal line. As a result, PCR products of the predicted size (ca. 0.9 kb) originating from *Wolbachia* 16S rDNA were obtained from all the individuals in female-biased lines tested, while no PCR product was amplified from all the individuals in a normal line tested. A PCR product was confirmed to have originated from *Wolbachia* 16S rDNA by its sequencing. These results suggest that *Wolbachia* present within female-biased lines caused the distortion of their sex ratio. We are examining to specify whether the bias was induced by male-killing. In addition, we are analyzing 16S rDNA sequences of two female-biased lines to detect their diversity within *Wolbachia* strains in the same host species.
Index terms: female-biased sex ratio, symbiont, 16S rDNA

[3347] EFFECT OF INSECT GROWTH REGULATOR BUPROFEZIN ON GREEN LEAFHOPPER (*EMPOASCA KRAEMERI* ROSS & MOORE, 1957) (HEMIPTERA, CICADELLIDAE) NYMPHS AND ADULTS UNDER LABORATORY CONDITIONS

P. R. Moreno[1] & O. Nakano[2], [1]Hokko do Brasil – P.O.Box:21 – CEP:18580-000 – Pereiras/SP – E-mail: prmoreno@zaz.com.br; [2]ESALQ/USP–P.O.Box:9–CEP:13418-900– Piracicaba/SP).

The green leafhopper, *Empoasca kraemeri*, is a very problematic insect pest in Latin America on drybean crop (*Phaseolus vulgaris*), where a chemical control is necessary when population reaches high level. In most of cases the organophosphate insecticides are used to control them. Through the bioassay it was studied the effect of buprofezin, a chitin synthesis inhibitor, on the mortality of nymphs of this insect under laboratory conditions. It was adopted an completely randomized experimental design, with 8 treatments and 6 replications and each plot had 5 nymphs at first instar located on the leaflets previously treated with buprofezin at following concentrations: 0; $6.25x10^{-4}$; $3.51x10^{-4}$; $1.976x10^{-4}$; $1.111x10^{-4}$; $0.962x10^{-4}$; $0.833x10^{-4}$ and $0.625x10^{-4}$ g a.i./L. It was observed that the most adequate distribution for the proportional dead nymphs was the beta binomial, although proportional data in general has binomial distribution. The LC_{50} obtained was $1.121x10^{-4}$ g a.i./L of solution with limits: [$8.559x10^{-5}$; $1.459x10^{-4}$]. In another bioassay it was studied the effect of buprofezin on adult fecundity of *Empoasca kraemeri*. Virgin pairs, recently emerged (0-12 hours aged) were put into contact with drybean plants previously dipped into buprofezin solution. The experimental design adopted was completely randomized with 3 treatments (50, 10 and 0 ppm of buprofezin) and 4 replications. Each plot consisted by 4 pairs allocated on drybeans plants previously contaminated with the insecticide. After this period, the plants were replaced to go on oviposition process. Plants were cleared by lactophenol solution and the number of eggs was counted under stereoscopy microscopy. The longevity average of the insects in the control plot was 46 and 27 days for female and male, respectively. At the concentration of 10 ppm, the longevity for female and male was 18 and 16 days, respectively, compared with the value obtained with 50 ppm was 16 and 14 days. However, the most interesting result was obtained through the oviposition. For this parameter it was obtained an average of 406 eggs per plot in the control treatment; at concentration 10 and 50 ppm the average of eggs per plot was 3.5 and 0.5, respectively. The rhythm of oviposition, eggs/female/day, was 2.31; 0.09 and 0.01 for control, 10 and 50 ppm of buprofezin, respectively.
Index terms: fecundity, reproduction, oviposition, egg laying

[3347] EFFECT OF BUPROFEZIN ON GREEN LEAFHOPPER (*EMPOASCA KRAEMERI* ROSS & MOORE, 1957) (HEMIPTERA, CICADELLIDAE) FECUNDITY UNDER LABORATORY CONDITIONS

P. R. Moreno[1] & O. Nakano[2], [1]Hokko do Brasil – P.O.Box:21 – CEP:18580-000 – Pereiras/SP – E-mail: prmoreno@zaz.com.br; [2]ESALQ/USP–P.O.Box:9–CEP:13418-900– Piracicaba/SP).

The green leafhopper, *Empoasca kraemeri*, is a key insect pest on drybean (*Phaseolus vulgaris*) crop in Latin America and it is necessary the chemical control when population reaches high level. The insecticide buprofezin is a chitin synthesis inhibitor that works during the ecdysis of the insects. This compound is very effective on young phases of Hemiptera Order such as: leafhoppers, whiteflies and some species of scales. Otherwise, insect growth regulators had shown good effects on the fecundity of several species. This study was done to observe the effect of buprofezin on fecundity of *Empoasca kraemeri*, when males or females adults are treated with insecticide. For that, virgin adults (male or female), recently emerged (0-12 hours aged), were contaminated through a contact on insecticide treated surface at concentrations of 1000 ppm during 30 seconds them the treated insect was allocated with its couple of opposite sex that did not submited to the treatment. Experimental design adopted was completely randomized with 3 treatments (female treated, male treated and control) and 4 replications. Four pairs placed on drybean plants during 5 days formed each plot. After this period, the plants were replaced to go on the oviposition process. The plants were pulled out and cleared by lactophenol solution and the eggs were counted under stereoscopy microscopy. In relation to the longevity it was observed, 46 and 27 days for female and male, respectively, in control treatment. When female received the treatment, the average of longevity was 35 and 23 days for female and male, respectively. However, when male was treated it was observed the shortest longevity, 27 and 16 days for female and male, respectively. Regarding to the total of eggs, it was observed 406 eggs on average per plot in control treatments. When female was treated the average per plot was 292 and when male was treated the average of eggs was 235. However, the rhythm of oviposition did not show significant difference: 2.31; 2.56 and 2.42 eggs/female/day for the control, female and male treated, respectively. We conclude that the reduction on oviposition was a response of the reduction of the longevity and when male received buprofezin application the longevity of couple suffered great reduction.
Index terms: reproduction, oviposition, egg laying, insect growth regulator

[3349] FEEDING RESPONSES AND GROWTH OF *HELICOVERPA ARMIGERA* (LEPIDOPTERA: NOCTUIDAE) LARVAE MAINTAINED ON CHICKPEA, COWPEA, BLACKGRAM AND PIGEONPEA DIETS

S. Mullick & A. K. Singh, Dept. of Zoology, Univ. of Delhi, Delhi-110007, India

Studies on the feeding preferences and growth of last instar *Helicoverpa armigera* larvae on legume seed based synthetic diets were carried out in controlled laboratory conditions. The basic ingredients and their proportions were similar in all the test diets, save these differed in powdered seed materials, i.e. chickpea, cowpea, blackgram, and pigeonpea. The larvae were tested in early last instar after rearing them on a particular diet upto the penultimate larval instar. Food intake of larvae in 24 hrs was minimum on pigeonpea diet ($p<0.05$). However, the consumption of chickpea diet by chickpea diet-reared last instar larvae, cowpea diet by cowpea diet- reared larvae, and blackgram diet by blackgram diet- reared larvae, was statistically identical. Growth of the larvae was also observed significantly lower on pigeonpea diet in comparison with other test diets ($p<0.05$). The results indicated equal food value of chickpea, cowpea, and blackgram diets for the gram podborer larvae. Consumption of chickpea, cowpea and blackgram diets by chickpea diet-reared larvae was statistically similar. However, consumption of chickpea diet by chickpea diet-reared larvae was significantly higher compared to consumption of pigeonpea diet. Growth of chickpea diet-reared larvae on chickpea diet was also significantly higher ($p<0.05$) as compared to growth of chickpea diet -reared larvae on pigeonpea diet, but this was statistically identical to growth of chickpea diet-reared larvae on cowpea and blackgram diet. Food consumption of cowpea diet- reared larvae on cowpea diet was statistically equal to consumption of chickpea and blackgram diets, but significatly lower as comapred to pigeonpea diet ($p<0.05$). However, growth of cowpea diet-reared larvae on cowpea, chickpea, pigeonpea, and blackgram diets was identical. Consumption of blackgram diet by blackgram diet-reared larvae was significantly higher than the consumption of chickpea and cowpea diets, but identical to consumption of pigeonpea diet. Growth of larvae reared on blackgram was significantly lower on pigeonpea diet compared to blackgram diet. Food consumption and growth of pigeonpea reared larvae on chickpea, cowpea, blackgram and pigeonpea diets was identical. The results indicated that pigeonpea seed kernels contain both antixenotic and antibiotic factors, which is reflected by lower food intake and lower growth rate of larvae. Also, induction of feeding preferences in terms of quantitative consumption were observed for blackgram diet reared last instar larvae for the blackgram diet. However, such preferences were not evident for the larvae reared on other diets.

Index terms: Food consumption, antixenosis, antibiosis, induction.

[3350] STRUCTURAL BASIS FOR WATER EXCHANGE BETWEEN THE FEMALE COCKROACH (BLATTELLA GERMANICA L.) AND HER OOTHECAE

D. E. Mullins, K. J. Mullins & K. R. Tignor, Dept. of Entomology, Virginia Polytechnic Institute and State University, Blacksburg, VA 24061-0319.

Female German cockroaches usually carry their oothecae until after hatch and it appears that the success of embryogenesis appears to be dependant on the water balance relationship between females and their developing oothecae. Oothecae detached early in embryogenesis may fail to develop, especially in low humidity environments. Experiments using tritiated water have confirmed the exchange of significant amounts of water to the ootheca by the female during embryogenesis. For example, 17% of the tritiated water injected into gravid females was recovered in their oothecae after twenty-four hours. We have discovered that an area located on the proximal portion of the ootheca (the "escutcheon-shaped vaginial imprint", first described in 1889 by Wheeler) contains small pores that penetrate the oothecal covering to access portions of the chorion lying beneath these pores. An elaborate system of chorionic structures associated with the spongy bodies located in the keel appear to provide interconnections of the chorion throughout the oothecae. Studies using a variety of techniques including transport of tritiated water and darkfield birefringent microscopy supports the hypothesis that this chorionic network is capable of conducting water throughout the interior of the ootheca. Further, the structural arrangement and intimate association of the female vestibulum with the oothecal pore field contained in the escutcheon-shaped vaginial imprint appears to provide an efficient conduit to the chorion. The overall structural arrangement may be a means for maintaining water balance between females and their oothecae during embryonic development.

Index terms: water relations, embryogenesis, chorion

[3351] TIMING OF DIAPAUSE INDUCTION OUTSIDE THE NATURAL GEOGRAPHICAL RANGE OF A SPECIES: AN OUTDOOR EXPERIMENT WITH THE BEAN BUG *RIPTORTUS CLAVATUS*

D. L. Musolin[1], H. Numata[1] & A. H. Saulich[2], [1]Dept. of Bio- and Geosciences, Grad. School of Science, Osaka City Univ., Osaka, 558-8585, Japan, E-mail: musolin@sci.osaka-cu.ac.jp; [2]Lab. of Entomology, Biological Research Inst., St.Petersburg State Univ., Stary Peterhof, St.Petersburg, 198904, Russia, E-mail: Saulich@AS1061.spb.edu.

The phytophagous bug *Riptortus clavatus* (Heteroptera: Alydidae) produces 2 or 3 generations per year in Central Japan and overwinters at the adult stage. In the Kyoto (35°00′N, 135°45′E) population, we studied (1) the effects of day-length on the nymphal and preoviposition periods under constant photoperiod at 20.5°C, (2) photoperiodic induction of adult diapause at 20.5°C and under a combination of constant photoperiod and natural daily rhythm of temperature in the forest-steppe zone of Russia (50°38′N, 35°58′E). Then, we examined (3) the timing of diapause induction under quasi-natural conditions in the same region, far outside the species' natural range. At 20.5°C, the nymphal period in both males and females was significantly longer in the regimes with shorter photophases than under those with longer photophases. The preoviposition period in females was significantly longer under the near-critical long-day regime L14:D10 than under typical long-day regimes (L15:D9, L16:D8 and L17:D7). The critical day-length for diapause induction was shorter under conditions of natural daily rhythm of temperature than those reported at constant 20, 25 and 30°C. Under quasi-natural conditions in the forest-steppe zone, *R clavatus* entered diapause in September, much later than the local populations of true bugs studied to date and this finding is well explained by the characteristics of the phtoperiodic response of this species. These results illustrate the proposition that when a species with a photoperiodically induced diapause is introduced into new environmental conditions far outside its natural geographical range, day-length and temperature remain the leading factors in the control of seasonal development and diapause induction. The results will be discussed in comparison with the findings in other heteropterans in the same region and with the records of seasonal development of *R. clavatus* in Kyoto.

Index terms: Heteroptera, photoperiodism, seasonal adaptations, life cycle, voltinism

[3352] SUMMER DORMANCY ENSURES UNIVOLTINISM IN THE PREDATORY STINK BUG *PICROMERUS BIDENS*

D. L. Musolin[1] & A. H. Saulich[2], [1]Dept. of Bio- and Geosciences, Grad. School of Science, Osaka City Univ., Osaka, 558-8585, Japan, E-mail: musolin@sci.osaka-cu.ac.jp; [2]Lab. of Entomology, Biological Research Inst., St.Petersburg State Univ., Stary Peterhof, St.Petersburg, 198904, Russia, E-mail: Saulich@AS1061.spb.edu.

The seasonal cycle of *Picromerus bidens* (Heteroptera: Pentatomidae) is usually considered to be univoltine with an obligatory winter egg diapause. Seasonal adaptations of the species were studied in the laboratory and in field experiments performed in the forest-steppe zone of Russia (50°38′N, 35°58′E). When reared under short-day photoperiodic conditions (L12:D12 and L14:D10), all females began to lay eggs synchronously soon after their emergence. However, in the females reared under long-day conditions (L18:D6 and L20:D4) and outdoors in June–July, oviposition was significantly delayed. This delay in reproduction induced by photoperiodic conditions and then spontaneously terminated was considered to be aestivation. Egg batches laid by females in the laboratory and in the field were kept at 25°C for two months. From 30.8 to 93.8% of batches contained eggs which hatched without cold treatment between day 14 and 60 after oviposition. The proportion of eggs hatched was 17.7 to 20.9% in the short-day regimes, while it was significantly less (5.7 to 6.0%) under long-day conditions. It is concluded that in some eggs diapause is of low intensity and that if under natural conditions the first batches had been laid at the end of June, nymphs would have hatched at least from some eggs during the same season even without cold treatment. Such untimely hatching would have resulted in the death of nymphs and adults unprepared for overwintering. A photoperiodic response which induces aestivation in the early emerging adults in June–August may prevent early oviposition and occurrence of a second generation and thus maintains univoltinism in *P. bidens*.

Index terms: Heteroptera, photoperiodism, seasonal adaptations, diapause, aestivation

[3353] DIAPAUSE TERMINATION IN EGGS OF COTTON APHID, *APHIS GOSSYPII* (HEMIPTERA: APHIDIDAE), FOR CROSSINGS IN THE LABORATORY

Y. Narai[1] & T. Murai[2], [1]Shimane Agricultural Experiment Station, Izumo, 693-0035, Japan; [2]Research Institute for Bioresources, Okayama University, Kurashiki, 710-0046, Japan

Every clone of *Aphis gossypii* has a characteristic life cycle pattern, insecticide resistance and host preference. These genetic backgrounds could be understood by crossings among clones. Prior to crossing trials, the condition for diapause termination of eggs should be determined. Therefore we investigated the condition for diapause termination in eggs produced by selfings and reciprocal crossings. Two holocyclic clones of *A. gossypii*, GMP and GSM collected on melon and on eggplant, were used. Oviparae and males were induced by the rearing at the condition of short-day photoperiod (10L14D) and 16 °C. The fertilized eggs were kept at 2.5 °C and 7.5 °C for 0 to 240 days. After the chilling treatments, egg hatching was observed for 80 days at the condition of long-day photoperiod (16L8D) and 16 °C. Although some eggs without chilling hatched, egg hatching was gradual and low. At the chilling of 2.5 °C for 60 to 100 days and at the chilling of 7.5 °C for 70days and 90days, eggs produced by GMP oviparae hatched simultaneously with the rate higher than 67%. Eggs produced by GSM oviparae hatched with the rate lower than 42% at the chilling of 2.5 °C and 7.5 °C. At the chilling of 7.5 °C for 90 or 100days some eggs produced by GPM and GSM oviparae hatched during the chilling. It was cleared that chilling treatment of 2.5 °C needed at least 60 days for diapause termination of egg in *A. gossypii*.
Index terms: chilling treatment, selfing, reciprocal crossings, holocyclic clone.

[3354] UTILIZATION OF SPECIFIC PLANT VOLATILES IN MATING STRATEGIES IN THE ORIENTAL FRUIT FLY AND MEDFLY

R. Nishida1, K. H. Tan2, T. E. Shelly3 & K. Y. Kaneshiro3, 1Lab of Chemical Ecology, Kyoto Univ., 606-8502 Japan, E-mail ritz@kais.kyoto-u.ac.jp; 2School of Biological Sciences, Univ. Sains Malaysia, Penang, Malaysia; 3Hawaiian Evolutionary Biology Program, Univ. of Hawaii, HA 96822, USA

Males of pest fruit fly species (Tephritidae) show strong affinity to specific volatile chemicals produced by plants. The oriental fruit fly, *Bactrocera dorsalis* (and several within its complex species), are strongly attracted to methyl eugenol and some related phenylpropanoids often found as flower fragrances. Males fed on the attractants converted the compounds to female-attracting pheromone and selectively stored them in the rectal glands. Males 'scented' with phenylpropanoids were more successful in mating than unscented males, indicating the advantage of acquiring the compound(s) in mating success. Likewise, males of melon fly, *B. cucurbitae*, sequestered raspberry ketone in the rectal glands. Pharmacophagous acquisition of phenylpropanoids by *Bactrocera* species seems to have evolved within the context of sexual selection, particularly female preference for males scented with chemicals derived from plants. On the other hand, alpha-copaene, a potent attractant for males of Mediterranean fruit fly, *Ceratitis capitata*, is found as a minor component in the essential oils of various plant species including its major hosts such as orange, guava and mango. Despite such specific attraction, the male flies never feed on the intact compound and hence the biological significance of alpha-copaene remains unknown. In laboratory tests, lek-like behavior of *C. capitata* was induced artificially using a plastic leaf model treated with (+)-alpha-copaene. It was also found that alpha-copaene affected virgin females provoking 'pseudomale' courtship behavior in a short-range bioassay. Mating occurred exclusively on the artificial leaves treated with alpha-copaene, suggesting the compound serves potentially as one of the chemical cues to facilitate orientation of the flies to the rendezvous site in their host habitat.
Index terms: *Bactrocera dorsalis, Ceratitis capitata*, methyl eugenol, alpha-copaene, sex pheromone.

[3355] BIMODAL LIFE CYCLE AND SUMMER DIAPAUSE IN THE BURYING BEETLE, *NICROPHORUS QUADRIPUNCTATUS*.

T. Nisimura[1], M. Kon[2] & H. Numata[1].

[1]Dept. of Bio- and Geosciences, Grad. Sch. of Sci., Osaka City Univ., Osaka 558-8585, Japan, E-mail tomoyosi@sci.osaka-cu.ac.jp; [2]Sch. of Environ. Sci., Univ. of Shiga Pref., Shiga 522-8533, Japan

Burying beetles reproduce on small vertebrate carcasses, and bury them as a food resource for their progeny larvae. Adult pairs remain with the larvae and provide extensive biparental care, such as regurgitating predigested carcass for the larvae and defense against competitors and predators until the larvae cease feeding. Under natural conditions in Kyoto, Japan, the reproductive activities of *Nicrophorus quadripunctatus* (Coleoptera: Silphidae) decreased in summer and showed a bimodal life cycle. To explain the seasonal changes in reproductive activities, the effects of temperature and photoperiod on reproduction were examined in the laboratory. Most of adult pairs raised at 20 °C under LD 12:12 reproduced when provided with a piece of chicken. In adults raised at 20 °C under LD 16:8, however, both reproductive behavior and ovarian development were reduced. It was concluded that these adults entered a reproductive summer diapause. Moreover, high temperature of 25 °C also suppressed the reproductive behavior and ovarian development even under LD 12:12. This suppression at 25 °C was not related to diapause but was a direct response, because these adult pairs reproduced within 3 days after transfer to 20 °C under the same photoperiod. In the field, therefore, adults reduce their reproductive activity in summer, because of diapause induced by long-day photoperiod and direct inhibition of reproduction by high temperature. In the laboratory, when temperature was changed from 20 °C to 25 °C immediately after hatching of larvae, these larvae reached the wandering stage in 95 % of adult pairs. When temperature was changed from 20 °C to 25 °C immediately after oviposition, however, no larvae hatched in 85 % of pairs. Finally, the eggs were dug out within 1 day after oviposition and kept at various temperatures. Egg mortality was significantly higher at 25 °C than at 20 and 22.5 °C and, no eggs hatched at 27.5 °C. Therefore, the physiological mechanisms for reducing reproduction probably prevent the beetles from inefficient oviposition in summer.
Index terms: Silphidae, reproductive behavior, photoperiod, high temperature, egg mortality.

[3356] PHOTOPERIOD AND TEMPERATURE CONTROL ON MORPHOLOGY, PIGMENTATION AND REPRODUCTION IN *HALYOMORPHA BREVIS*

C. C. Niva[1]& M. Takeda[2], [1, 2] Grad. Sch. Science and Technology, Kobe Univ., Nada-ku, Kobe, Japan 657-8501 E-mail cintiacn@hotmail.com

Photoperiod is the major seasonal cue used in the regulation of a variety of insect life cycle traits. We investigated effects of photoperiods and temperatures on morphological, reproductive and developmental traits in *Halyomorpha brevis* (Heteroptera: Pentatomidae). Short lengths of ovariole (♀) and narrow widths of ectodermal sac (♂) were diagnostic for adult diapause. All adults reared under short days (LD14:10 and 11:13) and 30-40% of adults reared under a long day (LD16:8) had diapause-like gonads even 15 days after emergence. Before the reproductive stage is reached, environmental influences were already apparent. Females generally outgrow males, but diapausing adults were smaller than non-diapausing ones. The color of adult sternum varied from ivory to red. Fifteen days after emergence, 22-77% of long day males had red sternum, while no insect under 20°C/LD11:13 showed red color. Adults of different ages and in different conditions also showed some differences in fat body accumulation and pigmentation of trachea and gastric caeca (possibly due to the endosymbionts). The involvement of pteridines in the pigmentation is presently being investigated. The present results suggest that temperature also plays a role in the morphology, pigmentation and reproduction in *H. brevis*.
Index terms: Heteroptera, diapause, color change, pteridines

[3357] ARTIFITIAL INDUCTION OF SEXUALS IN GREENBUG

A. Noriega, A.M.Castro, A.A. Clúa & H.O. Chidichimo, Dept. of Biology and Ecology and Dept. of Production, Fac. of Agronomy, Univ. Nac. La Plata, CC 31, 1900-La Plata, Argentina amcastro@isis.unlp.edu.ar

This work was aimed at i) determining the temperature and photoperiod thresholds for artificial induction of sexuals; ii) studying the relation between these environmental requirements and the geographic origin of natural populations. Selected clones of greenbug, (*Schizaphis graminum*, Rond.) reared on susceptible barley plants were subjected to different photoperiod treatments under controlled conditions in cabinets. The clones were selected by their ability to produce sexuals under natural conditions. These clones were parthenogenetically maintained in insectary with 16 h: 8 h (light: darkness) and 20°C. One replicate of every selected clone was kept under 12, 11, 10, 9 8.30, 8 and 7.30 Hs of photoperiod treatments in two different temperature regimes: 20°C and 12°C. Controls were the same clones maintained at 16 h of daylength in both temperatures. Host plants were grown in both daylength conditions and temperatures. The induction of sexuals occurred with hosts cultivated under short day condition regardless the temperature regime. It was found variability between and within greenbug populations. Clones belonged to the populations collected in the warm and humid region developed sexual forms in contrast with those ones from populations collected at low latitudes that remained parthenogenetic under controlled conditions. It was found variability in the daylength requirements between clones of the same population. The variability determined within populations suggests that the induction of sexual reproduction is switched on by the photoperiod in several aphid genotypes, meanwhile for other genotypes temperature is the factor that interacts for that induction . Biochemical and molecular markers associated to different regulation of greenbug breeding system are discussed.
Index terms: *Greenbug, sexuals induction, parthenogenesis, genetic and environmental factors*

[3358] VARIETAL DIFFERENCE IN NYMPHAL SURVIVAL RATE, ADULT FECUNDITY AND LONGEVITY OF *FRANKLINIELLA OCCIDENTALIS* (TYSANOPTERA: THRIPIDAE) ON JAPANESE CHRYSANTHEMUM LEAVES

I. Ohta & M. Kobayashi, Lab. of Insect Pest Control, Chugoku Nat. Agr. Exp. Stn., 6-12-1, Nishifukatsu, Fukuyama 721-8514, JAPAN, E-mail ohtaiz@cgk.affrc.go.jp.

Western flower thrips (WFT), *Frankiliella occidentalis* has become one of the most important pests to many vegetable, ornamental and fruit crops in Japan. Especially, Japanese chrysanthemum receives serious damage from WFT. Some chrysanthemum cultivars in Netherlands are known to have resistance to WFT infestation. This work was performed to investigate variental differences in nymphal survival rate, adult fecundity and longevity of WFT on Japanese chrysanthemum leaves. Two cultivars, Yuki-no-izumi(YI) and Kan-komichi(KK), were used in this test. WFT nymphs provided YI leaves successfully developed to adult. The survival rates in mature and young leaves at 25 degrees Celsius were 85.7% and 78.6%, respectively. In KK leaves, WFT nymphs hardly completed their development. The survival rates in mature and young leaves were 3.7% and 5.0%. These values were significant lower than those of YI leaves. The fecundity of WFT adult females at 25C was averagely 11.0 nymphs on YI mature leaves, 0.5 nymphs on KK mature leaves, 46.7 nymphs on YI young leaves and 45.7 nymphs on KK young leaves. There was significant difference in mature leaves between YI and KK, but not in young leaves. The female longevity was 16.8 days on YI mature leaves at 25C, 10.8 days on KK mature leaves, 13.8 days on IY young leaves and 17.7 days on KK young leaves. The male longevity was 12.2 days on YI mature leaves, 5.8 days on KK mature leaves, 14.2 days on IY young leaves and 17.0 days on KK young leaves. These results suggest that WFT population may not increase on KK leaves because WFT nymphs can not develop on it.
Index terms: *Frankliniella occidentalis*, chrysanthemum, survival rate, fecundity, longevity

[3359] BIOLOGY OF Urbanus acawoios (LEPIDOPTERA, HESPERIIDAE) IN LABORATORY

J. M. Pinto[1], A. M. Lunz[2], J. G. N. Wendt[2], M. C. Machado[2], A. G. Carvalho[2] & E. B. Menezes[3], [1]Depto. Fitotecnia, Univ. Fed. Rural do Rio de Janeiro, Seropédica, RJ, 23851-970, Brasil. E-mail: jmiranda@ufrrj.br; [2]Depto. de Produtos Florestais, Univ. Fed. Rural do Rio de Janeiro; [3]Dept. de Entomologia e Fitopatologia, CIMP, UFRRJ, Seropédica, RJ 23.890-000, Brasil.

The genus *Urbanus* (Lepidoptera, Hesperiidae) is associates to the Leguminosae as bean and soy, feeding of the leaves, causing great damage to the plantations. The damages caused by these defoliators show the importance of the study of its biology to plan its control. This work objectified to study some biological aspects of *U. acawoios* being used as food bean leaves, *Phaseolus vulgaris*, of four cultivate: "Cavalo", "Vermelho", "Manteiga" and "Roxo". The experiment was driven in the Laboratory of Forest Entomology of the Universidade Federal Rural do Rio de Janeiro. After the appearance, the caterpillars were conditioned in gerbox boxes, one caterpillar for box, being thirty repetitions for each to cultivate. They were appraised the duration, in days, of the larval apprenticeship, pupa and the adults' longevity, as well as the weight, in grams, of the larval apprenticeship and pupa. Five larval instars were observed. After comparison of the averages for the Test of Tuckey at 5% of significance, were met significant differences in the medium duration of the first instar among the caterpillars fed with the cultivates "Cavalo" x "Vermelho", average of 2,862 ± 0,1187 and 2,483 ± 0,0944, respectively; in the duration of the 5° instar, in the treatments "Vermelho" x "Manteiga", 7,423 ± 0,3602 and 5,813 ± 0,2617, respectively, and "Vermelho" x "Roxo", 7,423 ± 0,3602 and 5,833 ± 0,2802, respectively. In the longevity, significant differences were observed among the cultivates "Vermelho" x "Roxo", 12,400 ± 0,2340 and 13,462 ± 0,1831, respectively. With relationship to the weight, there was difference in the prepupa apprenticeship, whose caterpillars was fed with the cultivate "Vermelho" x "Manteiga", 0,2202 ± 0,0054 and 0,2599 ± 0,0069, respectively, and "Vermelho" x "Roxo", 0,2202 ± 0,0054 and 0,2748 ± 0,0075, respectively; in the weight of the pupas among the treatments "Vermelho" x "Manteiga", 0,2012 ± 0,0052 and 0,2428 ± 0,0053, respectively; and "Vermelho" x "Roxo", 0,2012 ± 0,0052 and 0,2518 ± 0,0081, respectively. Therefore, the alimentary diet interferes in the duration of the larval apprenticeship of the first and fifth instars, in the adults' emergency and in the prepupa weight and pupa of *U. acawoios*, in the studied conditions.
Index terms: *Phaseolus vulgaris*, Feeding, Defoliate

[3360] OVIPOSITION BEHAVIOUR OF THE STRAWBERRY BLOSSOM WEEVIL *ANTHONOMUS RUBI* (COLEOPTERA: CURCULIONIDAE)

S.Ya. Popov, Dept. of Entomology, Moscow Agricultural Academy, Timiryazevskaya str. 49, 127550 Moscow, Russia

Strawberry blossom weevil *Anthonomus rubi* (Herbst) is a very serious pest. It cuts buds during its oviposition. We studied egglaying behaviour of the pest to find "narrow places" in its stereotype to prevent the damage. Host plants used were strawberry (*Fragaria x ananassa* Duch.) and geum Siberian (*Geum urbanum* L.). Oviposition of *A. rubi* could be separated into 8 behavioural components: walking as a tactile contact perception of the bud surface, test biting, egg hole biting, oviposition with abdomen placing in the bite hole, sealing the egg hole with excrements, locomotion towards a peduncle, cutting a peduncle of the bud, locomotion down the plant. The behavioural components have followed each other in a certain strong order. Females only used buds (not flowers). This fact could be qualified as care for offspring. We have found that during bud examination prior to oviposition females did not analyse the peduncle surface. The egg was only laid into a new hole. If a female attempted to lay an egg several times unseccesfully, it enlarged the hole every time. After egglaying, the female moved towards the peduncle mainly over top of the bud. We suppose that such a traectory is an adaptation for stabilization of stereotype memory to choose an unopened flower. The average time of cutting the bud depended on not only the diameter of the bud peduncle but also on chemi cal compounds of the host-plants: on strawberry it was 11.7 min, on geum - 17.5 min under similar conditions ($P<0.05$). In laboratory conditions *A. rubi* almost always cut the bud. In the test where a peduncle was isolated by a Scotch tape to prevent cutting, the females had stereotype memory to cut a bud of 82.1 min (n=15, SD=34.0). In the field conditions, 8.4% strawberry buds with eggs were not cut. Our studies have shown that the oviposition behaviour of *A. rubi* was very stable, and serious influences should be made to interrupt or to change oviposition stereotype.
Index terms: *Anthonomus rubi*, oviposition behaviour, strawberry.

[3361] MODULATORS OF EGG MATURATION AND LONGEVITY IN *HELIOTHIS VIRESCENS*

S. B. Ramaswamy[1] & N. E. Cohen[2], [1]Department of Entomology, Kansas State University, Manhattan, KS 66506, USA. E-mail: rsonny@ksu.edu. [2]Department of Entomology, Rutgers University, New Brunswick, NJ 08901, USA. E-mail: nco@rci.rutgers.edu

The tobacco budworm (TBW), *Heliothis virescens*, is a polyphagous and economically important pest of several New World crops. The adult female has been shown to use mechanical, visual, and contact chemical cues to discriminate between acceptable and non-acceptable plants. Although plant characteristics (stimulants, deterrents, attractants, repellents, color, structure, etc.) have been shown to affect egg deposition in several species of moths, a multitude of endogenous and exogenous factors interact to control egg development and trigger oviposition. In an effort to elucidate these factors, studies were undertaken to determine the impact of quality and quantity of adult nutrition, mating, and host plant on fecundity and longevity of female *H. virescens*. Sugars, such as sucrose and fructose, and honey are equally effective at enhancing longevity and egg development by females; this effect is dose-dependent. Maltose, in contrast, is the least effective sugar. Addition of vitamin mix to the sugar solutions does not enhance egg production or longevity. Similarly, fresh and stale beer were no better than distilled water in enhancing egg production and longevity in females. The presence of a host plant (cotton) significantly stimulates development and deposition of eggs by *H. virescens* females. Similarly, mating is a strong trigger of egg development in this species causing a 2-fold to 5-fold increase in fecundity; multiple matings further enhance fecundity. In the absence of mating, females exhibit oosorption. We have demonstrated in other studies that the mating-induced stimulation in egg development is the result of three distinct phenomena: transfer of juvenile hormone (JH) during copulation by males to females; activation of the mated female's corpora allata to biosynthesize JH; and concurrent inhibition of the JH degradative JH-esterase. Thus, various endogenous and exogenous factors act in concert to influence fecundity and longevity in *H. virescens*, a phenomenon that is likely common in lepidopterans that feed as adults and rely on JH for egg maturation.
Index terms: Noctuidae, Lepidoptera, Fecundity, Juvenile Hormone

[3362] POSSIBLE REPRODUCTIVE DIVISION OF LABOR IN THE THELYTOKOUS ANT *CERAPACHYS BIROI*

F. Ravary & P. Jaisson, Laboratoire d'Ethologie Expérimentale et Comparée (CNRS 7025), Université Paris 13, 93430 Villetaneuse, France, E-mail: Pierre.Jaisson@leec.univ-paris13.fr.

Thelytokous parthenogenesis has been confirmed in only four species of the family Formicidae: the Myrmicine *Pristomyrmex pungens* (Itow et al. 1984), the Formicine *Cataglyphis cursor* (Cagniant 1973), the Ponerine *Platythyrea punctata* (Heinze and Hölldobler 1995) and the Cerapachyine *Cerapachys biroi* (Tsuji and Yamauchi 1995). In this last case, it was suggested that obligatory thelytoky ruled the Japanese populations of *C.biroi*. We support this hypothesis since we never found mated females in laboratory colonies, and the very rare males which casually appeared were rapidly killed by workers. The colony activity depends on the reproduction rhythm. Two phases alternate: a foraging phase during which specialised foragers prey on myrmicine ants whereas intranidal workers care for the developing larvae, and a statary phase during which all workers stay inside the nest and pupae develop. Eggs are laid during a limited period of the statary phase. Systematic dissections revealed the presence of ovaries in all individuals. However, once the laying phase began foragers presented no oocyte and probably did not participate in egg laying. Conversely, virtually all intranidal workers oviposited. We assume that a reproductive division of labor takes place in these ant populations and we hypothesize that age is responsible for this specialisation.
Index terms: Hymenoptera; Formicidae; parthenogenesis

[3363] SEASONAL PARTIAL INACTIVITY IN THE STINGLESS BEE *PLEBEIA REMOTA* (HYMENOPTERA, APIDAE)

M. de F. Ribeiro[1] & V. L. Imperatriz-Fonseca[1], [1]Dep. of General Ecology, Univ. of São Paulo, R. do Matão, trav. 14, n. 321 05508-900, São Paulo - SP, BRAZIL. E-mail: marib@ib.usp.br. Financial support: CNPq (522121/97-7) e FAPESP (98/01679-5)

The seasonal interruption of cell construction by the workers and egg laying by the queen is typical for some species of *Plebeia* with subtropical occurrence. However, no study has yet been performed to identify which factors influence this cessation of activity during fall and winter. In this work we investigated ecological and behavioural aspects which could be related to this phenomenon. We used circa of 40 colonies of *Plebeia remota* from Cunha (44°55'W 23°05'S) and Prudentópolis (50°59'W 25°13'S). All of them were kept at the Bee Laboratory, Univ. of São Paulo, in São Paulo (46°43'W 23°33'S), in thick wooden boxes (dimensions: 28x37x17cm). Around 10-12 colonies were placed inside the building with free access to the outside. The others were kept in the gardens of the laboratory. All colonies were maintained at environmental temperature. Climatic parameters (temperature, relative humidity, light intensity, precipitation, etc) were obtained from a meteorological station. Preliminary analyses showed these factors were indeed associated to the rhythm of colony activity. A more constant climatic alteration (decrease in the monthly average temperature, for instance) was followed by colony inactivity. On the other hand, an improvement in the environmental conditions had as reply the return to normal activity. Some colonies interrupted their activity already in February whereas others did only in July (winter). Therefore, there were five months of range between the first and the last colony, which stopped activity. Nevertheless, all of them reinitiated cell construction in a much shorter interval (in August). This shows that the answer of the colonies to environmental changes is more homogeneous in this period than in the beginning of inactivity. Maybe because at the end of the inactive period all colonies are under similar situation: no brood at all. Colony conditions (as food storage) were also evaluated. In this way, colonies in a poor condition generally interrupted activity earlier than strong colonies. In most cases the latter had large food reserves. All this suggests several aspects are important to colony decision of when stopping activity. Internal and external factors are certainly related to the behaviour of each colony.
Index terms: *Plebeia remota*, cell construction, oviposition rate.

[3364] THE EFFECT OF EXTRACTS FROM ARID AND SEMI-ARID PLANTS ON FALL ARMYWORM GROWTH

C. Richael & R. G. Cates, Chemical Ecology Laboratory, 425 WIDB, Brigham Young University, Provo, UT 84602. USA.

Plant secondary metabolites are potentially a source of insect control agents, or prototypes for such. The objective of this study was to determine the insecticidal potential of a diverse number of secondary metabolites isolated from Utah xerophytic species against the fall armyworm, *Spodoptera frugiperda*. An ecological-based approach was employed to select plant species for testing. Non-polar, polar and tannin fractions, each at doses of 1% and 0.5% wet weight, were administered to fall armyworm larvae in a semi-solid artificial diet. Every fraction from each species caused significant reduction in growth rate when compared to the control. Some fractions caused mortality of larvae in the first and second instars while other fractions had more pronounced effects against larvae older than three weeks. Time to pupation was greater for most larvae forced to eat amended diet. Fresh pupal weights varied according to type of fraction. Overall, the bioactivity of most extracts demonstrated that the selected plants were good candidates for potential botanical insecticides. The non-polar (NP), polar (P), and tannin (T) fractions from the species *Apocynum androsaemifolium* (P, T), *Rhus aromatica* (T), *R. glabra* (NP, P, T), *Ribes wolfii* (NP), *Solidago occidentalis* (P) and *Tetradymia canescens* (NP) warrant further fractionation, characterization and testing.
Index Terms: *Spodoptera frugiperda*, insect control, antifeedants, plant secondary metabolites, plant-insect interactions.

[3365] VIVE LA DIFFERENCE: FUSOMES AND RING CANALS IN POLYTROPHIC INSECT OVARIES

R. Rübsam & J. Büning, Developmental Biology Unit, Inst. of Zoology, Univ. of Erlangen, Staudtstr.5, 91058 Erlangen, Germany. E-mail: rruebsam @biologie.uni-erlangen.de.

Drosophila oogenesis is a thriving and successful model system for studying various aspects of cell differentiation in Metazoa. To what extent, however, *Drosophila* oogenesis may serve as a paradigm for polytrophic meroistic oogenesis in insects? We addressed this question by concentrating on two central cytoskeletal structures of the ovary, the fusome and the ring canal. Genetic studies in *Drosophila* have demonstrated the essential importance of both organelles for ovarian development (e.g. Lilly, M., de Cuevas, M. and Spradling, A.C. (2000), *Developmental Biology* 218, 53-63). Species of the following insect orders were examined: *Mecoptera, Phtiraptera, Neuroptera, Coleoptera: Adephaga, Hymenoptera Lepidoptera, Trichoptera, Diptera.* The membrane skeletal protein α-spectrin was identified as a component of the fusome in **each order. Therefore, α-spectrin may be a good candidate for a general "fusome** marker protein". In contrast, the fusomes' content in F-actin varied considerably between the different groups. F-actin was a prominent fusome component in several taxa: *Coleoptera: Adephaga, Hymenoptera, Neuroptera and Phtiraptera: Mallophaga.* Mecopteran, lepidopteran and trichopteran fusomes contained a clearly reduced quantity of F-actin when compared to the above mentionned. In dipteran fusomes, using phalloidin as reagent again, we failed to detect any fusomal F-actin. *Drosophila* ring canals are easily labelled due to their specific accumulation of phosphotyrosine containing proteins and F-actin (Robinson, D.N., Cant, K. and Cooley, L. (1994), *Development* 120, 2015-2025). Neither of both components was found to be a "general" component of the ovarian ring canal. Representatives of some groups, like *Lepidoptera* and *Trichoptera*, missed both components in the canal rim whereas others, like *Hymenoptera*, displayed an enrichment of F-actin but no phosphotyrosine. In our contribution we will describe not only differences in the sheer presence or quantity but also in the developmental kinetics and subcellular localization of both components. Further studies have to demonstrate, in how far the differences in the molecular constitution of both organelles reflect functional differences of fusomes and ring canals in these insect groups.

Index terms: oogenesis, actin, spectrin, cytoskeleton.

[3366] CONTROL OF APPLE KEY PESTS WITH MULTITIPLE MATING DISRUPTION IN JAPAN

Y. Sakagami, Apple research Center, National Institute of Fruit Science, MAFF. Shimokuriyagawa, Morioka, Iwate, 020-0123, Japan

The conventional pesticides spray for the control insect pests and mites carrying out between 8 and 13 times in a year on the apple orchard in Japan. About 75% of pesticides are applied for control the lepidopterous pests that are fruit bores, leaf rollers and leafminers. Two species of fruit borers, *Grapholita molesta* and *Carposina sasakii*, 3 species of leaf rollers, *Adoxophyes orana fasciata, Archips fuscocupreanus* and *A. breviplicanus*, and a leafminer, *Phyllonorycter ringoniella*, were already identified their sex pheromone. And these 6 moths were the main target of the spay calendar of apple on the most of all districts in Japan. Confuser-A® (Shin-Etsu Chem. Ltd.) was developed for control these 6 lepidopterous pests at the same time, included their effective substances of sex pheromone in a dispenser and it's effectiveness continue to keeping about 3 months. The pheromone dispensers were set on the last May every year, 25 tubes set on each tree (2000 per ha) and about 30% of those set on the canopy and 20% tubes added edges of orchard. After setting dispensers, the treated field was sprayed any insecticides for these 6 pests without for mites and aphids. And this treatment continued 6 years. Monitoring traps in the treated orchard were shown very good effectiveness for mating disruption every year, however some fruit damage were shown at the harvest time. The fruit damage injured by *A. fuscocupreanus* that is univoltine were less than the conventional spray and became less and less year by year , but damages after August were increased year by year. This late time damage mainly caused by *Pandemis heparana* which is bivoltine and the dispenser included no effective pheromone for *P. heparana*. Injured fruit by fruit borer that was mainly *C. sasakii* were less than the conventional spray, and most of all their damages were looked on the trees that stood on the edges of orchard. The leafminer's damage also reduced, but the leaf damage often increased in autumn after severer summer. The result shows the chemical sprays for the apple key pests are able to reduce less than a half. Multiple Mating Disruption (MMD) is a very beneficial control method for the apple key pests and entrance way to IPM, but it is not so effectively under the high density of pests. Therefore the pests densities of overwintering must be control before adapt MMD.

Key words: Multiple Mating Disruption, MMD, pheromone, Apple pests, Lepidoptera

[3367] INFLUENCE OF PRECIPITATION VOLUME AND SOIL TEMPERATURE ON THE POPULATION DYNAMICS OF THE BURROWING BUG *Atarsocoris brachiariae* Becker, 1996 (HEMIPTERA: CYDNIDAE)

M. O. Medeiros[1] & O. Sales Jr.[1], [1]Centro de Controle Biológico, Univ. Federal de Mato Grosso, Av. Fernando Corrêa, s/n, Cuiabá, MT 78060-900, BR, ccb@cpd.ufmt.br.

This research presents data on the population dynamics of *Atarsocoris brachiariae*. Comparisons are made against the precipitation volume and soil temperature for the region of Rondonópolis, MT, Brazil. Population surveys were performed at Fazenda Guarita, in a 4-hectare, 8-year old *Brachiaria decumbens* rangeland highly infested with *A. brachiariae*, formerly an experimentation field owned by Empresa Mato-grossense de Pesquisa, Assistência e Extensão Rural S/A (EMPAER/MT). Weekly soil samples were taken at random from January, 1995 through December, 1997; sample size was 10 × 20 × 40 cm (width, length, depth). The number of eggs, nymphs and adults present in each sample was recorded. Nymphs and adults were also found within small chambers excavated in the soil in a sub-cylindrical or oval shape, showing a darker layer internally. It is suggested that these chambers are constructed as a protection during ecdysis and/or to withstand weather changes. Precipitation volumes indicated a positive correlation with number of nymphs ($P > 0.05$) and adults ($P < 0.01$), and were negatively correlated with number of eggs ($P < 0.01$). The greatest number of eggs (63.8%) was collected in the dry season; egg population density was highest in 1996, when the smallest rainfall amounts were verified. On the other hand, nymphs (57.17%) and adults (72.6%) were collected mainly in the rainy season. Soil temperature was negatively and not significantly ($P > 0.05$) correlated with number of nymphs and adults collected, whereas it was positively and significantly ($P < 0.05$) correlated with number of eggs. An increase in the population level of *A. brachiariae* in the order of 266.5% was observed from 1995 to 1997. This should serve as a warning for technicians and farmers to plan control measures for the pest, which is already expanding to other regions in the state of Mato Grosso.

Index terms: rainfall, ground, *Brachiaria*, pest

[3368] SPERM TRANSFER AND PRECEDENCE IN THE COMMON CUTWORM, *SPODOPTERA LITURA* : AN IMPORTANT FACTOR IN OPTIMIZATION OF F-1 STERILITY TECHNIQUE FOR PEST SUPPRESSION

R. K. Seth[1], D. K. Rao[1], V. P. Sharma[1] & S. E. Reynolds[2], [1] Department of Zoology, University of Delhi, India; [2] Department of Biology and Biochemistry, University of Bath, UK.

Sperm behaviour is crucial in ascertaining the competitiveness of irradiated insects and their progeny in inherited sterility technique for pest suppression. The mechanics of sperm transfer and phenomenon of sperm precedence were studied in the treated male moths of *Spodoptera litura* (irradiated with sub sterilizing doses, 100Gy, 130Gy) and their F-1 progeny. In normal population, *S. litura* showed 94.1% mating success, and a proportion of mated females underwent multiple matings, with the mean frequency of mating as 1.73. The mating success in irradiated P-1 males and their F-1 progeny was 84.0% and 80.9% at 100Gy; 72.6% and 75.6% at 130Gy, respectively. Whereas the mating frequency in irradiated P-1 males and their F-1 progeny was 1.87 and 1.92 at 100Gy; 1.86 and 1.96 at 130Gy, respectively. The remating propensity of females was more in P-1 and F-1 crosses than in the controls. Both irradiated *S. litura* males and their F-1 progeny were able to transfer eupyrene sperm (confirmed by fluorescent microscopy using DNA specific probe DAPI (4,6-diamidino-2-phenylindole dihydrochloride) to the female. However, as compared to their parents, the F-1 males transferred sperm less successfully, adding to the sterility induced by irradiation, but this inability to transfer sperm would not add to the success of F-1 sterility due to non utilization of F-1 male germ cells with altered genome. For instance, at 100Gy the proper eupyrene sperm transfer during matings was reduced by 24.8% in P-1 males and by 49.3% in F-1 males as compared to controls; whereas at 130Gy this reduction in sperm transfer was noticed as 38.9% in P-1 and 62.6% in F-1 moths. Due to increased remating propensity of females when crossed with treated males, it was imperative to study the sperm utilisation pattern in P-1 and F-1 moths. The sequential matings of partial sterilized males and normal males were conducted for determining the sperm precedence. The P2 value determined for these P-1 males was 0.9166 at 100Gy and 0.9098 at 130Gy. Whereas in case of F-1 progeny of these sub-sterilized males, the proportion of eggs fertilized (or fathered) by sperm from second mating was 0.9442 at 100Gy and 0.9136 at 130Gy. The results were confirmed by examining F-1 and F-2 spermatocytes for radiation induced chromosomal aberrations. These findings depicted the sperm precedence from the last mating with little mixing. Present sperm studies reflect the feasibility of using these sub-sterilizing doses in inherited sterility technique, and it would help in optimizing the dose and operation of this pest suppression modality.

[3369] ANTIREPRODUCTIVE EFFECTS OF THE ECDYSTEROID AGONISTS ON THE COMMON CUTWORM, *SPODOPTERA LITURA*

R. K. Seth[1], J. J. Kaur[1] & S. E. Reynolds[2],[1] Department of Zoology, University of Delhi, India; [2] Department of Biology and Biochemistry, University of Bath, UK.

Bioefficacy of moulting hormone agonists, RH-5849 (1,2-dibenzoyl-1-*tert*-butyl hydrazine) and tebufenozide (RH-5992; 3,5-dimethylbenzoic acid 1-1(1,1-dimethyl ethyl)-2)4-ethylbenzoyl) hydrazide (Rohm and Haas Company, USA) as male reproductive suppressants was explored in *Spodoptera litura,* a serious pest in the Indian subcontinent. Larval treatment with RH-5849 adversely affected the development of the testes and the male reproductive tract. There was a dose-dependent reduction in the production of eupyrene and apyrene spermatozoa and a decrease in the number of spermatozoa released from the testes into the male reproductive tract. RH-5849 treatment (administered in diet) led to disturbance in the daily pattern of sperm release and descent. A similar suppressive effect on sperm release was observed when normal pharate adult or newly emerged adult male moths were injected with RH-5849. Anti-reproductive effects were manifested on male longevity, mating behaviour, oviposition and egg viability. RH-5849 reduced the longevity, percentage mating success and oviposition due to matings of treated males in a dose-dependent way.The fertility of the resulting eggs was also reduced significantly; at a dose of 5ppm egg hatch was only 20.6% compared to 91.8% in the controls, a reduction of 77.5%. The overall suppression of reproduction, considering the impact on oviposition and fertility, was 85% at 5ppm RH-5849. Treatment of *S. litura* larvae in the fifth instar affected reproduction more adversely than the treatment in the last instar. During insemination the number of eupyrene sperm bundles transferred from the exposed male to the untreated female was significantly less with 4ppm RH-5849 than in the case of normal males. In general, the effects of tebufenozide on reproduction were similar to those of RH-5849, but were manifested at lower concentrations of the insecticide. Upto 2ppm tebufenozide allowed a proportion of the treated insects to survive and form viable adults that could reproduce with normal mates. The impact of tebufenozide on the surviving adults was more pronounced than that of RH-5849, in terms of mating success and fertility. For instance, the fertility of eggs resulting from larval exposure of the male to 2ppm tebufenozide was 23.7%, as compared to the 20.6% fertility resulting from exposure to 5ppm RH-5849. Mating frequency was significantly decreased by larval exposure to tebufenozide at 2ppm. Although the range of insecticides causing adverse effects on reproduction is narrow, the sub-lethal effects of these chemicals on male reproduction may significantly extend their ability to deliver effective pest control under field condition.

Index terms : RH-5849, RH-5992, sperm production, sperm transfer, reproduction.

[3370] BIOLOGY OF *Phthia picta* (HEMIPTERA: COREIDAE) IN THREE CULTIVARS OF TOMATO

R. A. da Silva[1] & G. S. Carvalho[1], [1]Dept. Fitossanidade, Univ. Fed. do Rio Grande do Sul, P.O. Box 776, Porto Alegre, RS 90001-970, BRAZIL, E-mail: ricadaime@zipmail.com.br

The tomato culture has great social and economic importance to Brazil. Among the agents that make difficult the production of tomato for *in natura* consumption is *Phthia picta*, a bug considerate an important pest of this culture. The damage happens because of the feeding of the nymphs and adults on leaves and fruits. There are not studies on this bug under controlled conditions. So, it was developed this work aiming at the study of this insetc biology in three cultivars of *Lycopersicon esculentum*. The study was carried out in the Laboratório de Entomologia, Departamento de Fitossanidade, Faculdade de Agronomia, UFRGS, Porto Alegre, RS, under controlled conditions (26 ± 1°C; 70 ± 10% RH and photophase of 14 h), using as food leaves and fruits of tomato (cultivars: Empire, Santa Clara and Carmen). The duration of the stages was different depending on the cultivar that was used as food, except in the third stage. Also the duration of the nymphal phase was different: 34.39, 36.94 and 39.65 days, respectively to Carmen, Santa Clara and Empire. The mortality was different depending on the cultivar that the insects fed on, in the second, third and fifth stages. In the nymphal phase the mortality was largest in insects that fed on Empire (76.41%) and smaller on that fed on Carmen (55.97%), in Santa Clara it was intermediary (65.31%). Considering the three cultivars together, the average mortality was largest in the third, fourth and fifth stages. The after oviposition period was largest in females that fed on Santa Clara (26.4 days). The eggs incubation period was largest in the females that fed on Carmen (10.90 days) and Empire (10.73 days); and the hatching percentage was largest in eggs from females on Carmen (65.87%).

Index terms: *Lycopersicon esculentum*, insecta, bug, laboratory.

[3371] HISTOLOGICAL AND ULTRASTRUCTURAL INVESTIGATIONS ON THE OVARY STRUCTURE AND OOGENESIS IN HANGING-FLIES (MECOPTERA: BITTACIDAE)

B. Simiczyiew, Zoological Inst., Univ. of Wroc law, Sienkiewicza 21, 50-335 Wroc law Poland, E-mail simicz@biol.uni.wroc.pl

The structure of ovaries and oogenesis in four members of the genus *Bittacus* (*I hageni, B. nipponicus, B. stigmaterus and B. strigosus*) were studied using ligh fluorescence and electron microscopy. In all studied species the ovaries are of polytrophic meroistic type. Each ovary consists of several ovarioles. An individual ovariole i differentiated into a terminal filament, germarium, vitellarium and ovariole pedicel. Withi the germarium germ cell clusters are formed. Each cluster consists of 4 sibling cell (cystocytes). In the basal region of the germarium the differentiation of the clusters occur One of the central cells of the cluster transforms into the oocyte, the remaining 3 cell differentiate into polyploid nurse cells. The vitellarium contains developing egg chambers i linear arrangement. Each egg chamber is built of an oocyte-nurse cells complex surrounde by somatic follicular cells. In early previtellogenic egg chamber the oocytes are relativel small, while the nurse cells grow rapidly. Their nuclei are filled with numerous DN positive clumps and nucleoli. The cytoplasm of the nurse cells contains numerous ribosome elements of RER and accumulations of nuage material. In early previtellogenesis th follicular epithelium is morphologically uniform while in later stages of oogenesis follicula cells diversify into 3 distinct subpopulations: 1) columnar cells covering the oocyte, 2 flattened cells surrounding the nurse cells and 3) a group of cells migrating between th nurse cells and the oocyte. In advanced stages of vitellogenesis the follicular cells coverin the oocyte starts to synthesize and secrete precursors of egg envelopes. The egg capsules c the studied bittacids are built of a thick layer of compact and tough chorion. The surface c the chorion exhibits hexagonal pattern. Three micropyles are found on the anterior pole c the egg.

Index terms: polytrophic ovary, follicular cells, egg envelopes.

[3372] THE OVARIES OF *NANNOCHORISTA NEOTROPICA* NAVÁS (MECOPTERA: NANNOCHORISTIDAE) ARE PANOISTIC

B. Simiczyiew, Zoological Inst., Univ. of Wroc law, Sienkiewicza, 50-335 Wroc law, Poland, E-mail simicz@biol.uni.wroc.pl

The ovary of the *N. neotropica* consists of several segmentally arranged panoistic ovarioles. An individual ovariole is differentiated into terminal filament, vitellarium and ovariole pedicel. In adult females germaria are absent. This indicates that the initial stages of oogenesis (mitotic divisions of gonial cells, oocyte determination) take place during postembryonic development (in pupae or larvae). The vitellarium contains 3-4 developing ovarian follicles (oocytes surrounded by somatic follicular cells) in a linear arrangement. The ovarian follicles have been classified into previtellogenic, vitellogenic and choriogenic. Previtellogenic oocytes are localized in the apical part of the vitellarium. The oocyte nucleus (germinal vesicle) is voluminous, spherical, and contains nucleolar masses in form of numerous granules. By means of histochemical methods it was evidenced that these granules contain DNA and AgNOR proteins. These results suggest that amplification of rDNA takes place in the oocyte nuclei. During vitellogenesis large yolk spheres and lipid droplets are deposited in the ooplasm. Choriogenic ovarian follicles are characterized by the presence of thin chorion layer covering the oocyte. The structure of ovarioles and oogenesis in the studied nannochoristid is similar to those of boreids and entirely different from that found in other mecopterans (Panorpidae, Panorpodidae, Bittacidae and Meropeidae) that possess meroistic-polytrophic ovaries. These data suggest that among Mecoptera Nannochoristidae represent a distinct evolutionary lineage.

Index terms: oogenesis, amplification, phylogeny.

[3373] EFFECT OF FOOD QUALITY ON THE FECUNDITY OF SPITTLEBUG

E.R. Sujii[1], C.S.S. Pires, E.M.G. Fontes & A.L.P. Figueiredo, Embrapa Recursos Genéticos e Biotecnologia, PqEB Final W3 Norte, C. P. 02372, 70849.970 Brasilia, DF, Brazil E-mail sujii@cenargen.embrapa.br.

The spittlebug, *Deois flavopicta* (Hom.: Cercopidae), occurs naturally on native grasses in Central Brazil, in low population densities After the introduction of African grasses, mainly of the genus *Brachiaria*, for cattle raising, *D. flavopicta* started to produce population outbreaks and became a pest. Two studies were conducted, aiming at the estimation of the effect of variations in the host plant quality on the fecundity of this insect. The effect of host plant in the reproduction capacity of *D. flavopicta* was evaluated in adults newly emerged from nymphs reared on potted plants of *Axonopus marginatus*, a native host species, and *Brachiaria ruziziensis*, an introduced host. Half of the couples, emerged from a given host plant, were transfered to oviposition cages containing the same grass species. The other half were placed on cages containing the alternative host plant. Females of *D. flavopicta* reared during the adult stage on *B. ruziziensis* produced more eggs than those reared on *A. marginatus*, independently of the host plant on which the nymphs were reared. Due to damage produced by adult insects on the host plant, the effect of insect density on its own reproductive capacity was evaluated in oviposition cages containing plants of *Brachiaria*, standardized in height and stem number. Densities of 1, 2, 4 and 6 couples with virgin females were evaluated. Population densities of 4 couples, equivalent to 100 adults/m^2, or upper decreased the insects fecundity. These results contributed to the understanding of the mechanisms that influence low levels of spittlebug populations in the native grasses and promote population outbreaks in the introduced plants.
Index terms: Population dynamics, reproductive biology, insect-plant interaction

[3374] PHOTOPERIODIC CONTROL OF SEASONAL DEVELOPMENT IN THE SCUTELLERID BUG, *POECILOCORIS LEWISI*

S. I. Tanaka[1], Y. Natuhara[2], C. Imai[2] & H. Numata[1], [1]Dept. of Bio- and Geosciences, Grad. Sch. of Sci., Osaka City Univ., Osaka 558-8585, Japan, E-mail: shinchan@sci.osaka-cu.ac.jp; [2]Osaka City Inst. of Publ. Health and Environ. Sci., Osaka 543-0026, Japan.

In Heteroptera, only a small number of species overwinter at the nymphal stages, and their seasonal adaptations remain poorly understood. A scutellerid bug, *Poecilocoris lewisi* is distributed in central Japan, China and Taiwan, and overwinters in the final (5th) instar. In Osaka (34.5°N), final instar nymphs appear in mid-summer and then most of them overwinter. However, a small portion of insects emerge as adults in the same summer. Under long-day laboratory conditions at 25°C, adults emerged without any developmental retardation, whereas under short-day conditions final instar nymphs entered diapause. The critical daylength for the induction of nymphal diapause was about 14.5h, which corresponds to the daylength including twilight in mid-August in Osaka. On the other hand, under long-day conditions, female adults entered reproductive diapause. Under quasi-natural conditions, female adults emerging from mid-May to mid-June started oviposition only after summer solstice. When nymphs were collected from the field in May and then reared under a long-day photoperiod (LD 16:8) at 25°C, female adults did not lay eggs until 37 days after emergence. However, females transferred to LD 13:11 on the day of adult emergence started oviposition 20 days after the transfer. Furthermore, when insects were reared under LD 16:8 from eggs and transferred to LD 13:11 on the day of adult emergence, they started oviposition 11 days after emergence. The critical daylength for the induction of adult diapause was between 14 and 15h. This photoperiodic response results in a shorter preoviposition period in adults emerging from non-diapause nymphs in mid-August than in adults after overwintering as nymphs. Seeds of the dogwood *Cornus controversa*, the principal food of this species, ripen in July in Osaka. It is suggested that adult diapause of *P. lewisi* prevents reproduction until the season when ripen seeds of host plant are available.
Index terms: Heteroptera, nymphal diapause, adult diapause, photoperiod, host plant.

[3375] SECRETION OF SEXUAL ACCESSORY GLANDS OF FEMALE FLIES: SOME BIOCHEMICAL CHARACTERISTICS AND ANTIBACTERIAL ACTIVITY (DIPTERA, CALLIPHORIDAE, MUSCIDAE)

G. Tirone[1], R. M. P. Avancini[2], E. R. Pimentel[1] & W. D. Silveira[3], [1]Dept. of Cell Biology, [2]Dept. of Parasitology, [3] Dept. of Microbiology and Immunology, Inst. of Biology/ State Univ. of Campinas P. O. Box 6109 Cep 13083-970 Campinas, São Paulo, Brazil.

Blowflies and some of their relatives are potential vectors of microorganisms to human beings since they feed and lay eggs in decaying matter such as animal carcass and faeces where the larvae will develop. The secretion of the female sexual accessory glands has important roles in different steps of egg fertilization and also coats the eggs, attaching them to the oviposition substract. Our interest is to know the biochemical composition of the secretion of different species of flies and also investigate if it has antibacterial activity. We analyzed the products of female sexual accessory glands from *Chrysomya putoria*, *Chrysomya megacephala* (Calliphoridae), *Muscina stabulans* and *Synthesiomya nudiseta* (Muscidae) in SDS-PAGE (4-16%) under reducing and non-reducing conditions. The molecular range of proteins is 16.5 – 77.5, 15.8 – 79.5, 19.5 – 82.3 and 14.7 – 38.6 kDa respectively, for the species above. Some of the proteins are glycosilated, specially those under 57kDa and all proteins are monomeric. We determined the protein content of the secretion of each gland by bradford method (1976), using as standard bovine serum albumin (BSA); they are: 1.2, 1.26, 0.39 and 1.2 µg, respectively. We used 120µg of protein of gland secretion of *C. putoria* and *S. nudiseta*, respectively, for antibacterial activity assay against *Escherichia coli* K12 and observed that the secretion inhibited the bacterial growth.
Index terms: blowflies, muscoid flies, reproduction, mechanical vectors

[3376] AN EVIDENCE OF MATERNALLY CONTROLLED SEX DETERMINATION IN *PHYTOSEIULUS PERSIMILIS*

S. Toyoshima[1] & H. Amano[2], [1] Apple Research Center, National Institute of Fruit Tree Science, Ministry of Agriculture, Forestry and Fishery, Shimokuriyagawa, Morioka 020-0123, Japan; [2] Faculty of Horticulture, Chiba University, Matsudo 271-8510, Japan

Phytoseiulus persimilis females lay eggs with the exact sex ratio in relation to the environmental condition, e.g. the number of conspecific females and/or prey density. Such precise control of sex ratio in offspring is evidently known in hymenopteran parasitoids, and the theories of sex allocation were demonstrated by the studies of reproductive behavior of the species. In addition, since haploid males in hymenopteran insects are derived from unfertilized eggs and diploid females are derived from fertilized eggs, sex is controlled by fertilization and determined by the combination of sex genes in some species, which is known as CSD (complementary sex determination) model. On the other hand, since *P. persimilis* is known as the pseudo-arrhenotokous mite in which both sexes are derived from fertilized eggs but males develop to the haploids, the mechanism of sex control has been unknown. Hence, the mechanism of sex control in pseudo-arrhenotokous mites was studied using the reproductive characteristics in *P. persimilis*. Sex control by females is induced easily by adjusting prey density. Females under the ample prey density lay eggs with female-biased sex ratio and one under the poor prey density do with balanced sex ratio. Although ovipositing females could increase the proportion of male offspring in relation to the prey density, the first egg is destined to male and the second egg is destined to female under all prey densities. In the experiment, females that had laid first eggs under the ample prey condition were transferred and kept for 24, 36, 48 hours under no prey condition, and then returned to the ample prey condition. These females without prey laid one or two eggs, growing into females. In the ample prey condition, they laid the egg destined to female followed by the egg destined to male. When the starving females were sectioned, eggs with yolk granules and two pronuclei were observed in the dorsal region of the body. Although the egg must have experienced starvation through the gravid female, it did destine to female. The next egg, which experienced starvation longer than the observed one, did grow into male. From the sequential order of sex after starvation and the observation of internal structure of starved females, four points were suggested: 1) *P. persimilis* does not have the ability of egg resorption. 2) Sex of eggs is not changed during the development in female body. 3) Sex of eggs is not determined genetically but did maternally. 4) Sex is fixed at the early stage of egg formation.
Key words: Pseudo-arrhenotoky, Sex determination, Sex allocation.

[3377] HEXOKINASE ISOENZYME PATTERN IN THE DEVELOPMENT OF *APIS MELLIFERA* DRONES

Sibele de Oliveira Tozetto, Vera Lúcia Castelo Figueiredo & Zilá Luz Paulino Simões, Dept. of Biology, FFCLRP, Univ. of São Paulo, Av. Bandeirantes 3900, 14049-901, Ribeirão Preto - SP, Brazil. E-mail: tozetto@rgm.fmrp.usp.br. Financial support: FAPESP (98/01842-3)

The study of enzyme polymorphism and of enzymes of the glycolytic pathway is essential for the understanding of the transformations occurring during the different developmental phases. Among the various enzymatic systems studied thus far, hexokinase (HK) is a well known isoenzyme because of its involvement in carbohydrate metabolism. Since a physiological activity is always related to the transformations experienced by an organism during development, the objective of the present study was to investigate the sexual maturation of *Apis mellifera* drones, which can be demonstrated by their flight activity and may be related to changes in the pattern of the HK isoenzyme. The analyses were conducted on larvae in the penultimate stage (L4) and in the last stage (L5), in the pupal stage and in imagoes aged up to 14 days. The effect of juvenile hormone (JH) on this process was analyzed by comparative study with drones submitted to topical JH application. Larvae and pupae were homogenized individually, while adults were divided into head, thorax and abdomen. For HK electrophoretic analysis we used 14% penetrose gel. We confirmed that the HK pattern during ontogenetic development consists of 2 regions of activity (1 and 2). The results of these analyses indicate differences in the expression of the isoenzyme during the different phases of development. The staining intensity of region 1 was quite weak almost throughout development, except for the chest of drones aged 2 and 6 days. In contrast, the staining intensity of region 2 was quite variable but more intense in thorax and abdomen extracts of adult drones and of larvae in early L5. The bands for the samples containing extracts of the head of adult drones showed very weak intensity, possibly indicating the virtual absence of the isoenzyme. The present analyses also show that HK is involved in the processes needed for flight activity in drones, since its expression was more intense in thorax and abdomen samples from adult drones. The HK pattern of controls differed from that of JH-treated drones, with samples of treated young drones being similar to those of older control drones. These comparative studies permitted us to establish a correlation between the differences in isoenzymatic pattern and flight activity of drones, thus indicating their sexual maturity. Similarly, we observed that JH has a significant effect on these processes during the ontogenetic development of drones.

Index terms: *Apis mellifera*, isoenzyme, hexokinase , juvenile hormone, drones

[3378] CYTOSKELETON DYNAMICS DURING SPERMATOGENESIS IN *APIS MELLIFERA* DRONES

S. O. Tozetto[1], R. Rübsam[2], J. Büning[2] & Z. L. P. Simões[1], [1]Dept. of Biology, Univ. São Paulo, Av. Bandeirantes 3900, 14049-901, Ribeirão Preto - SP, Brazil; [2]Dept. of Zoology, Univ. Erlangen-Nürnberg, Staudtstr. 5, D-91058, Erlangen, Germany. E-mail: tozetto@rgm.fmrp.usp.br. Financial support: FAPESP (98/01842-3) and DAAD/CAPES.

A phylogenetically conserved trait in gonadal differentiation and gametogenesis is the formation of syncytial clusters among germ cells. In insect females cluster formation is essential only in meroistic ovaries whereas in males cluster formation seems to be an absolute prerequisite for spermatogenesis in all metazoa. Germ cell clusters are build by incomplete cytokinesis during the mitotic germ cell multiplication steps, immetiately before meiosis. In males, the two meiotic divisions remain incomplete too; thus, a high number of siblings remain interconnected during spermatide and sperm differentiation. We analyzed two important cell organelles, the polyfusomes and the ring canals during the whole process of male gonad formation in bees. Both structures are part of the cytoskeleton and are essential during cluster formation. We used in this study fluorescently labelled α-spectrin antibodies and TRITC- and/or FITC-falloidin as markers for F-actin. Whole mount analysis of males gonads during larval stage gave following results: Cluster formation starts in L2, where the first fusome was detected by staining with the anti-spectrin antibody or phalloidin, respectively. In the next stage the polar organization of testioles adds newborn clusters while maturation of older cluster proceeds. In L3 and L4, the polyfusomes are compacted and in L4 these are ramified too. In the beginn of the 5th instar, they increase in size and start to extend. At spinning phase they seem to be divided. In the basal part, the polyfusomes are bigger and extended. During the last phase of the L5 they became more extended and filamentous. With respect to the ring canals, we confirmed that in drones F-actin is probably aggregated with other components or that the interaction between F-actin and α-spectrin can be considered a typical characteristic of the formation of intercellular bridges (of the ring canals) of the clusters during more advanced developmental stages.

Index terms: Fusome, ring canal, F-actin, α-spectrin.

[3379] EFFECT OF MORPHOGENETIC HORMONES ON THE PROTEIN PROFILE OF TESTES, MUCUS GLANDS AND SEMINAL VESICLES OF *APIS MELLIFERA* DRONES.

S. de O. Tozetto, A. R. Puccia & Z. L. P. Simões, Dept. of Biology, FFCLRP, Univ. of São Paulo, Av. Bandeirantes 3900, 14049-901, Ribeirão Preto - SP, Brazil. E-mail: tozetto@rgm.fmrp.usp.br.

In the present study we investigated the effect of morphogenetic hormones (juvenile hormone (JH) and ecdysteroids) on the protein profile of testes and mucus glands during post-embrionic development in *Apis mellifera* drones. The analyses were performed on 4th and 5th instar larvae, on pupae and adults up to 14 days (d) of age. Total protein concentration was estimated by colorimetric assays according to the method of Smith et al., 1985. Samples containing the same amount of protein were later separated by SDS/PAGE by the method of Laemmli (1970), with some modifications, and stained with silver. The hormonal control of this process was analyzed by comparative study of drones that received these hormones during defined developmental phases. JH was topically applied (10(g), while makisteron A was injected (5(g). In the controls, the amount of total protein in the testes increased gradually, accompanying the increase in the testis size. In the mucus gland, the protein concentration newly emerged drones was quite low compared to the amount detected in 2d old drones, which was twice as high. Starting on the 4th day of life, the values reached remained more and less constant. In the seminal vesicles, the amount of protein detected in all assays was relatively low compared to the data obtained for the testes and mucus gland. On the basis of the present data, we may relate the rate of protein synthesis to the dynamics of gonad growth. The hormonal control of reprodution was also elucidated by correlating the changes in the pattern of expression of some proteins with the modulation of JH and ecdysteroid titers, since the expression of certain proteins is affected by the morphogenetic hormones during different phases of development.

Index terms: *Apis mellifera*, protein profile, juvenile hormone, ecdysteroids, makisteron A, drones.

[3380] CLONING OF VITELLOGENIN cDNA OF *PERILTANETA AMERICANA* AND ITS STRUCTURE AND EXPRESSION

M. Tufail, J.M.Lee, M.Hatakeyama,,K.Oishi & M.Takeda, (Grad. Sch. Sci.Technol.,KobeUniv.,657-8501 Jpn E-mail:mtakeda@kobe-u.ac.jp)

cDNA library was constructed from the poly(A+) RNA, extracted from the adult female fat body(FB) cells (3-5 days old) of *Periplaneta americana*. The library was screened using the polyclonal antiboby, raised against M-Vn (100KDa). The obtained cDNA was 5854bp-longencoding 1896 amino acid(aa)s (including a signal peptide) in a single ORF followed by termination codon and a consensus polyA signal. The entire aa sequence deduced was confidently aligned with known insect Vgs. The existence of the motif GL/ICG and the Cys residues was noted at conserved locations near the C-terminus. The determined N-terminal aa sequence for 170KDa was identical with that deduced from Vg cDNA following a consensus cleavage site (RTRR), indicating post-translational cleavage in FB cells, unlike 100KDa and 50KDa. The cloned cDNA therefore is Vg1 whereas 50KDa peptide is the product of Vg-2. The occurrence of 2 polyserine stretches around the cleavage site and the C-terminus was characteristic. The synthesis of Vg is limited only to the FB cells of adult females. Vg mRNA starts appearing in 3 days old adult female FB cells, whereas hemolymph Vg was first detected in 4/5 days old adult females, 1 day after the gene expression. A phylogenetic tree using the Vg aa sequences of 10 insect species was constructed which agrees with conventional ones. Vn-antigenicities among 10 cockroach species, belonging to 2 superfamilies, using the anti-*P. americana* Vn-antisera depicted that the Vns are very similar within the members of the same superfamily.

Index words: vitellin, fat body, *vg-1*, *vg-2*

[3381] MOLECULAR CLONING OF JUVENILE HORMONE BINDING PROTEINS OF SILKWORM, BOMBYX MORI

A. M. W. Vermunt, M. Hirai, M. Kamimura & T. Shiotsuki, Dept. of Insect Physiology and Behavior, National Inst. of Sericultural and Entomological Science, 1-2 Ohwashi, Tsukuba, Ibaraki 305, Japan. E-mail : shiotsuk@nises.affrc.go.jp

Juvenile hormone binding proteins (JHBPs) are carriers of juvenile hormone (JH) in the hemolymph and the cytosol. JHBPs had been purified from hemolymph and cytosol of silk gland of the last larval instar of *Bombyx mori*. The former (hJHBP) had a molecular mass (Mr) of 32 kDa and a dissociation constant (Kd) of 390 nM for JH III, and the latter (cJHBP) had Mr of 59 kDa and Kd of 16 nM. Based on the *N*-terminal amino acid sequence of purified hJHBP and a conserved region near the C-terminus of two other lepidopteran hJHBPs, we designed degenerate primers for RT-PCR to amplify a hJHBP cDNA fragment. cDNA 5'- and 3'-ends were amplified by RACE to yield cDNAs hJHBP1 (1076 nucleotides) and hJHBP2 (976 nucleotides). Encoded proteins bore three amino acid substitutions. The amino acid sequences of the mature protein (225 amino acids, 25 kDa) showed 50% identity with lepidopteran hJHBPs. Predicted isoelectric point of 4.84 resembled experimental 4.9. hJHBP-mRNA, synthesized in the fat body, was constant in the 4th instar, but decreased in the 5th. hJHBP protein was constant until wandering, then declined. Recombinant protein expressed in *E. coli* migrated on SDS-PAGE with M_r of 32 kDa. The dissociation constant K_d of recombinant hJHBP1 was 446 nM with JH III, similar to native hJHBP. The cJHBP is composed of two different subunits, 36 kDa and 23 kDa. Based on the N-terminal amino acid sequence of the 36 kDa subunit, we designed degenerate primers, which were used in RT-PCR to amplify a fragment of the cytosolic JHBP cDNA from *B. mori*. The 5'-end was amplified with 5'-RACE. The size of the cDNA was 1.8 kb. The deduced amino acid sequence of the mature protein (283 amino acids) showed 47% identity with a hypothetical 32 kDa protein of *C. elegans*. The transcript was most abundant in the anterior part of the silk gland. Also in the fat body, midgut, testes, ovary and malpighian tubes a signal was found, which was significantly lower than in the anterior silk gland. Two transcripts of different size were detected, a major one of 2.0 kb and a minor one of 3.2 kb. In the last larval instar, both sizes of the 36 kDa transcript were present at high levels in the anterior silk gland from day 0 until wandering on day 7. The exact function of this 36 kDa subunit is unknown yet. It may act as the JH binding subunit or as co-factor of the 23 kDa subunit.

3382] COMPARATIVE STUDY OF PHASE RESPONSE CURVES BETWEEN TWO CLOSE-RELATED COCKROACHES

Y. S. Wei & H. J. Lee, Dept. of Entomology, National Taiwan University. No. 1 Roosevelt Rd., Sec. 4, Taipei, 106, Taiwan, E-mail m480@ccms.ntu.edu.tw.

A phase response curve (PRC) is a polynomial curve plotted phase shifts induced by changes of environmental signals given at certain circadian time against the time when the stimulus pulse onset of an organism. The study of PRCs to a Zeitgeber lead us to understand how the circadian pacemakers adjust their phases to environmental changes. Among the various Zeitgeber signals, including light, temperature or social factors, light stimulus is the most powerful one. The effects of 2 different Zeitgeber pulses, light (3600 lux) and sound of human activities, on the locomotor onset phase in two close-related cockroaches, *Blattella bisignata* and *B. germanica*, are investigated. Since both cockroach species are closely related, the PRC differences may reflect the various characteristics of circadian clock to the living environment. From the light induced PRCs, the amplitude of phase shift in *B. germanica* is much smaller than that of *B. bisignata*. This finding indicates the adjustability of the circadian clock of *B. germanica* is inferior to that of *B. bisignata*. However, the consequence of this inferior clock does not impair its timing of locomotion since *B. germanica* lives in a relatively stable domicile habitat. The PRCs of cockroach species show that their circadian clocks are more resisting the advance adjustment than the delay phase shifting. As the phase advance occurring, the circadian periods of *B. bisignata* are increased, and vice versa. On the contrary, negative correlations between circadian periods and phase shifts of *B. germanica* are found. The sound induced PRCs and free-running periods are compared with those induced by light pulses.
Index terms: PRCs, light pulse, locomotor activity, circadian rhythm, sound pulse.

[3383] LEAF AREA CONSUMPTION OF *Urbanus esmeraldus* (LEPIDOPTERA: HESPERIIDAE) IN *Centrosema pubescens*, *Clitoria fairchildiana* AND ALTERNATE FEEDING

J. G. N. Wendt[1] & A. G. Carvalho[1], 1Depto. de Produtos Florestais, Univ. Fed. Rural do Rio de Janeiro, Seropédica, RJ 23851-970, Brasil. E-mail: wendt@ufrrj.br and acacio@ufrrj.br.

The lepidopterouses, in a general way, are a reflex of what they consume and this fact evidence the importance for the organism. This way the quality and the amount of food consumed in the larval phase affect the growth, time of development and weight directly. This work had as purpose to study the leaf area consumption in the five larval instars of *Urbanus esmeraldus* (Lepidoptera: Hesperiidae) in *Centrosema pubescens*, *Clitoria fairchildiana* and alternate feeding, with *Centrosema pubescens* and *Clitoria fairchildiana*. These Leguminosae are considered of extreme importance for the replanting of degraded areas and fixation of nitrogen. The study was driven in the Laboratory of Forest Entomology of the Institute of Forests of the Universidade Federal Rural do Rio de Janeiro in 1998. The medium temperature during the conduction of the experiment was of 23,74 °C ± 1,43 °C, while the relative humidity of the air was of 74,35% ± 13,7%. The leaf area consumption of the caterpillars, in cm^2, in the five larval instars for the treatment *C. pubescens* was of 0,540; 1,212; 6,837; 27,761 and 123,880. The caterpillars fed with *C. fairchildiana* the leaf area consumption it was of 0,106; 1,565; 5,649; 24,553 and 111,600 and in the alternate feeding it was of 0,646; 1,904; 6,066; 27,064 and 138,980. The leaf area consumed by the caterpillars of first instar, in *C. fairchildiana*, was inferior to the other treatments presenting statistical difference (Tuckey 5%). However, the consumption in the fifth instar in the alternate feeding was superior statistically to the others.
Index terms: *Urbanus esmeraldus*, *Centrosema pubescens*, *Clitoria fairchildiana*, *Galactia striata*, Consumption

[3384] CATHEPSIN B-LIKE CYSTEINE PROTEINASE FROM *HELICOVERPA ARMIGERA*

X. F. Zhao, J. X. Wang, Zh. H. Zhang, F. X. Li, Zh. M. Li and X. L. Xu, Dept of Biol, Collegy of Life Science, Shandong Univ, Jinan, 250100, China Email:zhaoxf@life.sdu.edu.cn

A cysteine proteinase was identified and purified from ovary of cotton boll worm, *Helicoverpa armigera*. The molecular mass of the proteinase was estimated as 30 kDa on SDS-PAGE. The optimum pH is 3.0-4.0. It effectively hydrolyzes bovine hemoglobin, bovine serum albumin, gelatin and vitellin. The function of the enzyme was assumed as hydrolyzing vitellin during embryonic development since it degrades vitellin well *in vitro*. The partial amino acid sequence obtained by chemical cleavage suggests that the proteinase is a cathepsin B-like cysteine proteinase. Partial cDNA sequence of the proteinase was obtained using RT-PCR and 3'end Rapid Amplification of cDNA End. The proteinase distributes in fat body, hemolymph and ovary detected using polyclonal antiserum. An intensive stain was observed in the space between follicle cells which suggested that the proteinase was internalized from out side of the ovary. The fact that an active product obtained from adult female fat body by *in vitro* translation of RNA using rabbit reticulocyte lysate system suggests that this enzyme is synthesized in adult female fat body. A 94 kDa proenzyme can be converted to 30 kDa form with the increase of the activity in reducing condition.
Keywords: Characteristics, cDNA clone, distribution, synthesis site, activation

[3385] TERMITE PROBLEM SPECIES AND MANAGEMENT OF TERMITE PROBLEMS IN AUSTRALIA

M. Lenz, CSIRO Entomology, GPO Box 1700, Canberra ACT 2601, Australia, E-mail Michael.Lenz@ento.csiro.au.

The damage to structures caused by pest species of subterranean termite, belonging to the genera *Mastotermes, Coptotermes, Heterotermes, Schedorhinotermes and Nasutitermes*, and the associated cost of managing termite problems is estimated at Aus$ 80-100 million/year (1995 figures). The ban in 1995 on the use of cyclodienes, the mainstay for termite control in Australia for well over 30 years, has triggered the development of diverse and novel alternative termite management systems (TMS). Termite management (TM) focuses currently on non-chemical preventive measures, on methods permitting safer application of chemical barriers, and on control of infestations in existing buildings through 'trap-and-treat' and bait-systems. The concept of "Building-Out" termites forms an integral part of strategies to reduce the incidences of termite damage. It includes measures such as rendering a building site less attractive to termites, design of buildings with termite biology in mind and ongoing site management. Requirements for the protection of new buildings are detailed in the Australian Building Code (structural elements only) and the Australian Standard AS 3660 (whole-of-house protection). The latter also covers the control of infestations in existing buildings. The following range of TMS is currently available: Protective measures for new buildings include (1) Physical barriers [stainless steel mesh; solid sheet metal; graded stones; concrete slab designed and produced in accordance with AS2870 with associated protection of slab penetrations ('pipe seals') and joints]; (2) Chemical barriers [dursban and clones; bifenthrin or imidacloprid applied either directly to the soil or via a reticulation system for slab-on-ground constructions; chemical (deltamethrin) in a fibrous blanket rather than soil as carrier]; (3) Termite resistant materials (inclusive preservative-treated timber); (4) Any of the above measures singly or in combination coupled with appropriate building design (for example, site preparation, exposure of slab edge, removable skirting boards etc.) and building practice. Regular building inspections and TMS maintenace are critical for the success of any TM strategy. Treatments of infestations in existing buildings include (1) Restoration or the establishment of physical or chemical soil barriers, can be combined with use of nematodes (*Steinernema carpocapsae*); (2) Location and direct treatment of colonies; (3) Dusting [stand-alone or with 'trap-and-treat' systems: arsenic trioxide, triflumuron (possibly *Metarhizium anisopliae*)]; (4) Bait-systems (one complete commercial bait system and various devices for termite aggregation and detection).

Index terms: Isoptera, subterranean termites, physical barriers, chemical barriers, bait systems

[3386] GLOBAL TRENDS ON WOOD PRESERVATIVES FOR TERMITE MANAGEMENT

J.W. Creffield, CSIRO Forestry and Forest Products, Private Bag 10, Clayton South MDC, Victoria 3169, Australia.

Worldwide, wood and wood products are exposed to many biodeteriogens, particularly insects (including termites) and wood-decay fungi. Preservative chemicals that are either impregnated into the wood, or applied to the wood surface can be used to assist in the management of both insect and fungal biodeterioration, thereby extending the service life of the material. Traditionally, three wood preservatives have been used to protect wood, namely creosote, pentachlorophenol and water-borne inorganics. These low-cost, general-purpose preservatives have performed well, but are now under increasing scrutiny with regard to environmental, health and safety concerns. As a consequence, much research has been undertaken internationally on alternative biocides and carrier systems that are more environmentally friendly. There is a global trend to replace or reduce heavy metals (chromium and arsenic) which are contained in the most widely used water-borne preservative, copper-chromium-arsenic (CCA). Hence, the development and acceptance in some countries of alternatives such as ammoniacal copper quaternaries (ACQ's), copper azoles, copper dimethyldithiodicarbamate and other formulations. Instead of broad-spectrum preservatives like creosote, there is a trend to more specific niche-market preservative formulations. Although being available for about 40 years, boron compounds have made a remarkable reappearance, particularly for the management of termites. Alternative oil-borne biocides, with good termiticidal efficacy, have also shown potential. Emulsion preservatives look promising. With the advantage of being formulated with reduced quantities of petroleum-based carriers, emulsion preservatives are more environmentally acceptable and safer to handle. Nowadays, the insecticide components of a light organic solvent preservative (LOSP) are commonly synthetic pyrethroids, and when formulated with one or more biocides, can often have a synergistic effect on one another. There is a trend to protect wood-based composites from termite attack by adding to the adhesive, borates and other insecticidal additives of low mammalian toxicity. Interest continues in chemical modification of wood, heat treatment and development of novel chemicals, biocides and natural products for the preservation of timber from attack by termites, fungal decay and other biodeteriogens.

Keywords: Biodeterioration, biocides, wood based composites, fungal decay

[3387] TERMITE PESTS AND THEIR CONTROL IN MALAYSIA

C.Y. Lee[1] & A.S. Sajap[2], [1]School of Biological Sciences, Universiti Sains Malaysia, 11800 Penang, Malaysia, E-mail: chowyang@usm.my; [2]Department of Forest Management, Universiti Putra Malaysia, 43400 UPM, Selangor, Malaysia.

Termites are an important group of insects. In Malaysia, they are pests in the urban, agricultural and forest environment. Termite control constitutes 40% of the total business turnover of the Malaysian pest control industry, of which about US$20 million was spent each year for termite control in the urban environment. About 70% of termite treatments were done on household premises, 20% on industrial buildings (eg. factories, warehouses) and 10% on commercial buildings (eg. shopping malls, office complexes, etc.). The most important structural pest species are the subterranean termites *Coptotermes travians* and *Coptotermes curvignathus*. *Coptotermes curvignathus* usually attacked houses built on areas where rubber trees (*Hevea brasilliensis*) were previously planted (mainly houses in rural and suburban areas), while *Coptotermes travians* is mainly found in urban buildings. Other subterranean and mound-building species that are found around household premises, urban gardens and parkland, but do not attack structures include *Macrotermes gilvus, Globitermes sulphureus, Microtermes pakistanicus* and *Odontermes* sp. These species are also present in rubber, oil palm and other tree crop plantations. Drywood termites such as *Cryptotermes cynocephalus* and *Cryptotermes domesticus* are also common in building premises (especially in untreated door frames and furnitures) throughout the country and in untreated timbers. Current control of subterranean termites in Malaysia rely heavily on pre- and post-contruction soil treatment, while fumigation and residual treatment are used for control of drywood termites. Spot treatment is also commonly done in buildings using insecticidal dusts. The recent ban on chlordane as a soil termiticide has caused pest control operators to opt for organophosphate and pyrethroid insecticides. Field evaluation of termite baits containing hexaflumuron against *Coptotermes* populations in the natural environment and in buildings showed very promising results. The activities of several termite colonies diminished within 70 days after bait application with maximum consumption of 626 mg hexaflumuron. The potential of baiting in termite control in Malaysia is discussed.

Index terms: termites, *Coptotermes*, control, baiting, Malaysia.

[3388] RECENT DEVELOPMENT IN THE CONTROL OF JAPANESE SUBTERRANEAN TERMITES

M. Takahashi & T. Yoshimura, Wood Res. Inst., Kyoto Univ., Gokasho, Uji, Kyto 611-0011, Japan

Two subterranean termites, *Coptotermes* formosanus Shiraki and *Reticulitermes speratus* (Kolbe), have been causing the great economic losses against wooden constructions in Japan. Because most of Japanese houses have crawl space under the first floor, the control of subterranean termites has been commonly done by soil and floor woodwork treatments with termiticides. Termiticidal water emulsion is usually applied to soil poisoning in crawl space, but use of termiticidal granule is starting for reducing the atmospheric concentration of chemicals in operation. For this purpose, several improved methods have been devised by using micro-capsulated formulations, foaming formulations, termiticide-treated sheets, and easy-hardening pastes containing termiticides. Formulations for woodwork treatment should contain termiticide and fungicide, and they are applied to timbers by pressure and/or superficial treatments. To control the humidity condition in crawl space, slab concrete on soil is becoming popular in Japan. Humidity–regulating materials are also used in crawl space to make unfavorable condition for termites and fungi. Increased public criticism to man-made chemical products is supporting the development of alternative termite control. Setting of physical barriers using stainless steel mesh is being introduced from Australia, and anti-termite plate for floor post has been devised and marketed. The idea of IPM (Integrated Pest Management) for termite control has been considered for long years also in Japan. Bait-toxicant system using inhibitor of chitin synthesis was introduced few years ago from U.S., and some domestic companies are researching this system.

Keywords: *Copotermes formosanus*, *Reticulitermes speratus*, crawl space, physical barrier, bait-toxicant system.

[3389] TERMITE FAUNA IN CHINA, AND THEIR ECONOMIC IMPORTANCE

J. H. Zhong & L. L. Liu, Guangdong Entomological Institute, 105 Xingang Road West, Guangzhou 510260, P. R. CHINA, E-mail: zhong @ gdei.gis.sti.gd.cn.

The termite fauna of China comprises 45 genera in 4 families of which approximately 500 species are described. The distribution of termites which damage buildings, river dikes, reservoir dams, trees, crops, etc. in China, and the 9 principal damaging species are listed. The economic loss caused by termites in RMB 1700-2000 million per annum. South China has more serious termite problems than any other area in China. Termite fauna of this region consists of over 200 species. In Guangdong province, about 80-90% of the buildings were damaged or are being damaged by *Coptotermes formosanus* Shiraki, *Reticulitermes flaviceps* Oshima, *Cryptotermes domesticus* (Haviland), and *C. declivis* Tsai et Chen, over 90% river dikes and reservoir dams are infested by *Odontotermes formosanus* (Shiraki) and *Macrotermes barneyi* Light. Baiting techniques, which have been developed over the years to control termites in China, are reviewed and discussed. The potential of other methods for termite control is assessed.
Index terms: *Coptotermes formosanus, Odontotermes formosanus,* buildings, Reservoir dams, control.

[3390] ECONOMICALLY IMPORTANT TERMITES IN INDONESIA AND THEIR CONTROL

D. Nandika, Faculty of Forestry, Bogor Agricultural Univ., Bogor 16680, Indonesia, E-mail Isipb @ bogor.wasantara.net.id.

As in other tropical countries, termites in Indonesia are known as the most important wood destroying insect. Their role in infesting building, particularly in urban areas, has been caused significant economical as well as ecological problems. In 1999, the financial loss caused by termite attack on building only was reach to four billion dollars. In Addition some economically important crop and forest trees such as coconut, oil palm, rubber wood, and Eucalyptus spp. were succeptable to subterranean termites attack, particularly when they grown in peat soils.

There are four subterranean termites species and one dry wood termite species identified as the most important building pest, namely *Coptotermes curvignathus* Holmgren, *Schedorhinotermes javanicus* Kemner, *Macrotermes gilvus* Hagen, *Microtermes inspiratus* Kemner and *Cryptotermes cynocephalus* Light respectively. Wood preservation and soil treatment are two of the most popular control techniques used to protect timber or building from termite attack. Since the use of copper-chrom-Arsen (CCA) compound has been banned in 1992, most of wood preservatives used in Indonesia is boron compounds. Meanwhile, most of soil termiticides used in soil treatment are pyrethroid and organophosphate compounds. Recently, the efficacy of baiting technique using chitinase inhibitor such as hexaflumuron has been promoted

[3391] ECONOMICALLY IMPORTANT TERMITE SPECIES IN INDIA

D.Rajagopal, Agricultural College,University of Agricultural Sciences, V.C.Farm, Mandya-571405, Karnataka, India.

Termites are widely distributed insects in red, sandy loams, lateritic, red loams etc under Indian conditions. They are serious pests on several agricultural crops and wood works of the buildings. Termites are known to damage major field crops such as wheat, maize, sugarcane, cotton, groundnut, pulses etc. and forest plants such as eucalyptus, silver oak, casuarina and all kinds of timber in the buildings. Termites attack the roots of crops at all the stages, seed setts, newly planted seedlings, tree trunks and also wooden logs. In addition to causing direct damage to crops they feed on the organic matter such as leaf litter, root stubbles, dung pads etc under natural ecosystem. They are responsible for reducing the fertility of the soil by removing both plant and animal debris and locking them up in the nest underground thus making unavailable to the plant growth. They are also litter consumers in the forest ecosystem and are much helpful in breaking down the dead wood and decomposing the organic matter in the forest floor. About 10-25 percent loss is estimated in most of the field and forest crops. The loss due to their damage runs to several millions of rupees in agricultural crops alone. Severe loss in different regions of India has been recorded on highly susceptible crops such as wheat and sugarcane in northern India, maize, groundnut, sunflower and sugarcane in southern India, tea in north eastern India and cotton in western India. The timber damage in buildings has been observed in all parts of India. Out of 300 species of termites known so far from India, about 35-40 species have been reported to damage agricultural crops and timber in buildings. However, the pest status varies from species to species. These species belong to three families viz., Kalotermitidae, Rhinotermitidae and Termitidae. The species of Kalotermitidae are exclusively dry wood feeding termites. Majority of the pest species are soil inhabiting either as mound builders or subterranean nest builders. The movement of these species is confined to the underground by the construction of subterranean galleries, which run for several meters in order to reach the cellulose food materials on the ground surface. Many times their damage goes unnoticed as these are generally concealed. The major mound building species are *Odontotermes obesus*, *Odonototermes redemanni* and *Odonototermes wallonensis.* Similarly, the major subterranean species are *Heterotermes indicola, Coptotermes ceylonicus, Coptotermes heimi, Odontotermes horni, Microtermes obesi, Trinervitermes biformis* and *Microcerotermes beesoni.* Their abundance, distribution, nesting, pest status etc., under Indian conditions will be discussed in this paper.
Index Terms: *Odontotermes obesus, Heterotermes indicola, Coptotermes ceylonicu.,*

[3392] TERMITES AS PESTS IN SOUTHERN AFRICA

J.D.Mitchell, Agricultural Research Council- Plant Protection Research Inst., Private Bag X134, Pretoria 0001, South Africa. (e-mail: *rietjm@plant2.agric.za*).

Of a total of 50 termite genera recorded from southern Africa, 18 have one or more known pest species. Termites attack a wide range of crops at all stages of the growth cycle. Crop losses are estimated at between 3 – 30% while stand losses of up to 90% have been recorded. Post-harvest loss due to termite activity is common on many small-scale farms. Members of the fungus-growing sub-family Macrotermitinae (Termitidae) are responsible for the majority of crop damage and 90% of tree mortality in forestry. The genera most commonly involved include; *Macrotermes, Odontotermes, Pseudacanthotermes, Synacanthotermes, Microtermes, Ancistrotermes,* and *Allodontotermes* together with *Microcerotermes* (Termitinae). The harvester termite, *Trinervitermes trinervoides* (Termitidae: Nasutitermitinae), common to the southern part of the region, is pest of overgrazed rangelands. It is, however, *Hodotermes mossambicus* (Hodotermitidae), that is the major role-player in the destruction of rangeland in the arid and semi-arid areas throughout the region. Populations of this species build up during dry summers, increasing over successive dry years and removing 60% and more of the standing grass biomass and all the litter, posing severe competition to domestic stock and game and exposing vulnerable soil to erosion by both wind and water. This species also periodically causes severe damage to crops. While termites rarely attack indigenous tree species, exotic species such as *Eucalyptus* and *Acacia*, grown commercially and in communal woodlots, are frequently severely damaged. Seedlings in the nurseries and newly planted trees are particularly susceptible to attack during the first 6 – 9 months after planting. Mortalities vary between 19 – 78%, occasionally approaching 100% in some areas. Indigenous dry-wood termites, while occasionally infesting buildings, are not a serious threat. The exotic species, *Cryptotermes brevis* (Kalotermitidae) has,however, caused considerable damage in coastal areas of South Africa. The indigenous East African subterranean termite *Coptotermes amanii* (Rhinotermitidae) is responsible for severe damage to buildings and wooden structures. *Psammotermes allocerus* (Rhinotermitidae), widespread in the more arid western parts of the region, regularly infests buildings and causes considerable damage to timber. Termites of the genera *Macrotermes* and *Odontotermes* cause the heaviest destruction of seasoned timber both within buildings and extramurally. Damage to wood and thatch traditional rural homes and granaries is often substantial, requiring their replacement every 5 to 10 years. Urban brick homes with steel window and door frames are less vulnerable.

[3393] TERMITES OF MARIANA ISLANDS AND PHILIPPINES, THEIR DAMAGE AND CONTROL

L. S. Yudin, College of Agriculture and Life Sciences, Univ. of Guam, UOG Station, Mangilao, GU 96923, USA, E-mail lyudin@uog.edu

The Mariana and Philippine archipelagos lie in the western Pacific ocean and are separated from each other by a few thousand kilometers. Subterranean termites are considered the most destructive insect pests of both residential and commercial structures in these island archipelagos. Present studies have shown that many of the subterranean termite fauna between these two geographical island groups are closely related. This may be due in fact to the Spanish colonizers who once governed both island entities and had well established trade routes that transported lumber and other wooden materials between Manila and the Mariana islands. Today, subterranean termites cause millions of dollars of economic loss to both urban and rural dwellers. Due to climatic conditions that are hot, humid and wet during most of the year, termite feeding is continuous during most months of the year. *Coptotermes vastator* is the primary subterranean termite species found inhabiting most urban structures in Manila and on the islands of Guam and Saipan. Studies utilizing mark and recapture methodologies, wood consumption rates, and the use of hexaflumuron bait have shown conclusive evidence of successfully eliminating *C. vastator* colonies from single family dwellings, apartment complexes, and large commercial buildings. However, subterranean termites of *Schedorhinotermes*, *Nasutitermes*, *Microcerotermes*, and *Macrocerotermes* species that can be found inhabiting many rural dwellings, have been harder to control with hexaflumuron baits. The usefulness of these findings will aid in the reduction of chemical applications in urban settings in sensitive island environments.
Index terms: *Coptotermes vastator* , subterranean termites, hexaflumuron, Pacific islands.

[3394] TERMITE DAMAGE TO BUILDINGS IN THE PROVINCE OF CORDOBA

M. Gaju[1], Mª. J. Notario[1], R. Mora[1], E. Alcaide[1], T. Moreno[1] & C. Bach[2], [1] Dept. of Animal Biology (Zoology). Univ. of Córdoba. C-1 Campus Rabanales 14014 Córdoba (Spain). e-mail: balgarim@uco.es; [2] Dept. of Animal Biology, Vegetal Biology and Ecology. Autonomous University of Barcelona (Spain). * Work supported by grants from Consejería de Medio Ambiente (Junta de Andalucía) and Delegación de Medio Ambiente y Protección Civil (Diputación de Córdoba).

In continental Spain there are only two termite species: the drywood termite *Kalotermes flavicollis* which produce some problems in vineyards and trees in public gardens and the subterranean termite *Reticulitermes lucifugus* distributed throughout Spain and responsible for numerous problems in buildings. The presence of *Cryptotermes brevis* is not clear in continental Spain, but is found in the Canary Islands. In 1997 extensive and severe damage was observed in Palenciana, a small town in the Southwest of Córdoba. The inspection showed that nearly half of the buildings in the town could be affected; we have put forward an erradication plan taking into account the characteristics of Spanish urbanisation and construction patterns. In order to understand the termite problem, the remaining towns in the province were also investigated in search of termite troubles. The province of Cordoba is administratively divided into 74 towns plus the capital. Prior to the inspections we contacted the Major of each town asking for known termite damage. Posteriorly visual inspections of the towns showed us the presence or the possible absence of termites. We have found termites in buildings in 65 towns which means that in 10 villages we have not found any termites which does not necessarily exclude their presence. The extension of the termite damage in each town was variable; in 33 towns damage has been found in only a few houses but, in the rest, one or more extended areas were affected. In Palenciana a deep study was made; we have monitored the village marking termites externally with spray paints or using the internal markers (Neutral Red and Nile Blue). The triple mark-recapture methods were applied to know the colony population. In Palenciana there are approximately 640 houses, we have information from 377, of which we found termite damage in 184. Because the affected area is clearly defined we have established a zone where there are 315 buildings (49.2 % of the town) and in which the damaged houses represent 58% of the zone but, we can anticipate that all will be affected if no treatment is applied. Our Monitored work has allowed us to study six colonies, ranging from 50 to 2342 m^2 territory and 157.846 to 5.200.000 termites per colony.
Index terms. *Reticulitermes lucifugus*. Urban pest. Spain.

[3395] DISTRIBUTION AND MANAGEMENT OF TERMITES IN HAWAII

J. K. Grace[1], R. J. Woodrow[2], & J. R. Yates[1], [1]Dept. of Entomology, Univ. of Hawaii, 3050 Maile Way, Honolulu, HI 96822-2271, USA, E-mail kennethg@hawaii.edu; [2]Dept. of Preventative Medicine, Tripler Army Medical Center, 1 Jarrett White Road, Tripler AMC, HI 96859-5000, USA.

The Hawaiian Islands are home to a number of introduced pest termites (Isoptera). The Formosan subterranean termite, *Coptotermes formosanus* Shiraki, is the most serious of these pests and appears to have been present in Hawaii as early as 1869, although it was first collected in Honolulu in 1907. A second subterranean termite, *Coptotermes vastator*, was collected from a single structural infestation in 1963, and was not collected again in Hawaii until 1999. These recent collections indicate that *C. vastator* is established on the Island of Oahu, but currently has a very limited distribution. The drywood termites *Cryptotermes brevis*, *Incisitermes immigrans*, and *Neotermes connexus* are also long-term residents of Hawaii, with *C. brevis* representing the greatest structural hazard, although *I. immigrans* also occasionally infests buildings. In the past few years, the structural pest *Cryptotermes cynocephalis* has also been collected on Oahu, although only in a limited area and in dead vegetation rather than structural timbers. *Incisitermes minor* was also found infesting two buildings in different parts of Oahu and should probably be considered to be established with a very limited distribution since alate flights occurred, although both buildings were subsequently fumigated. Lastly, the rotten wood termite *Zootermopsis angusticollis* was recently found to be well-established in the Kula region of the Island of Maui, and two alates of this species have also been collected on the eastern (windward) side of Oahu. The majority of termite control efforts in Hawaii target the Formosan subterranean termite, and include the use of gravel and stainless steel physical barriers, soil insecticides, baits, and wood preservatives. Hawaii is unique within the USA in that use of preservative-treated wood is generally mandatory in wood-frame construction, and disodium octaborate tetrahydrate is currently the most widely used of these preservatives. The University of Hawaii has evaluated the performance of soil insecticides since the 1950's, with studies ongoing to date on all of the major islands. Baiting systems have proven to be quite effective in Hawaii against *C. formosanus*, with Hawaii and Florida being the first two states in which hexaflumuron baits were used commercially. Since their introduction, hexaflumuron baits have been used successfully to protect both private and public buildings, including the historic Iolani Palace in Honolulu.
Index terms: *Coptotermes, Cryptotermes, Incisitermes, Zootermopsis*, pest control

[3396] NOVEL TECHNOLOGIES FOR SUBTERRANEAN TERMITE CONTROL

N.Y. Su, Ft. Lauderdale Research and Education Center, University of Florida, 3205 College Ave., Ft. Lauderdale, FL 33314, USA

Subterranean termites (*Reticulitermes* spp., *Coptotermes formosanus*, and *Heterotermes aureus*) account for 80% share of the over US$ 2 billion spent annually for termite control in the United States. Up until mid 1980s, cyclodienes dominated the termite control industry as the main treatment for subterranean termites. These insecticides provided persistent soil barriers for excluding soil-borne termites from structures, but were withdrawn form the market due to public health concerns. Currently-registered termiticides include chlorpyrifos, permethrin, cypermethrin, bifenthrin, fevalerate, imidaclomid, and fipronil. Physical barriers such as stainless-steel mesh and soil particle barriers are also available but have yet to become widespread use; while pyrethroid-impregnated polymer barriers may become available in near future. Aside from these barrier techniques, population control using baits have become more widely adopted by the industry in recent years. Baits containing hexaflumuron, sulfluramid, or diflubenzuron are currently available for the industry. For the monitoring-baiting program that incorporated hexaflumuron, stations containing a monitoring device are first installed in soil surrounding a home. When termites are found in the station, the monitoring device is replaced with a tube containing the hexaflumuron-laced bait. Termites feeding in the stations then carry baits to other members of a colony, leading to the demise of entire colony population.
Keywords: Soil termiticide barrier, physical barriers, baits

[3397] TERMITE FAUNA OF THE SOUTH AMERICA CONTINENT AND THEIR ECONOMIC IMPORTANCE

L. R. Fontes, SUCEN, R. Cardeal Arcoverde, 2878, 05408-003 São Paulo, SP, Brazil, E-mail: lrfontes@uol.com.br.

Damages caused by termites to agriculture, commercial forests, pastures and urban areas are little known in South America, when compared to other continental areas of the world. There are comparatively few reports of damages, taxonomic surveys by regions or by economic subjects are scarce, and quantitative assessments of crop losses are available only for a few cultures, mainly sugarcane and eucalyptus forests. Information is very scarce or even non-existent for most countries and for large geographic regions, as the Northeast region of Brazil, where termites play an important role as pests of historic buildings, but published information is not available. In the last decade, however, this picture is gradually changing. Two conditions contributed to this improvement of the termite problem consciousness. First, the true pest status of some species, particularly in large urban areas, where the termite problem is growing bigger each day, enhancing the consciousness among the population. Second, the 4 symposia on termites that privileged the southern cone of the continent (a regional and a national ones in Brazil, and two international ones in Uruguay and Brazil), resulting in two books, which are rich sources of information. Remarkable facts in the history of economic termitology in South America are: (1) the very destructive subterranean termite, *Coptotermes havilandi*, which was introduced and established in the past into SE Brazil, is continuously spreading towards the west and was recently reported from a site 2000 km away in the NE region, (2) the introduction of another pest species of subterranean termite, *Reticulitermes lucifugus*, in the city of Montevideo, Uruguay, the most remarkable termitic event in South America in the last half of the century, (3) the spread of the introduced dry-wood termite, *Cryptotermes brevis*, throughout the east half of Brazil, where nowadays it is the main biological agent of heritage degradation, (4) the introduction of *Nasutitermes corniger* in the NE region of Argentina, where it is an important pest of structural wood of buildings, and (5) the development of a new concept, named "aesthetic pest" and applied to the common mound building termites of the Brazilian pastures and open lands, which have been traditionally considered pests, without any scientific support.

Index terms: *Coptotermes havilandi*, *Reticulitermes lucifugus*, *Cryptotermes brevis*, *Nasutitermes corniger*, *Cornitermes*, pest termites

[3398] THE INTRODUCED SUBTERRANEAN TERMITE, RETICULITERMES LUCIFUGAS IN URUGUAY

A. Arber

ABSTRACT NOT RECEIVED

[3399] TERMITE PESTS AND THEIR CONTROL IN URBAN BRAZIL

S. Milano, PPV Controle Integrado de Pragas - Rua Bamboré, 41 - CEP 04278-060 São Paulo - SP - Brazil

Termite control is a challenge anywhere. For Brazilian pest control professionals this is a particularly difficult task. First of all, tropical climate encourage all biological processes and enhances species diversity. So, infestations caused by different termites belonging to the genera *Cryptotermes*, *Glyptotermes*, *Coptotermes*, *Heterotermes*, *Rhinotermes*, *Amitermes*, *Microcerotermes* and *Nasutitermes* have been frequently reported causing damages to structures in Brazil. Thus, control deals with species showing very different behaviors. And we have little or no scientific knowledge about the behavior of our pest termites. Most of our little knowledge was built on a practical basis, by pest control professionals. The rapid urbanization and vertical growing of the most important cities eliminate species and create a lot of new micro-habitats, some of which were occupied by termite species. Despite *Coptotermes havilandi* had been detected in the beginning of this century in the cities of São Paulo, Santos and Rio de Janeiro, the boom of this species started 25 or 30 years ago. In the last 3 decades those cities greatly expanded and showed a quick vertical building process, and the termite evolved as the most important pest of structural wood, buildings and urban trees. In terms of control practices most of the procedures were adapted from American and European standards. The four basic strategies (soil treatments, wood treatments, foundation treatments and mechanical alterations) are also adopted in Brazil by the pest control technicians with few adaptations, despite they may not be enough to control some infestations typical of Brazilian building patterns. Brazilian building practices are very variable and can create various conditions that simultaneously facilitate termite infestations and make control more difficult. Walls are built with hollow blocks. These hollows and the grooves opened in the walls for the placement of electrical, water and telephone lines allow easy termite hidden access to all building stories and to all cellulose materials in contact with the walls. So subterranean termites can heavily attack a building without any external evidence in early stages of infestation. It is also common to build structures with voids for acoustic or thermic insulation or only for aesthetic reasons. These large voids frequently allow the installation and the development of large colonies away from soil contact. The wooden molds abandoned inside the voids provide nourishment for the young colony until 10 or more years. So, when termite activity is diagnosed a very big and starving colony is already established. It is very common to find infestations restricted to the highest floors of a building. In these situations to find and remove all colonies from the voids are the only ways to solve the problem.

Index Terms: *Coptotermes havilandi*, pest control, buildings.

[3400] FIFTEEN YEARS OF EXPERIENCE ON GEOGRAFICAL DISTRIBUTION, BEHAVIOR AND CONTROL OF *COPTOTERMES HAVILANDI* IN BRAZIL

E. B. Menezes, CIMP "CRG" / UFFRJ, Br 465 –km 07, Seropédica, RJ 23890-000, Brazil.

Of the approximately $ 1,5 billion spent for the termite control in the USA annually, subterranean termites account for an 80% share (Su and Scheffrahn 1988, Grace et al. 1989, Su et al. 1993). Many old buildings of baroque style contain termite-infested timber and, in addition, modern buildings are being attacked within a few year of completion in the big cities of Brazil. The major cause of such rapid infestation is considered to be due to the wood formers to the concrete foundation being left in place. Scraps of wood left in crawl spaces by builders also encouraged infestation. It has just became public recently in early 1985, *Coptotermes havilandi* were the responsible for destroying lighting cables at the Galeão International Airport (Tom Jobim, nowadays) at Rio de Janeiro and interfered in the flight operations for several days and causing more than $300,000 in losses. Asian subterranean termite, *C. haviland* attacked also installations at the Manguinhos oil refinery, in the same year. Costs of the repair work ran over $250,000. Thousands of cables and telephones wires are destroyed every year in Brazil, and elsewhere by subterranean termites. They attack materials like wood, expanded polystyrene, long play covers, floppy disks, PVC tubing, telephonic wires, subber and any kind of material that contains cellulose. To deal with subterranean termites the only way is to replace damage material periodically. Experiments with electric wire cables treated with organophosfate termiticide were conducted in the Amazonian Region, during three years (1987, 1988 and 1989). We were looking for a resistant material against subterranean termites damages. We detected the presence of *C. haviland*, at the 14th floor in the sauna of Equatorial Hotel at Belém city, state of Pará. A secondary nest (policalic behavior) was found under wood threshold of the sauna, at that time. Araújo (1958) mentioned it as *C. testaceous*; however, we have chance to confirm it was *C. havilandi* instead of *C. testaceous*. A high infestation by *C. havilandi* was detected at terminal railway of CVRD in Vitória (ES), in 1991. As a consultant we did a great job there, for two years, we had in mind that the best way to decrease the high infestation of *C. havilandi* was to proceed a curative and preventive control against it. A chemical barrier using chlorpiriphos was done. However, it was not sufficient. From Vitória (ES) to Itabira (MG) a special train trip was made. Our field observations allowed us to say that all extension of the railway track and stations were infested by *C. havilandi*. Indeed, as time goes by more experience we have been got. After my stay in Fort Lauderdale REC, University of Florida for learning more about termites with Dr. Su and Dr. Krecek in 1995/97 it made me feel more comfortable and much better.

Index terms: *Coptotermes havilandi*, wire cables damages, subterranean termites, scraps of woods

[3401] TERMITE AS PESTS OF SUGARCANE IN THE SOUTHEAST AND NORTHEAST REGIONS OF BRAZIL

W. R. T. Novaretti[1] & L. R. Fontes[2], [1]ANNA, R. Francisco P. Maia, 100, 13.405-098 Piracicaba, SP, Brazil, E-mail: novarett@zaz.com.br; [2]SUCEN, R. Cardeal Arcoverde, 2878, 05408-003 São Paulo, SP, Brazil.

The main soil pests of sugarcane in Brazil are termites, beetles of the genus *Migdolus*, nematodes and leaf-cutting ants. Termites can attack sugarcane in any phase of the culture cycle. They damage the sets, buds, stalks and stools, causing crop reduction and shortening of the culture cycle. Losses caused by termites can be as large as 10 tons/hectare per year, or approximately 50 to 60 tons/hectare in the whole cycle of the sugarcane culture, and the control areas are estimated in 20-40% of the total planted area, according to the region of the country. These figures are the highest in the Northeast region. Southeast Region. In the Southeast, productivity seems to be dependant upon a constellation of factors, including termites. Six species of 4 genera damage sugarcane: *Heterotermes tenuis*, *H. longiceps*, *Proconitermes triacifer*, *Neocapritermes opacus*, *N. parvus* and *Cornitermes cumulans*. Crop losses are higher in certain areas, demanding mostly focal control activities. An efficient monitoring system is highly desirable to prevent undesirable chemical treatment in areas where losses are low. Northeast Region. Conversely, in the Northeast region termites are the most important soil pests and one of the main factors affecting productivity. The most destructive are species of 5 genera: *Amitermes*, *Cylindrotermes*, *Nasutitermes*, *Heterotermes* and *Neocapritermes*. The harmful effect of large termitic populations in the soil and the eventually higher damaging potential of some species are strongly stressed by relevant local circumstances, as soil types (randy and/or poor soils, with low content of organic matter, and shallow soils), climate (prolonged and well defined dry and warm season) and cultivation conditions (hillsides and minimum and chemical tillage, preventing mechanical work of the land). Monitoring tools have thoroughly shown the pest status of the subterranean populations of termites. Control. Control of termites is based upon long lasting soil insecticides. In Brazil, organochlorines are prohibited since 1985. Soil insecticides now available for sugarcane are Fipronil and Endosulfan that will protect the culture for at least two years after application. Other insecticides either are not registered or have a short-time effect on the soil. Infestation level is estimated by means of a simple technique: through visual inspection of two sampling sites per hectare, pest termites are identified and quantified. Scores 0 to 3 will define the infestation levels and elect areas for chemical control.
Index terms: *Heterotermes*, *Proconitermes*, *Neocapritermes*, *Cornitermes*, *Cylindrotermes*, *Nasutitermes*, control, monitoring system.

[3402] TERMITE PESTS IN EUCALYPTUS FORESTS OF BRAZIL

C.F. Wilcken[1], Dept. Plant Production - FCA / UNESP - Campus of Botucatu – P.O. box 237 - 18603-970, Botucatu – SP - Brazil. E-mail: cwilcken@fca.unesp.br

The termite problem in eucalyptus forest plantations in Brazil has been registered since 1908. The main termite pests can be separated in two groups: a) young plant termites and b) trunk termites. The termites of first group attack the roots and stalk base of young eucalyptus plants. The most common species are *Syntermes* spp. and *Cornitermes* spp. and are a serious obstacle to early eucalyptus developing. The trunk termites attack formed trees, destroying eucalyptus heartwood, being *Coptotermes testaceus* the most cited species in reports, but, probably, occur more species in different regions of Brazil. There are not effective control methods to trunk termites. The main young plant termite control strategy is the chemical barrier around root system of plants. Recently, fipronil was officially registered as forest termiticide to use in eucalyptus plantations. Nowadays, studies are being carried out to determine monitoring systems to termite infestations. Early results indicated that, proportionally, few areas really need insecticide application, due to spatial distribution of termites to be aggregated. Therefore, are necessary developing techniques to rationalize insecticide utilization in eucalyptus plantations, to keep feasible the production system and to be suitable to environmental exigencies.
Index terms: Forest pest, damage, control, monitoring.

[3403] PROTECTION OF HISTORICAL MONUMENT FROM TERMITES IN BRAZIL

C. Paiva

ABSTRACT NOT RECEIVED

[3404] TERMITES IN EUROPE: PERSPECTIVES OF RESEARCH AND MANAGEMENT FROM THE LAST CENTURY

R.H.J. Verkerk & L.V. Lainé, Imperial College of Science, Technology & Medicine, Biology Dept, Silwood Park, Ascot, Berkshire SL5 7PY, UK. E-mail: r.verkerk@ic.ac.uk

Biological studies of *Reticulitermes*, the only subterranean termite genus present in Europe, have been limited compared with those of many widely distributed or economically important tropical or subtropical termite genera. Rigorous field studies have been particularly few and far between. Although two species of *Reticulitermes* (*R. lucifugus* and *R. santonensis*) are widely credited as being indigenous to Europe, recent research suggests that only one species (*R. lucifugus*; described in 1792) is indigenous, while the other (*R. santonensis*; described in 1924) was introduced, possibly during the nineteenth century. Current knowledge suggests that *R. santonensis* and the North American species *R. flavipes* could represent a single species. One species of drywood termite, *Kalotermes flavicollis*, described in the eighteenth century, is also considered indigenous to southern Europe. Limited research on the natural history and damage caused by European termites was first published in the 1830s and 1840s, although confusion over the systematics of 'European *Reticulitermes*' and *R. flavipes*, has existed since this time. Laboratory studies, undertaken during the early and mid-twentieth century, have to-date shown few significant differences in the bionomics of *R. santonensis* and *R. lucifugus*, while field observations reveal asynchronous swarming of alates and antagonism between the two species where they are found to co-exist in the Charentes region of France. *Reticulitermes santonensis* appears to have rapidly expanded its distribution during the twentieth century in areas north of the northern indigenous limit of *R. lucifugus* (approximately latitude 45°N) with outbreaks recorded particularly along major transport routes between SW France and areas to the north. Infestations of *R. flavipes* became established decades ago in localised areas in Hamburg (Germany) and Hallein (Austria), while a localised infestation in Devon (United Kingdom), presently the subject of an intensive eradication programme, represents the northernmost known establishment of *R. lucifugus*. Methods of subterranean termite control in Europe have more or less mirrored those adopted in North America and Australia, with liquid termiticide treatments providing the mainstay technique in the latter half of the twentieth century. Baiting techniques were introduced commercially during the mid-1990s, although modifications to commercial systems have often been necessary to cater for differences in behaviour between North American *Reticulitermes* spp. and *R. lucifugus*. There is increasing evidence that large numbers of culturally important buildings and other structures with significant heritage value in Southern Europe are under increasing threat from termites. Conservation orders

[3405] ANTS AS PEST IN HOSPITALS: A COMPARISON BETWEEN NORTHERN AND SOUTHERN HEMISPHERES

J. H. C. Delabie, CEPEC-CEPLAC & UESC, 45660-000 Ilhéus, Bahia, Brazil, delabie@nuxnet.com.br

In the northern hemisphere, ants which live in hospitals have been the focus of attention by entomologists over the last 40 years. The most complete inventories of urban ants which can proliferate in buildings have been carried out in the United States (35-49 species), particularly in Florida and California. Except for in Brazil, reports on the number of species which can be responsible for serious public health problems are surprisingly few and are largely limited to the pharaoh's ant *Monomorium pharaonis* (L.) in Europe and the Argentine ant *Linepithema humile* (Mayr) in Chile, United States and Australia. *M. pharaonis* is as frequent in the hospitals of the south-east of United States (Florida and neighboring states), as *Camponotus pennsylvanicus* (De Geer) and *Tetramorium caepistum* (L.) are in the north-west of the same country. Furthermore, the ponerine *Hypoponera punctatissima* (Roger) seems to form stable populations in Connecticut and Wisconsin hospitals, as it does in Great-Britain. In Brazil, ants are the commonest visible organisms that occur in public health installations. A single hospital can reveal up to two dozen ant species. An older paper on ants in Bahia concerns fire-ants (*Solenopsis* spp) foraging on human carcasses in a mortuary and references to old Brazilian publications reveal a possible interrelation between ants and smallpox. In former-East German hospitals and in other countries, up to 30 types of pathogens have been identified as being associated with *M. pharaonis*. Several authors point out that *L. humile* can also transmit serious infectious pathogens of several diseases, including dysentery, typhoid fever and tuberculosis. In Brazil, 15 to 20% of the ants found in a large Sao Paulo hospital carried pathogens, and 60% of the bacteria found on the body of ants in another hospital were associated with the ghost ant *Tapinoma melanocephalum* (Fabricius). A range of pathogens have been identified from the bodies of ants found in these hospitals, mainly *T. melanocephalum* with 66.7% of the identified bacteria and *Paratrechina longicornis* (Latreille) with 11.1%. The larger the hospital is, the richer will be the ant community. Due to the richness of ants in the public health services and the ability of ants to be vectors of a range of pathogens, the transmission risk if real and high; it is estimated that 1 to 2% of nosocomial infections acquired in the hospitals of Brazil may be attributed to ants. These infections may afflict 5 to 20% (generally less that 7%) of the patients after a surgical procedure in Brazilian hospitals In the U.S.A., where ants have a neglible impact, the level of nosocomial infection is estimated to be between 3.8 to 5.7%.

Index terms: Formicidae, hospital, nosocomial infections, public health

[3406] SOCIAL WASPS AS URBAN PESTS IN THE NORTHERN HEMISPHERE

J. McGlynn

ABSTRACT NOT RECEIVED

[3407] HUMAN COMMENSALISM AND ECOLOGICAL INVASIONS OF NORTH AMERICAN EXOTIC ANTS

T.P. McGlynn, Department of Biology, Gettysburg College, Gettysburg, PA 17325, USA, E-mail tmcglynn@gettysburg.edu.

Language provides the conceptual framework for our ideas. While many ant researchers around the world have settled on the same language -- English -- we still have trouble with a standard vocabulary for exotic ants. A variety of terms often are used interchangeably, but upon dissection these terms reveal significant ecological differences. Thus, our use of language has retarded our efforts to synthesize our work into a global understanding. Using the diverse ecological roles of the known exotic ant species of North America as an example, I propose a standard nomenclature for exotic ants to be shared by myrmecologists, reflecting the terms used by researchers of biological invasions among all taxa. "Imported" indicates species that have been transported into non-native habitat. I propose to use the terms "introduced," "exotic," "non-native," and "adventive" equivalently, for species that have been transported into a new region and can be found in the wild. "Invasive" and "invader" species are a limited subset of exotic species that expand their geographic range into natural areas, often to the detriment of native species. "Tramp" species may or may not be invasive, but do share large number of uncommon life history characteristics. I use the term "human commensalist" to describe an ant species that is closely associated with human environments. Some exotic species are very successful human commensalists, primarily occupying human structures. Invaders are found outside of human structures and invade into more natural habitats where they interact with native species. A small number of exotics are both successful in human structures and natural environments. Because the attributes that assist human commensalism are different from those that assist ecological invasions, we can learn more about invasions with comparative studies of ants fulfilling different ecological roles. Though we know much about the most problematic invaders, we are limited in our understanding of invasion processes because we have little natural history information about other exotic ants.

Index terms: Invasive species, non-native species, tramp ants, introduced ants.

[3408] THE MANAGEMENT OF UNDESIRABLE ANTS IN THE URBAN ENVIRONMENT

D. F. Williams & D. H. Oi, U.S. Dept. of Agriculture, Agricultural Research Service, Center for Medical, Agricultural & Veterinary Entomology, P.O. Box 14565, Gainesville, FL, 32604, USA, E-mail dwilliams@gainesville.usda.ufl.edu.

In the next 5 years, half of the world's inhabitants will be living in cities and more than 80% of the population growth during this time will occur in urban areas. Although there are over 9,500 species of ants worldwide, only about 40- 60 species of ants infest houses. In the future, there will be an even greater impact of undesirable ants on the urban environment. A 1992 study in the United States indicated that ants were the number one annoyance insect pests in households. The increase in problems can be related to the use of different pest control practices for other urban pests, the movement of pest ants around the world through international commerce, and a shift in dominant ant species due to urbanization. Ants cause numerous problems in the urban environment such as a nuisance resulting in undue stress, contamination by spreading disease-causing organisms, stings which can be life-threatening to some individuals, wood damage, damage to electrical equipment, computer equipment, roofs, and roadways. Urban pest ants can be very difficult to control. Most of these ant species produce "super colonies" with characteristics of multiple queens, non territorial resulting in a labyrinth of interconnected nests and very large populations. They build nests in a variety of locations and utilize numerous food sources which makes urban dwellings ideal locations. It is difficult to maintain long term control against these pest ants and because in many cases, the ant colonies are not eliminated completely, reinfestations occur rapidly. The habits of many undesirable ants in urban areas make control techniques utilizing sprays and dusts ineffective because the treatments may kill foraging workers, but they do not result in elimination of the colonies. Toxic baits relying on slow-acting toxicants, either alone or in combination with residual insecticides, are presently one of the best methods to control urban pest ants. It is important that the attractants used in the baits do not spoil quickly, a large quantity of the bait is available, especially when dealing with super colonies, and bait placement is where a large number of foraging workers will find it. There are several excellent active ingredients in use for urban pest ants such as hydramethylnon, fenoxycarb, abamectin, methoprene, pyriproxyfen, and boric acid. However, there is still a need to develop 1) new, more attractive and effective bait formulations and delivery systems; 2) control strategies for new pest ant species; and 3) multiple ant attractants, repellents and biorational methods of control.

[3409] AN INTEGRATED MANAGEMENT APPROACH FOR CONTROLLING TERMITES IN THE URBAN AREAS OF NORTH AMERICA

F. M. Oi[1] & B. T. Forschler[2], [1]USDA-ARS Center for Medical, Agricultural, and Veterinary Entomology, 1600 SW 23rd Drive, Gainesville, FL 32608, USA, E-mail: Foi@gainesville.usda.ufl.edu; [2]Dept. of Entomology, 424 BIO SCIENCE, Univ. of Georgia, Athens, GA 30602-2603, USA, E-mail: bfor@arches.uga.edu.

Termites are the most important structural pests in urban environments in terms of physical damage to structures and liability. By far, the most economically important genera of termites in North America are *Reticulitermes*, *Coptotermes*, and *Heterotermes* (Isoptera: Rhinotermitidae), commonly known as subterranean termites. As with all integrated pest management plans, timely implementation of control measures is as important as the method of the control selected. For subterranean termites, the best time to protect a structure is before it is built. However, the termite control is usually considered for a structure is post-construction, which is the least optimal time to implement control measures. Current control practices rely heavily on the sole use of termiticides applied either as a soil drench or incorporated into various bait matrices. The newer non-repellent termiticides have lead researchers to investigate whether or not these termiticides are more effective in control. Wood treatments also are used occasionally as part of an integrated approach to termite control as are other building related modifications dating back to the early 1900's. In the 2000's we still deal with building construction issues as an important part of integrated termite control strategies; however, we face the additional challenge of new building materials and their novel uses, which have forced us to develop new techniques in termite management strategies.Integrated strategies for subterranean termites have been slow to develop because of the lack of information on basic biology and foraging behavior. Where termite foraging was once believed to be random, we will demonstrate that termite tunnels are stable structures that evenly divide a foraging area. Thus, termite tunneling is not a random event. Guidelines and edges have also been determined to be important in subterranean termite foraging behavior. Molecular techniques have enabled us to re-examine the definition and structure of subterranean termite colonies. New information on termite foraging behavior in the field and colony dynamics are being incorporated into a spatial analysis using simple map algebra to develop a new tool for integrated management strategies of termites.

Index terms: Subterranean termites, Rhinotermitidae, Integrated Pest Management.
Index terms: *Monorium pharaonis, Linepithema humile, Solenopsis invicta*

[3410] INFLUENCE OF ARGENTINE AND COASTAL BROWN ANT (HYMENOPTERA: FORMICIDAE) INVASIONS ON RICHNESS AND SPECIES COMPOSITION OF ANTS IN GARDENS IN PERTH, AUSTRALIA

B. E. Heterick[1], J. Casella[1], J. E. May[1] & J. D. Majer[1], [1]School of Environmental Biology, Curtin University of Technology, GPO Box U 1987, Perth WA 6845, Australia. E-mail imajerj@info.curtin.edu.au.

Ants are a very important component of native ecosystems in Western Australia, where more than 700 species may exist. However, two tramp ants, the Argentine ant (*Linepithema humile*) and the coastal brown ant (*Pheidole megacephala*, appear to have severely reduced this richness in the Perth metropolitan area. Since their establishment in WA in the early 1940's, these two pests have spread throughout Perth and in various towns in the southern portion of the state. Despite an intensive and lengthy organochloride spraying regime directed at the Argentine ant, eradication of either species in Western Australia is now considered impossible. This paper summarizes the findings of two surveys examining the influence of Argentine and coastal brown ants on other ants in twenty-three Perth gardens. The coastal brown ant was the most abundant species, comprising 54.5% of all ants captured, and 92.7% of individuals captured in coastal brown-infested gardens. The Argentine ant comprised 15.7% of the total individuals collected with 92.1% of these coming from Argentine ant-infested gardens. We conclude that the ant fauna of gardens in metropolitan Perth is very depauperate. Moreover, where either the Argentine or coastal brown ants occur, all native species are absent, or virtually so. A couple of non-native species persisted in small numbers in gardens dominated by Argentine ants, but none did so where the coastal brown ant was well established. This may be due to different foraging patterns found in the two major tramp species. These results are of concern because both species are currently spreading throughout the Perth metropolitan area, and are invading some small bushland remnants within this region. Both have the potential not only to reduce the biodiversity of ants (and probably other invertebrates), but also to impact on the conservation status of certain localized species.

Index Terms: *Linepithema Humile*, Argentine Ant, *Pheidole Megacephala*, Coastal Brown Ant, Tramp Ants, Perth, Gardens

[3411] THE PEST TERMITES OF SOUTH AMERICA

R. Constantino, Dept. Zoologia, Univ. Brasilia, Brasilia, DF, 70910-900, Brazil, E-mail: constant@unb.br.

Termites are abundant and diverse in most parts of South America, particularly in tropical lowland forests, savannas and grasslands. The number of known species is currently 400, six of them introduced from other regions as urban pests. Five families are present: Kalotermitidae (53 species), Rhinotermitidae (20), Serritermitidae (1), Termitidae (325). Nasute termites (Nasutitermitinae) are dominant both in abundance and diversity, comprising 54% of all species. The proportion of Rhinotermitidae is low compared to other regions, but some species, particularly *Heterotermes* spp., are abundant in most areas. The taxonomy, biology and geographical distribution of most species are poorly known, and the number of undescribed species is high. About 36 species have been recorded as pests in the literature, corresponding 9% of the total. Although there is quite an extensive literature on the biology and economic importance of South American termites, most are too superficial and lack basic information. One of the most serious problems is the lack of a proper taxonomic treatment. Incomplete identifications, misidentifications and nonexistent names are very common, making it very difficult to accurately store and retrieve information on biology and control. Another problem is the general lack of quantitative data. Many works just mention the presence of termites as pests, but do not attempt to estimate the economic damage. Therefore, it is difficult to establish the relative pest status of each species or genus. Some of the most important structural pests are introduced species: the dry-wood termites *Cryptotermes brevis, C. dudleyi, C. havilandi*, and the subterranean termites *Coptotemes havilandi* and *Reticulitermes* cf. *lucifugus*. *C. brevis* is widespread as the common house termite,and is probably already present in most cities. *Coptotermes havilandi* is currently the major termite pest in the coastal region of Brazil, a densely populated area. *Reticulitermes* cf. *lucifugus* became an important pest in Uruguay and has been recently reported in Chile. It is likely to be introduced in neighbor countries in the future. *Nasutitermes corniger* and *Heterotermes tenuis* are the most widespread and important structural pests among native species. Termites have also been reported as pests in agriculture and forestry, especially sugarcane and *Eucalyptus*. The most important agricultural pests belong to genera *Heterotermes, Cornitermes, Nasutitermes, Procornitermes, Syntermes, Neocapritermes.*

Index terms: termites, Isoptera, South America, pests, taxonomy.

[3412] TOLERANCE TO THE MITE *VARROA JACOBSONI* IN AFRICANIZED AND EUROPEAN BEES IN MEXICO

R. Vandame[1,2], M. A. Felipe[2] & M. E. Colin[3], [1]Ecosur - Proyecto Abejas de Chiapas - Carretera al Antiguo Aeropuerto km 2.5 - Apartado postal 36 - 30700 Tapachula, Chiapas - Mexico - Tel +52 (962) 810 77 ext. 5242 - Fax +52 (962) 810 15 - rvandame@tap-ecosur.edu.mx ; [2]Colegio de Postgraduados, Instituto de Fitosanidad, Campus Córdoba, Ver. - Mexico ; [3]INRA, Station de Zoologie et Apidologie - Avignon, France.

Removal behavior of infested brood by the honey bee *Apis mellifera* has been invoked as a factor of tolerance to the parasitic mite *Varroa jacobsoni*. We have previously shown that africanized honey bees in southeastern Mexico were able to detect, uncap and remove 32% of naturally infested brood, vs. only 8% for european bees. We chose here to proceed by artificial infestation of brood. We selected morphometrically 3 colonies of various levels of africanization. In each colony, adult female mites were collected of emerging brood, and 30 of them were introduced in brood cells of the same colony, during the 3 hours following capping. Then the frames were placed newly in their hives, and artificially infested cells were observed each 2 days during 10 days. As control, 30 more cells were only uncapped and recapped. Worker bees detected, uncapped and removed 23 of 30 infested cells vs. 8 of 30 control cells in the most africanized colony ; 9 and 4 cells in the intermediate colony ; 4 and 4 cells in the most european colony. To estimate the impact of such behavior, we adapted the model of honey bees and *Varroa* population dynamics published by Calis *et al.* (Apidologie 30 111-124, 1999) to tropical conditions of Veracruz, Mexico. Taking into account a 'normal' level of removal (i.e. uncapping of 8% of brood), the *Varroa* population dynamics behaved in a somewhat similar dynamics that the one observed experimentally in European colonies. Keeping this 8% level during rainy season and winter, but introducing a level of removal of 50% during the flowering period, the population dynamics behavedin a similar fashion to the one observed experimentally in Africanized colonies. Such experimental and theoretical data confirm that africanized bees tolerance to *Varroa* mite in southeastern Mexico may be due to the ability of bees to detect diseased brood. This conclusion opens the way to selection of partial *Varroa* tolerance in European honey bees.

Index terms: *Apis mellifera*, africanized bee, *Varroa jacobsoni*, removal behavior

[3413] UNDESIRABLE EFFECTS OF EXOTIC ANTS ON THE LOCAL FAUNA

H. Jourdan[1,2], [1]Laboratoire de Zoologie Appliquée, IRD, BP A5, 98848 Nouméa Cedex, New Caledonia; [2]Laboratoire Ethologie et Psychologie Animale, CNRS-UMR 5550, Université Paul Sabatier, 118 Route de Narbonne, 31062 Toulouse cedex, France; E-mail: jourdan@cict.fr

Dozen of ant species are or have been transferred all around the world. Among them, some exhibit a wide success and are referred as "tramp species", including *Linepithema humile, Wasmannia auropunctata, Pheidole megacephala, Anoplolepis gracilipes, Paratrechina longicornis, Monomorium pharaonis, Solenopsis invicta*. Most of the time, they have spread in anthropic habitats, but it is now obvious that they can also invade a wide range of native ecosystems. In these new areas, exotic ants interact strongly with other components of the ecosystems. Formicidae as well as many other groups are affected, including higher trophic levels. Then invaded communities appear to be ruled by tramp ants and they experience major transformations, both from a structural and functional point of view. To illustrate these patterns, we draw a brief review of what has been registered worldwide for the most common tramp ants. We also focus more closely on the example of the spread of *W. auropunctata* onto New Caledonian archipelago (South West Pacific). Main results show that the biotic resistance of invaded communities seems low, while abiotic conditions appear to greatly modulate both invasive and competitive capabilities. Outnumbering (allowed by unicoloniality, a common characteristic of most tramp ants) rather than aggressive behaviour may be one of the key of exotic ants' success. If intercontinental comparisons are required to fully understand the mechanisms of exotic ants' invasion, it yet appears that transferred ants, especially tramp species, are a major concern for biodiversity and habitat conservation, in particular in the tropical belt.
Index terms: biological invasion, tramp ants, *Wasmannia auropunctata, Linepithema humile, Pheidole megacephala, Anoplolepis gracilipes, Solenopsis Invicta*

[3414] THE MICROSPORIDIUM *VAIRIMORPHA INVICTAE* (MICROSPORIDA: BURENELLIDAE), A POTENTIAL CANDIDATE FOR THE BIOLOGICAL CONTROL OF THE IMPORTED FIRE ANTS IN THE UNITED STATES

J. A. Briano[1] & D. F. Williams[2], [1]USDA-ARS-South American Biological Control Laboratory. Bolivar 1559 (1686) Hurlingham, Buenos Aires, Argentina. E-mail: jabriano@mail.retina.ar; [2]USDA-ARS-Center for Medical, Agricultural, and Veterinary Entomology, P.O. Box 14565, Gainesville, FL, 32604, USA. E-mail: dwilliams@gainesville.usda.ufl.edu.

The pathogen *V. invictae* was described by Jouvenaz and Ellis infecting the red imported fire ant, *Solenopsis invicta*, in Brazil. Its effect on fire ants has never been documented, but laboratory observations suggested that dual infections with the pathogen *Thelohania solenopsae* might increase the mortality of the colonies. Surveys were conducted in north-central Argentina to study the abundance of *V. invictae* on native fire ants. Since 1991, a total of 2,287 colonies (*S. invicta, S. richteri, S. quinquecuspis, S. macdonaghi*) was checked in 144 sites of 5 provinces. *V. invictae* was found only in 54 (2.4%) colonies in 18 sites. The highest infestations (23-35%) were found in Recreo-San Justo, Santa Fe Province, in 1999. Intracolonial prevalence of *V. invictae* was studied in 12 colonies of *S. invicta*. Individuals of all castes were examined: 315 eggs, 107 larvae, 58 pupae, 303 workers (50 dead individuals), 29 sexuals, and 3 queens. In immature ants, diagnosis of the infection was made by examining fresh Giemsa-stained smears of whole specimens (phase-contrast microscopy 1000x), and in adult ants, by examining whole individuals in aqueous extract for the presence of internal spore masses (phase-contrast microscopy 400x). Meiospores and free spores were quantified in workers and sexuals (n=34) by extracting them in 1 ml of water with a tissue grinder and counting them with a haemocytometer (phase-contrast microscopy 400x). Preliminary results showed that: (1) Both types of spores were present in larvae, pupae, and adult ants (workers, sexuals, and queens), (2) Vegetative stages were present in larvae and pupae, (3) Eggs were apparently uninfected, but the presence of spores in queens suggests that vertical infection might exist, (4) In some colonies, the prevalence of *V. invictae* was 100%, (5) The number of meiospores and free spores ranged from $2.5x10^2$ to $5.4x10^5$/ml and from $2.5x10^2$ to $6.5x10^4$/ml respectively, (6) In some colonies, 2 weeks after field collection, the prevalence of the infection in workers was reduced to <10%, however, 85% of the dead ants were highly infected. This might be indicating that fire ants infected with *V. invictae* show high mortality rates and reduced longevity. Tests are being conducted to determine the actual detrimental effect of this microorganism on local fire ants.
Index terms: *Solenopsis invicta*, microbial control, intracolonial prevalence

[3415] DEVELOPMENT AND UTILIZATION OF *ANAPHE INFRACTA*

H. Akai & T. Nagashima, Department of Agriculture, Tokyo University of Agriculture, Funako, Atsugi, Kanagawa 243-0034, Japan

Anaphe silkmoths behave as a group in their feeding, molting and movement during their larval stage, and the offspring from a single mother moth collaborate to make a huge silk nest. They belong to Thaumetopoeidae in Notodontoidea. *Anaphe* silkmoth makes a very large silk nest, about 25 X 15 cm in diameter, which contains numerous individuals in a single cocoon. Our interest in this insect is in the following : 1) Are they social insect? 2) How they collaborate to make their silk nest? 3) What are the structural characteristics of the cocoon and cocoon filaments? We will describe preliminary findings on this moth and its silk. An egg mass laid on a leaf is covered with a thick blanket containing scales and silk fibers originating from the moths. Matured larvae collaborate to make a huge silk nest which is composed of a common silk shell and numerous individual cocoons. A special stimulating vapor released from the silk nest causes the skin to itch when touched by the hand. Following degumming of cut nest, we no longer feel this sensation which means that the stimulating chemical is contained in sericin of the cocoon filaments. Each silk filament is extremely flat in cross section and compact, without any fine porous structure. Degumming of a bisected *Anaphe* silk nest was impossible by usual method, and a new method was developed.
Index terms: *Anaphe*, stimulating vapor, silk nest, cocoon filament, degumming method

[3416] FUNCTION OF WILD COCOONS AND ITS UTILIZATION

T. Nagashima & H. Akai, Department of Agriculture, Tokyo University of Agriculture, Funako, Atsugi, Kanagawa 243-0034, Japan

Various insect species spin silk and make a thick cocoon shell to protect their metamorphosis and hatching from various environmental factors, including ultraviolet rays. Those silk spinning insects have also acquired several biologically resistant roles during their long evolutional history, for example, antibacterial function and a protective effect of ultraviolet rays (UV). We have tested the UV absorption of the cocoons and silk-powder (about 10um in diameter) of protein type from various insects. As the results we recognized that the cocoons and silk-powder of Bombycidae mainly cut off UV-B, on the other hand cocoons and silk-powder of Saturniidae strongly cut off UV-A and B. Therefore the wild silk materials is vastly superior in cutting UV, differing from various synthetic materials in the developmental process of UV cut commercial goods.
Index terms: cocoon, silk powder, UV cut, Bobycidae, Saturniidae

[3417] BIOTECHNOLOGY OF SILK SPINING INSECTS: POSSIBILITY TO PRODUCE ANTHERAEA FIBROIN IN *BOMBYX* SILK GLAND

T. Tamura, Dept. of Insect Genetics and Breeding, National Institute of Sericultural and Entomological Science, Owashi 1-2, Tsukuba, Ibaraki 305-8634, JAPAN, Email ttamura@nises.affrc.go.jp

It was known many insects spin the silks. The silks are the mainly consists of two types of proteins, fibroin and sericin. Since the sericin was removed by degumming, the major component of the silk used as textile is fibroin. The silks produced by the insect can be classified into many different types by X-ray diffraction analysis. The domesticated silkworm, *Bombyx mori* and the wild silkmoth, *Antheraea yamamai*, produce the silks classified into beta(1) and beta(3a)types, respectively. The fibroin genes of the two species are already cloned, analyzed their structure and tuned out that the first exon is conserved in the two species. Although there is no similarity in the coding region for major fibroin peptide and for the promoter region, the experiment using *in vitro* trascription using cell free extract showed that the promoter region of *Antheraea* fibroin gene may work as a signal for the silk gland specific expression in *Bombyx*. The result also suggests that the major other signals for the secretion of the peptides are conserved in the two species. Recently, the germline transformation method in the silkworm has been developed by the vector made by the transposon *piggyBac* (Tamura, et al., 2000). The green flurorescent protein (GFP) gene fused with the promoter region of *Bombyx* cytoplasmic actin gene was used as a marker. The obtained transgenic larvae expressed large amount of GFP in the whole stage and all tissues. Interestingly, some lines of the transgenic silkworms produced large amounts of GFP in the cocoon filament. This indicates that the silk gland of *Bombyx* might be very well adapted to produce the different types of protein. We are studying the possibility of the *Bombyx* silk gland as a system for the protein synthesis.
Index term: transgenic, silkworm, wild silkmoth, GFP, transposon.

[3418] CLOCK-ENDOCRINE AXIS REGULATING BOLTINISM IN ANTHERAEA PERNYI

M. Takeda

ABSTRACT NOT RECEIVED

[3419] USE OF SILKWORMS AS THERAPY FOR PERSONS WITH SENILE DEMENTIA

M. Hattori[1], [1]Flower Villa for Seniors, 2677 Omaeda Hanazono-town Osato-gun, Saitama Prefecture, Japan.

As the aging of society progresses, people are concerned with the importance of welcoming the inevitable end of life while continuing to enjoy life and maintain dignity as human beings. Yet, when a person becomes afflicted with senile dementia, it becomes difficult for that person as well as those around him or her to live a worthwhile life and to maintain dignity as a human being. Researchers around the world are engaged in studies on methods to activate brain cells and delay or prevent their deterioration. Heretofore, no effective method has been discovered. This effort might be helped by silkworms (*Bombyx mori*), domesticated insects which have coexisted for many years with humans. It is thought that stimulation of the five senses is a positive method for delaying the progress of symptoms of senile dementia. Experiences and memories gained through the five senses that are deeply etched in a person's memory are awakened by the stimulation of neurons that are undergoing deterioration. Moreover, if those experiences and memories reflected habitual social activities with economic value, their therapeutic effect would presumably be enhanced. For these reasons, the raising of domesticated silkworms was undertaken. Those persons with senile dementia whose family occupation had been the raising of domesticated silkworms long ago reacted well to the reviving and stimulating of various memories about raising silkworms. In the elderly who were raising silkworms for the first time, we observed their involvement in the various life stages of the silkworms: the feeding of mulberry leaves, spinning thread from the cocoons, and weaving the silk thread. The comparing of wild silkworms (*Attacus atlas*, etc.) with domesticated silkworms might encourage intellectual curiosity and scientific inquiry, which would provide further stimulation of brain cells and the awakening of memory. Therefore, we were encouraged to test the effectiveness of silkworms in the therapy of persons with senile dementia.
Index terms: *Bombyx mori, Attacus atlas*, memory stimulation.

[3420] USE OF WILD SILKMOTHS AS A POOL FOR RURAL DEVELOPMENT

R. S. Uris

ABSTRACT NOT RECEIVED

[3421] RECENT TRENDS IN NON-MULBERRY SERICULTURE: VISION FOR THE NEW MILLENNIUM

M.V. Samson, central silk board, bangalore

Non mulberry silkworms except eri (*Philosamia ricini*) are reared out door and most of the time it faces vagaries of nature and yield loss of cocoon due to attack of various diseases, parasites and predators. During the last decade, much of the work has been done to increase the productivity potential of non-mulberry silk (tasar, oak tasar, muga and eri) in India. Various Integrated package for silkworm rearing and food plants maintenance has been devised and technologies have been transferred from laboratory to land. Even after this the silk production of non-mulberry silkworm contributes for only about 8.25 percent of total silk produced in India. Therefore, now time has come to apply biotechnological approach to increase the productivity potential of non-mulberry silk in India. Tasar Silkworm (*Antheraea mylitta*) has 28 ecoraces distributed across the country. These ecoraces have been characterized on the basis of protein banding. However, today molecular biological tools are available to analyse the genome and characterize eco-types on the basis of DNA markers. Characterization of eco-types is required for conservation of eco-types and for maintenance of bio-diversity in tropical tasar region of India . In order to increase the productivity potential of these eco-types, certain bacteriological flora have been screened from the leaf of primary tasar food plants (*T. arjuna* and *T. tomentosa*) which can be engineered as suitable bacterial genome in the silkworm for better yield output. For oak tasar (*Antheraea proylei*) development, molecular genetical studies towards improving fecundity is the demand of the age. The gene and hormone system responsible for egg production will provide a back ground information for deficiency in egg production in *A. proylei*. Muga (*Antheraea assama*) the golden yellow silk is endemic to India and is a very precious material. Characterization of muga food plants through use of specific gene and development of easy pigment to identify most palatable food plants is the need of the Industry. The continuous rearing coupled with poor hygiene is responsible for low productivity and crop failure in Assam. Morphology and etiology of some microsporidians have been studied but other pathogens viz. virus, bacteria and fungi needs special attention as they damage more than 30 to 35 percent loss to tasar and muga crops. It is pertinent to characterize pathogens on basis of the genome so that particular gene sequence specific to virulent strains (s) can be identified and diagnostics can be developed. Suitable Integrated Pest management package against every major pests and parasites will be developed to minimise the crop loss and increase the productivity potential of non-mulberry silkworms. All these aspects have been discussed in detail.

[3423] LIONING TUSSAH

D. Jianyi

ABSTRACT NOT RECEIVED

[3422] SILK COMPOSITION IN LEPIDOPTERA

F. Schnal & M. Žurovec, Inst. of Entomology, Acad. Sci., Branišovská 31, 370 01 České Budějovice, Czech Republic. **Supported by grant 204/00/0019 from the Grant Agency of** the Czech Republic.

Comparison of silk analysis data obtained in *Galleria mellonella* (Pyraloidea) with those from *Bombyx mori* (Bombycidae) and *Antheraea yamamai* (Saturniidae) permits certain generalizations on the composition of lepidopteran silk. The core of the silk fiber is made up of heavy chain fibroin (HF), light chain fibroin (LF), and P25 protein, which are all secreted in the posterior silk gland section. The formation of S-S linked HF and LF heterodimers is facilitated by the chaperon-like action of P25. LH (about 25 kDa) and P25 have been well defined only in *Bombyx* and *Galleria*. Between these species they exhibit about 50% homology, including conserved positions of 3 (LH) and 8 (P25) cysteine residues. P25s are present in the silk as two proteins (27 to 31 kDa, depending on the species) differing by their glycosylation. Physical properties of the silk fiber, such as strength, elasticity, and module, are determined by the high molecular HF (560 kDa in *Galleria*). HF homology between *Galleria*, *Bombyx*, and *Antheraea* is restricted to less than 70 N-terminal and 50 C-terminal amino acids, while the remainder consists of species specific repeats. In *Galleria*, three particularly regular repeats A (63 amino acids), B (43 amino acids), and C (18 amino acids) are assembled into a longer motif ABABABACAC(AC) that is reiterated 10-11 times in the HF protein. The coating of the silk fiber, which glues silk threads into a cocoon, is made up of several sericins that are derived from two related genes expressed in the middle silk gland section. Different sericins are produced due to developmental variations in the mRNA splicing and apparently also as a result of glycosylation. The silk coating, and to some extent also the silk core, contain additional proteins that apparently do not have structural roles but may protect the cocoons (and the insects inside) against pathogens and predators. These proteins have so far been identified only in the silk of *Galleria* and *Bombyx*. The largest of the putative protectors, the seroin, is produced both in the posterior and middle silk gland section as a 15 kDa peptide that is glycosylated to products of up to 23 kDa. The high content (more than 20%) and arrangement of proline residues resemble some of the insect bacteriostatic peptides. Two other newly identified silk proteins proved to be very stable serine proteinase inhibitors derived from the middle silk gland section. One of them is very unique by containing only a single incomplete domain of Kazal type proteinases. Low molecular tanning factors present in the cocoons of *Antheraea* have also a protective role.
Index terms: *Galleria mellonella, Bombyx mori, Antheraea yamamai*, fibroin, silk

[3424] Multipurpose Utilization of sericultural resources in China

Z.R. Huang, South China Agricultural University,Guangzhou, 510642, P. R. China

1) Silkworm feces utilization: the pigments of silkworm (*Bombyx mori*) feces are extracted with acetone or gasoline, and the solvent is recovered and saponified to obtain the product known as chlorophyllin. It can be used as food additives. We found the chlorophyllin possesses a high effect on suppressing the virus of hepatitis disease. The non saponified substance contains carotenoids, phytol and triacontanol etc. Carotenoid can be applied as food additives. Phytol as a resource is used to synthesize the vitamin E and K1. And Triacontanol is a growth regulator in agriculture. 2) Silkworm pupae utilization: Pupal oil contains more than 70% non-saturated fatty acid including linoleic, linolenic and oilic acid which can be used as nutrient oil. Pupal protein contains more than 36% essential amino acids. By injecting the *E. coli* into the pupae of Chinese oak silkworm (*Antheraea pernyi*) , Cecropin and Lysozyme can be induced in haemalymph. Ion exchange chromatography method was used to isolate and purify the cecropin from immunize haemalymph. We found that cecropin has a broad spectrum of bactericidal effect and possesses a high effect on inhibiting the DNA replication of the virus of hepatitis disease, but has no toxic on human. Ion exchange chromatography and affinity chromatograph method were used to isolate and purify the lysozyme. It can be used in antibiotic fermentation to break the cell membrane of microorganism and hence to increase the yield. 3) Silk protein utilization: Cocoon and silk fiber are hydrolyzed with acid to obtain the sericin and serine, which are good resources for cosmetic manufacture. Silk protein is used to immobilize the enzyme such as glucose oxidase, protease etc. We found the soluble silk protein chelates with silver or copper ion. The chelate compound has a broad spectrum effect on inhibiting the fungi and bacteria.
Index terms: Bombyx mori, Antheraea pernyi,

[3425] THE ORIGIN AND EVOLUTION OF FUNGUS-GROWING: CLUES FROM THE PHYLOGENY OF THE FUNGUS-GROWING ANTS

T. R. Schultz, Dept. of Entomology, National Museum of Natural History, MRC 188, Smithsonian Institution, Washington, DC, 20560, USA, E-mail schultz@onyx.si.edu

Current knowledge of the higher-level systematics of the fungus-growing ants (tribe Attini) is outlined, based particularly on the analysis of morphological and molecular (nuclear EF-1 alpha and mitochondrial cytochrome oxidase I) data sets generated by the author. The reconstructed phylogeny of the attine ants has implications for the evolution of the fungus-growing behavior. Evidence for a sister-group relationship between the Attini and another group of myrmicines is weak. Larval morphological data favor a relationship with the Neotropical *Blepharidatta* (and thus with *Wasmannia*), but molecular data are indecisive on this point. Both molecular and morphological data agree that some combination of of *Mycocepurus, Myrmicocrypta,* and *Apterostigma* are basal within the Attini, lending support to Kusnezov's 1963 hypothesis and making these genera particularly interesting for behavioral studies aimed at understanding the origin of fungus-growing. *Cyphomyrmex* is quite derived within the Attini, contradicting the assertion by some investigators that the yeast-cultivating *Cyphomyrmex* species represent the basal attine condition. The "higher attines," *Trachymyrmex, Sericomyrmex, Acromyrmex,* and *Atta*, constitute a "crown clade" within the Attini. *Trachymyrmex* appears to be paraphyletic both with respect to *Sericomyrmex* and with respect to *(Acromyrmex + Atta),* whereas *Acromyrmex* appears to be paraphyletic with respect to *Atta.* Attine ant and fungal phyogenies strongly suggest that the ancestral attine fungal symbiont was a member of the tribe Leucoprineae and was encountered as a saprophyte in leaf litter; that an ancestral *Apterostigma* species "host-swtiched" to a fungal symbiont in the family Tricholomataceae, a symbiosis inherited by all of its descendant species; that yeast cultivation in the *C. rimosus* group is derived from mycelium cultivation, and that the various phases of the leaf-cutting behavior can be recognized as "grades" within the clade of "higher attines."
Index terms: Attini, Formicidae, phylogeny, molecular systematics, fungus-growing

[3426] MYCOPHAGY AND FUNGUS-GROWING BEHAVIOR IN ATTINE ANTS: IMPLICATIONS FOR THE ORIGIN OF ATTINE FUNGICULTURE

T. Murakami, Integrative Biology, Patterson Laboratories, University of Texas at Austin, Austin, TX 78712, USA, E-mail taka@ecology.kyoto-u.ac.jp.

Mycophagy is a unique, derived behavior characterizing all ants in the tribe Attini (Hymenoptera; Formicidae). The ants not only consume fungi, but also grow them, and these behaviors appear to be ancestral in this tribe of ants. Several hypotheses have been proposed in the literature to explain the evolutionary origin of attine mycophagy. Detailed behavioral profiles are needed to test these hypotheses, particularly of the larvae which are the main consumers of the cultivated fungi. Behavioral observations of adult fungus-growing behavior and larval behavior for eight attine ant species, including four lower (basal), *Myrmicocrypta ednaella, Apterostigma mayri, Cyphomyrmex costatus,* and *C. rimosus* and four higher (derived) attine species, *Trachymyrmex* sp., *Sericomyrmex amabalis, Acromyrmex octospinosus,* and *Atta columbica,* indicate that: 1.Except for the yeast-grower *C. rimosus,* lower attine species generally provide fecal liquid as manure for their fungus garden rather than crop liquid. In contrast, higher attine species were more dependent on crop liquid rather than on fecal liquid; 2. The fungus-growing behavior of *C. rimosus* was unique in using crop liquid as substrate of their fungus garden; 3. In both lower and higher attine ants, queens and larvae almost exclusively depend on mycelium as food, while mycophagy was much less important for workers; 4. In the lower attine species, workers rarely took care of the larvae, and the larvae were always covered with a mycelial coat. The sessile larvae occasionally opened their mouthparts and licked mycelia around their mouth. In contrast, workers of higher attine species collected mycelia from the garden and placed the harvested mycelium at the mouth of larvae; larva then ate these mycelia. The absence of direct feeding of larvae by workers in the lower attines suggests that this behavior is ancestral and that direct feeding with harvested mycelium is derived and arose with the higher attine lineages. In addition, larval mycophagy may have preceded worker mycophagy during the evolution of the attine ant-fungus symbiosis. This suggests a new scenario to the origin of mycophagy in the Attini.
Index terms: Attini, behavior, crop liquid, feeding, fungivory, larvae

[3427] ENERGETICS AND THE CONTROL OF FORAGING DECISIONS IN LEAF-CUTTING ANTS

F. Roces, Behavioral Physiology & Sociobiology (Zoology II), Biozentrum, University of Würzburg, Am Hubland, D-97074 Würzburg, Germany, E-mail roces@biozentrum.uni-wuerzburg.de.

Leaf-cutting ants cut vegetation into small fragments that they transport to the nest, where the material is processed by the ant colony's resident fungal garden. Polymorphic foragers frequently harvest leaf pieces that correspond in size to that of the ants. This results from the geometric method of leaf cutting. Here I report measurements on the energetic costs of leaf-cutting, and their relationship with the worker's decision about the size of the leaf fragment to be cut. Based on the observation that foragers cut smaller fragments, the harder the leaf tissue, measurements of cutting speed, fragment sizes and metabolic rates were performed in workers of *Atta sexdens* presented with leaves of different toughness. It was observed that the total energy expenditure per fragment increased with increasing leaf toughness, and reached a maximum for a given leaf toughness. When workers harvested even harder leaves, they cut smaller leaf fragments, so that the more energy spent per unit length during cutting, the smaller the fragments cut by the foragers. This resulted in a total energy expenditure per fragment similar for leaves of different toughness. Same conclusions could be drawn after measuring foraging costs in ants cutting leaves at five different ambient temperatures. In addition, assessment of cutting performance under conditions of variable oxygen availability indicated that cutting behavior is not stereotyped, and that workers decide about the cutting angles based on their actual energy expenditure while cutting. Cutting costs not only determined the size of the leaf fragment to be cut, but also modulated the trip frequency of foraging workers, by changing the time spent by them in the nest between single foraging bouts. Comparative measurements on load-size selectivity by workers of the grass-cutting ant *Atta vollenweideri* revealed that workers cut grass fragments of different lengths depending on the grass width. As a result, the area of the harvested grass fragments is kept roughly constant, irrespective of the grass width, a phenomenon that seems to be related to the control of transport costs.
Index terms: leaf-cutting ants, social insects, foraging, energetics, metabolism

[3428] DIVISION OF LABOUR AND SIZE POLYMORPHISM OF FORAGERS OF THE LEAFCUTTER ANT *ATTA VOLLENWEIDERI*

J. Röschard & F. Roces, Universität Würzburg, Zoologie II, Biozentrum, Am Hubland, 97074 Würzburg, Germany; email: roeschard@biozentrum.uni-wuerzburg.de

The leafcutter ant *Atta vollenweideri* is distributed exclusively in the savannahs of the north of Argentina and Paraguay. Workers cut mainly fragments of grass, to a lesser extent herb leafs are collected as well. Like in other grasscutting ants fragments are cut into smaller pieces inside the nest and serve as substrate for the fungus they cultivate. The aim of the study was to investigate the cutting process and division of labour during foraging and its relation to worker size polymorphism. This was done by field observations in North Argentina. About half of the cutting events were given up by the cutters, which means that the ant stopped cutting and did not return to the cutting site. Workers frequently interrupted their cutting, i.e. the ant stopped cutting, maybe walked some seconds and returned to the cutting site. Interruptions during cutting were clearly more frequent in those cases in which cutting was given up later, than in those in which cutting was completed. There existed a division of labour among foragers in "cutters" and "carriers", but only if food sources had been located at least several meters away from the nest. Cutters were significantly bigger in body size than carriers, although variability was very high. Often freshly cut fragments have been larger at the cutting site than those carried near the nest entrance, so fragments have been cut a second time, and in some cases carriers differed in body size in different sectors of a trail. This suggests that there existed a further division in subgroups among the carriers, maybe working as some sort of working chain.
Index terms: foraging strategy, cutting behaviour, body size, loading

[3429] USURPERS AND MARAUDERS: THE SOCIAL PREDATOR *MEGALOMYRMEX SP. NOV.* (FORMICIDAE: SOLENOPSIDINI) PILLAGES BOTH GARDEN AND BROOD FROM FUNGUS-GROWING ANTS (ATTINI)

R. M. M. Adams[1,2], U. G. Mueller[1], T. R. Schultz[2] & B. Norden[2], Integrative Biol., Univ. of Texas at Austin, Austin, TX 78712, USA, E-mail rmmadams@mail.utexas.edu; [2] Dept. of Entomology, NMNH, Smithsonian Inst., Washington D.C. 20560, USA

Mycophagy, the consumption of fungi for food, has been observed in only two groups of ants: first, in the fungus-growing ants (subfamily Myrmicinae, tribe Attini) that cultivate mutualistic fungi; and second, in the distantly related genus *Megalomyrmex* (subfamily Myrmicinae, tribe Solenopsidini). Seven species of *Megalomyrmex*, all in the *M. silvestrii* species group, are considered non-obligatory lestobionts of "attine" (fungus-growing) ants, living in attine nests and consuming their fungus gardens. Four colonies of a new species in the *M. silvestrii* species group were collected in June 1998 and Sept. 1999 in the Republic of Panama. Although the nests contained fungus gardens of the lower attine ant *Cyphomyrmex longiscapus*, no or few *C. longiscapus* individuals were present at the time of collecting. Subsequent laboratory observations revealed that *M. sp. nov.* workers both consume the fungus garden and feed attine brood to their larvae. Unlike the attine ants, however, they do not forage for, nor add, substrate to manure the fungus, nor otherwise tend the fungus garden. Therefore, when the garden eventually becomes depleted, *M. sp. nov.* ants must locate new gardens in new attine colonies. When *M. sp. nov.* colonies were presented with active *C. longiscapus* nests in the lab, they aggressively usurped the fungus gardens by displacing "host" workers in mass raids. Some *M. sp. nov.* workers followed escaping *C. longiscapus* ants and attempted to retrieve attine brood carried by the attine workers. When presented with *C. longiscapus* larvae in laboratory experiments, *M. sp. nov.* workers first methodically removed the mycelial blankets that typically envelope attine larvae, then presented the attine larvae to *M. sp. nov.* brood as food. *M. sp. nov.* are social predators in the sense that they forcibly eject the resident *C. longiscapus* ants in order to usurp and then consume their fungus gardens and their brood.

Index terms: *Megalomyrmex*, Attini, fungus-growing ants, fungivory, social parasitism, lestobiosis

[3430] MATING SYSTEM EVOLUTION IN ATTINE FUNGUS GROWING ANTS

J.J. Boomsma[1], A.N.M. Bot[2], E.J. Fjerdingstad[3], P.J. Gertsch[4], H. Jungnickel[5], D. Ortius-Lechner[1], J.S. Pedersen[3], S.R. Sumner[1] & P. Villesen[2], [1]Dept. Population Ecology, Univ. of Copenhagen, Universitetsparken 15, DK-2100 Copenhagen, Denmark, E-Mail JJBoomsma@zi.ku.dk. [2]Dept. Genetics and Ecology, Univ. of Aarhus, DK-8000 Aarhus C, Denmark. [3]Inst. of Ecology, Univ. de Lausanne, 1015 Lausanne, Switzerland. [4]Dept. Conservation Biol. And Genetics, Uppsala Univ., Box 7003, 75007 Uppsala, Sweden. [5]Dept. Chemistry, University of Keele, Keele, Staffordshire. ST5 5BG. UK.

Atta and *Acromyrmex* leafcutter ants were recently shown to have high queen mating frequencies (Fjerdingstad & Boomsma, 1998; Boomsma et al. 1999; Bekkevold & Boomsma, 1999). Further studies with highly variable DNA-microsatellite markers on these and a selection of the "lower" attine ants (Villesen et al. 1999; Ortius-Lechner et al., 2000) have shown that queen mating frequency in *Acromyrmex* is extremely high, whereas we have still to detect the first multiple queen mating in any of the attine genera other than *Atta* and *Acromyrmex*. This implies that there has been a major evolutionary transition in queen mating frequency simultaneous with the origin of the other apomorphic traits (e.g. worker polymorphism, large colony size, adaptations to process fresh leaves) that separate the leafcutter ants (*Atta* and *Acromyrmex*) from the less advanced attine genera. A review of the most recent comparative data on attine queen mating frequencies will be presented and some of the implications of the observed trends will be discussed.

Bekkevold, D., J. Frydenberg, and J. J. Boomsma. 1999. Multiple mating and facultative polygyny in the Panamanian leafcutter ant *Acromyrmex echinatior*. Behav. Ecol. & Sociobiol. 46: 103-109.

Boomsma, J. J., E. J. Fjerdingstad, and J. Frydenberg. 1999. Multiple paternity, relatedness and genetic diversity in *Acromyrmex* leafcutter ants. Proc. R. Soc., Lond. B. 266: 249-254.

Fjerdingstad, E. J., and J. J. Boomsma. 1998. Multiple mating increases the sperm stores of *Atta colombica* leafcutter ant queens. Behav. Ecol. & Sociobiol. 42: 257-261.

Ortius-Lechner, D., P. J. Gertsch, and J. J. Boomsma. 2000. Variable microsatellite loci for the leafcutter ant *Acromyrmex echinatior* and their applicability to related species. Molec. Ecol. 9: 115-116.

Villesen, P., P. J. Gertsch, J. Frydenberg, U. G. Mueller, and J. J. Boomsma. 1999. Evolutionary transition from single to multiple mating in fungus-growing ants. Molec. Ecol. 8: 1819-1825.

Index terms: Ants, Attini, Mating frequency, Coevolution.

[3431] INTERACTIONS BETWEEN LEAF-CUTTING ANTS AND FOREST REGENERATION IN CENTRAL AMAZONIA

H. L. Vasconcelos, Departamento de Ecologia, Instituto Nacional de Pesquisas da Amazônia (INPA), C.P. 478, 69011-970 Manaus, AM, Brazil. E-mail heraldo@inpa.gov.br.

Leaf-cutting ant populations usually increase following habitat disturbance, as for instance after clearing of tropical mature forest. The defoliating activities of these ants could thus potentially affect forest regrowth by reducing tree seedling populations and by affecting plant species composition. Experimental tree seedling transplants and observations on seedlings which emerged naturally in an abandoned farm near Manaus, Brazil, showed that herbivory by *Atta laevigata* do indeed affect tree seedling survivorship and that preferred species suffered the greater mortality. However, these effects were dependent upon time of the year and spatial location. The chance of a seedling being attacked decreased as distance to existing trails increased, and consequently seedling mortality was low or did not exist in sites where the density of existing trails was low. Similarly, ant activity decreased during the rainy season, when rate of seedling emergence was greatest. As a result both the absolute and relative numbers of seedlings affected by leaf-cutting ants declined substantially during the rainy season. In addition, the relative number of seedlings affected decreased as time passed and seedling density in the study area increased.

Taken together these results indicate that although leaf-cutting ant herbivory affected seedling survival, it was not a major impediment to tree regeneration in the abandoned farm studied. Forest regeneration, in turn, appears to have a large control over the ants "leaf- diet", which changed according to temporal (successional) changes in plant species composition.

Index terms: *Atta laevigata*, ants, herbivory, tropical forests

[3432] LEAF-CUTTING ANT (*ATTA SEXDENS*) EFFECTS ON SOIL, ROOT DISTRIBUTION AND TREE GROWTH IN A SECONDARY FOREST OF EASTERN AMAZONIA

P. Moutinho[1], D. C. Nepstad[1,2] & E. A. Davidson[1,2], [1]Instituto de Pesquisa Ambiental da Amazônia, C.P. 6520, 66087-430 Belém, PA, Brazil, E-mail moutinho@amazon.com.br; [2] The Woods Hole Research Center, P.O. Box 296, 13 Church Street , Woods Hole, MA 02543-0296 USA.

In recent decades, large areas of primary forest in Amazonia have been converted to pasture, and now more than half of these deforested lands have been abandoned.Leaf-cutting ants (*Atta* spp.) often explode in abundance following deforestation and may have an important effect on forest succession in abandoned pastures.The most obvious effect of *Atta* activity is defoliation of selected tree species, however a more important effect may result from the deposition of large amounts of organic matter in belowground ant nests. Five mature nests of *Atta sexdens* (~ 70 m^2) were excavated in secondary forests (17 yrs. old) of eastern Amazonia, in Paragominas, Brazil.Shafts dug to 3 meters depth were opened in the center of each nest, and soil physical (texture, resistance, porosity, bulk density, and water holding capacity) and chemical (availability of nutrients to plants) parameters were measured and then compared to the same parameters measured in shafts excavated in soil that was not influenced by nests.The effects of nests on vegetation were estimated by monitoring the growth in diameter of nine tree species and by measuring the pre-dawn xylem pressure potential of *Banara guianensis*, a common tree species in the Paragominas secondary forest.Additional information about nest effects on the secondary forest was obtained in an experiment in which the growth of seedlings (*Cecropia* sp.) was compared among pots containing different proportions of mineral soil and organic matter removed from nest refuse chambers.The results showed that *Atta sexdens* reduce soil resistance to penetration (5 fold) below 1 m depth directly through their excavation activities and the incorporation of organic matter into refuse chambers. Also, soil from 1-3 m depth beneath *A.sexdens* nests was enriched in Ca (3-4 fold), K (7-14 fold) and Mg (2-3 fold) when compared to soil of the same depth that lies beyond the influence of the nest mound.The changes in the soil promoted by the nests were accompanied by increases in coarse (>2mm diameter) and fine (< 2mm) root biomass.The *B.guianensis* trees growing on ant nests experienced greater water stress than those growing away from the nests, apparently due to better water drainage and more water uptake that may have accompanied the proliferation of competing roots.Stem diameter growth of seven of the nine tree species measured was not affected by distance from the nest, and the effects were inconsistent and weak for the other two species.Roots found within nests included species that only grew distant from the nests, indicating that trees growing away from the nest may also be obtaining nutrients from the enriched nest soil. The growth of *Cecropia* sp. seedlings in the pot experiment was favored by the addition of organic matter from the refuse chambers. The competing *Atta* effects of defoliation vs. deep soil tillage and nutrient enrichment upon secondary forest growth are difficult to measure.The clear effects of bioturbation and modification of soil physical and chemical properties point to the potential role of a soil-excavating insect in explaining the rapid rates of deep root system recovery observed in secondary forests of Amazonia, with a potential positive effect on forest recovery.

[3433] GROWTH INHIBITION OF THE SYMBIOTIC FUNGUS OF *ATTA SEXDENS*, BY NATURAL PRODUCTS AND SYNTHETIC COMPOUNDS

J. B. Fernandes[1], F. C. Pagnocca[2], F. R. Crisóstomo[1], S. R. Victor[2], A. G. Correa[1], P. C. Vieira[1], M. F. G. F. da Silva[1], O. C. Bueno[2], M. Bacci[2] & M. J. A. Hebling[2], [1]Depart. de Química, Univ. Fed. de São Carlos, Caixa Postal 676, CEP 13565-905, São Carlos - SP, Brazil. [2]Centro de Estudos de Insetos Sociais, Univ. Est. Paulista, UNESP, Campus de Rio Claro, Caixa Postal 199, CEP13506-900, Rio Claro - SP, Brazil. JBF Email: djbf@power.ufscar.br.

The leaf-cutting ants of the genera *Atta* and *Acromyrmex* are generalist herbivores. They cut plant material and use it as the main substrate for the development of a symbiotic fungus which is the only alimentary source for larvae. The fungus may also provide 9,0 % of the energy requirements for adult workers. These insects exhibit preference for some plant species in a process related with chemical and physical properties of the plants. Secondary compounds seem to be important to the selection of the plant to be defoliated and their presence which can be toxic to the ant or to the symbiotic fungus can provide some protection for these plants against predatory insects. Using the methodology to determine the effect of plant extracts and pure compounds on the *Leucoagaricus gongylophorus* growth, developed by our group, we have studied some extracts from plants, their natural products and synthetic compounds. The consumption of leaves of *Ligustrum lucidum* (Oleaceae), *Sesamum indicum* (Pedaliacaea) and *Virola sebifera* by colonies of the leaf-cutting ant, *Atta sexdens*, were selective and *V. sebifera* was the last one to be picked up. *V. sebifera* leaves contain lignans, (bis-phenylpropanoids), which may occur in several plant species. Sesame oil is used as synergist of some insecticides due to the presence of sesamin, a lignan with anti-fungal and antibacterial activity. In these study our group showed that the presence of the piperonyl group in the lignan, as well as its stereochemistry could be responsible for the highest inhibitory effect observed on the development of the symbiotic fungus in presence of sesamin and other lignans. We have evaluate the effect of some synthetic ethers based on sesamin containing the piperonyl group, as well as of the commercial piperonyl butoxide and observed that the 1-(3,4–methylenedioxybenzyloxy)-octane showed the highest activity. Several amides from the *Piper* genus have insecticide activity and their structures contain the piperonyl group, therefore we have synthesized some of them and tested as above. The natural amides N-pyrrol-3- and N-piperyl-3-(4,5-methylenedioxyfenyl)-2-(E)-propenamide, as well as the synthetic N,N-diethyl-3-(4,5-methylenedioxyfenyl)-2-E-propenamide showed comparable activity to sesamim lignan on the *Atta sexdens* symbiotic fungus. These results suggest the use of lignans, amides and ether containing piperonyl group in the control of the *Leucoagaricus gongylophorus* growth. FAPESP/PRONEX-MCT-FINEP/CNPQ

[3434] THE ORIGIN OF THE ATTINE ANT-FUNGUS MUTUALISM

U.G. Mueller, Integrative Biology, University of Texas at Austin, Austin TX 78712, USA. E-mail: umueller@mail.utexas.edu

Cultivation of fungus for food originated about 45-65 million years ago in fungus-growing ants (Formicidae, tribe Attini) and involved a transition from an existence as a hunter-gatherer of arthropod prey, nectar and other plant juices, to an existence as a farmer subsisting on cultivated fungi. Seven hypotheses have been suggested for the origin of attine fungiculture, each differing with respect to the substrate used by the ancestral attine ant for fungal cultivation. Phylogenetic information on the cultivated fungi, in conjunction with information on the nesting biology of extant attine ants and their presumed closest relatives, reveal that the attine ancestor probably did not encounter their cultivars-to-be in seed stores (von Ihering 1894), in rotting wood (Forel 1902), as mycorrhizae (Garling 1979), or on arthropod corpses (von Ihering 1894) or ant faeces (Wheeler 1907) in nest middens. Rather, the attine ant-fungus mutualism probably arose from adventitious interactions with fungi that grew on walls of nests built in leaf litter (Emery 1899), or from a system of fungal myrmecochory where specialized fungi relied on ants for dispersal (Bailey 1920) and where the ants fortuitously vectored these fungi from parent to offspring nest prior to a true fungicultural stage. It is currently not possible to differentiate between these two hypotheses without additional behavioral, ecological, and mycological information. If Bailey's hypothesis is correct, it is likely that associations between ants and "buccophilous" fungi actually originated multiple times, and that one of these associations became elaborated and externalized in the case of the attine ant-fungus mutualism. Thus, contrary to the traditional hypotheses assuming that the fungi were passive symbionts that happened to come under ant control, Bailey's alternative hypothesis of a myrmecochorous origin of the attine mutualism attributes an important role to evolutionary modifications of the fungi that preceded the ant transition from predator to fungus-farmer.

Index terms: Attini, fungus-growing ants, fungal myrmecochory, fungiculture, fungivory, symbiosis.

Bailey, I.W. 1920. *Ecology* 1: 174-189.
Emery, M.C. 1899. *Archives Sciences Physiques et Naturelles* 8: 488-490.
Forel, A. 1902. *Journal für Psychologie und Neurologie* 1: 99-110.
Garling, L. 1979. *Biotropica* 11: 284-291.
Ihering, H. von. 1894. *Berliner Entomologische Zeitschrift* 39: 321-446.
Wheeler, W.M. 1907. *Bulletin of the American Museum of Natural History* 23: 669-807.

[3435] TOLERANCE TO THE MITE *VARROA JACOBSONI* IN AFRICANIZED AND EUROPEAN BEES IN MEXICO

R. Vandame[1,2], M. A. Felipe[2] & M. E. Colin[3], [1]Ecosur - Proyecto Abejas de Chiapas - Carretera al Antiguo Aeropuerto km 2.5 - Apartado postal 36 - 30700 Tapachula, Chiapas - Mexico - Tel +52 (962) 810 77 ext. 5242 - Fax +52 (962) 810 15 - rvandame@tap-ecosur.edu.mx ; [2]Colegio de Postgraduados, Instituto de Fitosanidad, Campus Córdoba, Ver. - Mexico ; [3]INRA, Station de Zoologie et Apidologie - Avignon, France.

Removal behavior of infested brood by the honey bee *Apis mellifera* has been invoked as a factor of tolerance to the parasitic mite *Varroa jacobsoni*. We have previously shown that africanized honey bees in southeastern Mexico were able to detect, uncap and remove 32% of naturally infested brood, vs. only 8% for european bees. We chose here to proceed by artificial infestation of brood. We selected morphometrically 3 colonies of various levels of africanization. In each colony, adult female mites were collected of emerging brood, and 30 of them were introduced in brood cells of the same colony, during the 3 hours following capping. Then the frames were placed newly in their hives, and artificially infested cells were observed each 2 days during 10 days. As control, 30 more cells were only uncapped and recapped. Worker bees detected, uncapped and removed 23 of 30 infested cells vs. 8 of 30 control cells in the most africanized colony ; 9 and 4 cells in the intermediate colony ; 4 and 4 cells in the most european colony. To estimate the impact of such behavior, we adapted the model of honey bees and *Varroa* population dynamics published by Calis *et al.* (Apidologie 30 111-124, 1999) to tropical conditions of Veracruz, Mexico. Taking into account a 'normal' level of removal (i.e. uncapping of 8% of brood), the *Varroa* population dynamics behaved in a somewhat similar dynamics that the one observed experimentally in European colonies. Keeping this 8% level during rainy season and winter, but introducing a level of removal of 50% during the flowering period, the population dynamics behavedin a similar fashion to the one observed experimentally in Africanized colonies. Such experimental and theoretical data confirm that africanized bees tolerance to *Varroa* mite in southeastern Mexico may be due to the ability of bees to detect diseased brood. This conclusion opens the way to selection of partial *Varroa* tolerance in European honey bees.

Index terms: *Apis mellifera*, africanized bee, *Varroa jacobsoni*, removal behavior

[3436] HONEY BEE TOLERANCE AGAINST VARROA JACOBSONI IN ARGENTINA

M. L. Del Hoyo,[1] L. S. Gonçalves, L. S. [2] & M.A Palacio[3], [1]Fac. de Cs. Veterinarias, UNCPBA. (7000) Tandil Argentina, E-mail mdelhoyo@vet.unicen.edu.ar; [2]Faculdade de Filosofía, Ciências e Letras de Ribeirão Preto, USP, Brasil; [3]Facultad de Ciencias Agrarias, UNMdP, Argentina.

In temperate climates in Argentina, honey bee (*Apis mellifera*) colonies untreated against *Varroa jacobsoni* are usually killed by this mite within a period of less than two years. On the other hand, some feral colonies (local ecotypes) survive long periods with no treatment against this mite. The objective of this work was to study some behaviors involved in honey bee tolerance to *Varroa jacobsoni* in temperate climates in Argentina. Eighteen commercial colonies (COM) from the Pampas Region in Argentina (where most of Argentina's honey production is concentrated) were compared with 16 feral colonies (FER) that had received no treatment against Varroa for many years. Varroa population growth, mite reproductive parameters, honey bee grooming, hygienic behavior and number of mites removed from brood cells were registered during two years. Although after two years the total mite population was similar in both groups of colonies (COM and FER), Varroa population growth was different. Varroa reproduction rate, rate of increase and percentage infertile females were not significantly different ($p>0.05$) between the two groups, but they had changed at different rates during the sampling period. Honey bee grooming behavior data in the SIL colonies indicated a larger number of fallen mites when compared with COM colonies ($p<0.05$). No significant difference was found in the kinds of damage detected in the mites. In both groups, the most frequent damage on mites was leg mutilation. Higher hygienic behavior values were registered in COM colonies when compared with FER colonies. This is probably because 10 colonies from this group were obtained from the Honey Bee Genetics Program in Argentina, which involves selection for this trait. No significant correlation ($p>0.05$) was found between hygienic behavior and total mite population in the colonies or other parameter associated with mite populations in both groups. There was no significant difference in infested brood removal behavior between the two groups but a significant correlation was found between removal rate (when two mites were introduced in brood cells) and hygienic behavior in both colony groups. We conclude that tolerance mechanisms against *Varroa jacobsoni* in some honey bee ecotypes in temperate climates in Argentina are the result of the addition and interaction of many associated behaviors and it is not possible to explain them by any particular parameter. Also, considerable genetic variability was found in the FER group, therefore it was difficult to detect differences between the groups. This is the first detailed description of tolerance mechanisms to Varroa in commercial and feral colonies in Argentina.

[3437] QUEEN PRESENCE AFFECTS VARROA INFESTATIONS

T.M.Cremonez[1], D.De Jong[2]. [1]Biology Dept., FFCLRP-USP,; [2]Genetics Dept., FMRP-USP, 14.049-900 Ribeirão Preto, SP, Brasil. e-mail: ddjong@fmrp.usp.br.

The mite *Varroa jacobsoni* is an important parasite of honey bees, however little is known about how the population dynamics of this mite is affected by biological events in *Apis mellifera* colonies, nor why some types of bees are more tolerant of this mite than are others. Honey bee queens control the reproductive status of the workers in their colonies, and could also affect the varroa found on these bees. We examined the effect of queen presence on varroa infestations in brood cells and on the worker bees of Africanized bee colonies maintained in our university apiaries. All of the newly sealed brood of four (Langstroth) nucleus colonies containing three frames of brood was examined daily for mite infestation during six days. The queen was then removed and queen cells appeared after one to three days, indicating that the bees had reacted to the absence of the queen. The newly sealed worker brood cells were examined for varroa infestation during six days, after the queen cells had appeared. The mean (± standard deviation) percentage of infested cells was 1.6 ± 0.6, in the queen-right colonies, and 5.1 ± 1.7 in the same colonies, after the queen was removed. The infestation rate of the worker brood increased signficantly after the queen was removed (P=0.012, paired sample t-test). A second experiment was prepared with five queen-rearing colonies. These were composed of two standard 10-frame Langstroth hive bodies, with a queen excluder between them. The queen was maintained in the bottom 10 frame box, and brood of all ages kept in both the top and bottom hive bodies. Newly sealed worker brood cells were examined for varroa infestation during three days. The infestation rate was also determined for samples of 150-200 adult bees collected from the upper and lower hive bodies, by brushing the bees into a detergent solution, and agitating the recipient to separate the mites. The infestation rate of the brood cells was significantly greater (P=0.02, paired sample t-test) in the upper part of the hive, where there was no queen 6.0 ± 2.7%) than in the lower hive body, where the queen was present (3.2 ± 1.9%). The adult bee infestation was also significantly higher (P=0.03, paired sample t-test) in the queenless hive body (3.5 ± 1.3 mites per 100 bees) than in the brood box that contained a queen (2.5 ± 1.0). We conclude that the absence of a queen significantly increases the infestation rate of worker brood cells, and also results in a higher infestation rate of the adult bees in the part of the hive that is without a queen, indicating that varroa is sensitive to changes in the colony queen status. Research supported by CNPq and CAPES.

Index terms: *Varroa jacobsoni*, *Apis mellifera*, queen, honey bee, tolerance

[3438] THE INFLUENCE OF COMB CELL SIZE ON THE WEIGHT OF EMERGING HONEY BEES (*APIS MELLIFERA*) AND ON INFESTATION WITH THE MITE *VARROA JACOBSONI*

G.A. Piccirillo[1] & D. De Jong[2], [1] Depto. de Biologia, Área de Entomologia - FFCLRP, Universidade de São Paulo, Ribeirão Preto, e-mail gpicciri@rgm.fmrp.usp.br, [2]Depto. de Genética, Fac. de Medicina, USP, 14.049, Ribeirão Preto, SP, Brasil.

Varroa jacobsoni infestations are influenced by brood comb cell size. Generally speaking, cells with larger diameters are preferred by this mite. We examined the infestation rates by this mite and the weight of emerging worker bees that were produced in an Africanized bee colony with several types (sizes) of brood combs placed in the same colony. The colony was supplied with a frame with Africanized (A) size comb, European (E) size comb, and with an old Africanized (OA) brood comb, that had thickened brood cell walls, and relatively smaller comb cells. Four measurements were made for each of 80-100 cells in each comb, after the bees had emerged from them: cell width (CW), cell depth (CD), cell volume (CV) and bee weight (BW). The mean weights of the emerging bees, determined within a few minutes after they left their cells were: 89.55±3.58mg and 77.56±4.22 mg for uninfested and infested bees, respectively in A. In the Italian comb the mean weights were 94.76±5.63mg and 88.54±11.87mg for uninfested and infested bees, while in OA, they were 88.71±12.63 and 82.00±5.33mg, respectively. There were significant differences in CD among the three types of combs (11.88±0.21, 11.97±0.29 and 12.16±0.0.49, for A, E and OA combs, respectively). In the E and OA combs there was a significant negative correlation between CD and CW (r=-0.77 and -0.82, respectively). The bees compensated for reduced cell width by producing deeper cells to accomodate the developing bee. Cell depth appeared to influence the infestation rates. In E and OA there was a signifant negative correlation between CD and BW in infested cells. Deeper cells also produced heavier bees.

Index terms: Worker bee, Africanized brood comb, *Apis mellifera*, africanized bee.

[3439] TECHNIQUES FOR COMPARING DATA ON REPRODUCTION OF *VARROA JACOBSONI*

M. H. Corrêa-Marques[1] & D. De Jong[2], [1]Biology Dept., FFCLRP-USP,; [2]Genetics Dept., FMRP-USP, 14.049-900 Ribeirão Preto, SP, Brasil. e-mail: ddjong@fmrp.usp.br

The reproductive capacity of the mite *Varroa jacobsoni* varies among honey bee races. Varroa reproduction was studied in Africanized bee colonies in Ribeirão Preto/SP, by a technique that involves the reconstruction of the original family groups. All of the infested brood cell contents are removed and observed with a stereomicroscope. The evaluation is made based on the supposition that a normal reproduction includes a single male as the first progeny, and subsequent females at 30 hour intervals. Analysis of debris from moults and feces patterns aid in the determination of the history of the mite family. An estimate is made of the number of progeny that will attain adulthood when the bee emerges. This technique is more precise and repeatable than simply counting the various types of progeny found in an infested brood cell. This type of data can be used to calculate the reproductive rates of this mite. However it is necessary to standardize the calculation of these reproductive rates so that comparisons can be made between published studies. One way to considerably simplify such comparisons is to include only those brood cells that are infested by a single original female mite.. In Africanized honey bees we found an effective reproduction rate of 1.59 (778/446). This effective reproduction rate is the number of viable females produced per original adult female, including only those that produced viable female progeny. A viable female progeny is one that can attain maturity by the time the bee emerges. When we calculated the number of viable females produced/the number of original females that produced any type of progeny (708/855), we obtained a mean of 0.83. When we made the same determination including all of the original females in singly infested cells (708/1100), the reproduction rate was 0.64. We suggest that this third measure is the most useful as it takes into account the non-reproducing mites, which are important for a determination of the real growth rate of the varroa population. Using the same logic, the total reproductive rate, that includes all progeny produced would be (3465/855) or 4.05, including only females that reproduced, or 3465/1100 = 3.15 when we included all the original females. Standardization of reproductive determinations would help make comparison studies more objective and would give us a better understanding of varroa reproduction.

Project financed by FAPESP.

[3440] *VARROA JACOBSONI* INFESTATIONS IN THE TRANSITION ZONE BETWEEN AFRICANIZED AND EUROPEAN BEES

M.R.C. Issa[1], D. De Jong[2], Z.L. Paulino-Simões[1]. [1]Biology Dept., FFCLRP-USP,; [2]Genetics Dept., FMRP-USP, 14.049 Ribeirão Preto, SP, Brasil.

In most of the countries where the parasitic bee mite *Varroa jacobsoni* is found it has provoked the mortality of countless colonies whenever these have not been treated with acaracides. The bees in Brazil, however, have demonstrated resistance and the infestations are naturally maintained at low levels, around 1-3%. This means that there was a rapid adaptation to this mite in the tropical and subtropical regions of this country. Both bee race and climate were found to have important influences on the action of this mite on its bee host, *Apis mellifera*. Generally speaking, infestations are higher in the cooler regions than in the tropics. Also Africanized bees have lower infestation rates than European colonies kept in the same region. To better understand these two factors, race and climate, we studied varroa infestations in apiaries located between 30° and 35° S latitude in South America (southern Rio Grande do Sul, Brazil, Uruguay and northern Argentina). This is a transition zone between Africanized bees to the north and European bees to the south. We wished to see how the infestations correlated with climate and race. The infestation rates were determined in samples of about 200 adult bees and 100 brood cells per colony. Analyses of the degree of Africanization were made by isoenzyme analysis: Malate Dehydrogenase (Mdh), Hexokinase (Hk), analysis of the cytochrome b region of the mitochondrial DNA and morphometric analysis of the wings. Infestation rates varied sharply in these regions, with the lowest infestations found at parallel 30°S, where Africanized bees predominated. Within some regions of Uruguay apiaries were maintained without treatment, and no signs of problems with varroa, while nearby apiaries were routinely treated, increasing the cost of maintaining the colonies. We are monitoring this region to determine if there is any migration from north to south of tolerance characters in the bees. Research supported by FAPESP.

Index terms: *Apis mellifera*, tolerance, Africanized bee, honey bee, climate

[3441] HONEY BEE DISEASES AND VARROA INFESTATIONS IN BRAZIL

D. Message[1], B.V.Ball[2], [1]Depto. de Biologia Animal, Universidade Federal de Viçosa, 36571-000, Viçosa, MG, Brasil, [2]Entomology and Nematology Dept., 2IACR-Rothamsted, Harpenden, Hertsfordshire, AL5 2JQ England.

Diseases, parasites and predators are associated with honey bees around the world. In Brazilian apiaries some of them cause financial problems for the beekeepers. European foulbrood has been detected in many apiaries throughout Brazil, but it is not a serious problem. Chalkbrood was detected recently in two isolated places. Sacbrood and American foulbrood have not been detected yet, but a sacbrood-like disease caused by a toxic pollen (*Stryphynodendron* sp.) has been detected causing serious problems to the beekeeping industry. At this moment it is the worst problem in Brazil. Other problems with brood with different symptoms has been detected but the causative agent has not been determined. Acariosis and Nosemosis was detected during the 70's and 80's, but at this moment they are not a problem. *Varroa jacobsoni* was introduced in the 70's years, and has spread around the country. However, Africanized bees have shown a high degree of tolerance to this parasite. Low levels of infestation are maintained without any treatment. Recently some viruses (Acute Paralysis Virus, Cloudy Wing Virus, Black Queen Cell Virus and Filamentous Virus) were detected in various regions of Brazil but we have not found any evidence of association between viruses and varroa infestation, even though numerous cases of collapsed colonies provoked by viruses associated with this mite as a vector have been reported in other countries. Africanized bees probably are more resistant or tolerant to the different pathogens and parasites than other races of bees around the world.

Index terms: *Varroa jacobsoni*, *Apis mellifera*, tolerance, viruses

[3442] MORTALITY OF THE MITE *VARROA JACOBSONI* IN AFRICANIZED BEES COLONIES

G. Moretto & L. J. Mello, Depto. Ciências Naturais, Universidade Regional de Blumenau, 89010-971 Blumenau (SC), Brasil.

Since the mite *Varroa jacobsoni* entered in contact with *Apis mellifera* L. honey bees, it has been considered a threat to world apiculture. Its effects range from weakening to death of bee hives. The various levels of infestation reached by the pest are directly correlated with the damage established in bee hives. The problems caused by varroa infestation differ in different parts of the world where the pest has become established. The climatic conditions and the bee race are important factors in the development of this mite. In Brazil *Varroa jacobsoni* has been in contact with Africanized bees for more than 20 years. However, the effects of this pest on these bees are not a source of concern for Brazilian apiculture. The tolerance of Africanized bees for *Varroa jacobsoni* is explained by several factors. Important among them is the lower reproductive rate reached by varroa females in the brood cells of Africanized worker breed compared to the reproductive rate among European bees. Although the reproductive success of varroa on Africanized and European bee brood affects the population dynamics of the pest, other mechanisms, as grooming behavior, are associated with the low development of this mite. Africanized bees, also show the ability to eliminate mites that parasitize adult bees and worker brood. The objective of the present study was to determine the mortality rate of the varroa parasite and its relationship with proportion of mites *versus* adult bees. The study was conducted on ten colonies (nuclei) of Africanized bees under the climatic conditions of Blumenau, Santa Catarina State, Brazil. The mortality rate of *Varroa jacobsoni* was estimated from the daily number of dead mites found at the bottom of the hive and from an estimate of the total mite population of each hive. Mean daily mortality of the mites was 1.85%, i.e., almost 2% of the varroa population died daily. A high correlation was detected between mortality rate and the proportion of number of mites *versus* number of adult bees existing in each bee colony ($r = -0.83$; $P<0.001$). The mortality rate obtained in the present study differed from colony to colony, with an almost ten-fold difference between the highest (4%) and lowest (0.43%) daily mortality rates. This differential parasite mortality in the different bee colonies suggests that the cause of death is not only natural but must be affected by other factors.

Index terms: Africanized bees, *Varroa jacobsoni*, mortality.

[3443] VARROA RESEARCH IN BRAZIL

D. De Jong[1], L.S. Gonçalves[2], [1]Dept. of Genetics, Fac. de Medicina, Univ. de São Paulo, 14.049-900 Ribeirão Preto, SP, Brasil, e-mail ddjong@fmrp.usp.br, [2]Biology Dept., FFCLRP-USP, 14.040-901 Ribeirão Preto, SP, Brasil.

The parasitic honey bee mite, *Varroa jacobsoni*, was first found in Brazil in 1978, and has been the subject of an extensive research program since 1979. Despite considerable economic and political pressure, due to the grave consequences for apiculture in the rest of the world, Brazilian experts avoided the immediate application of control measures. Some of the available chemical controls were tested in Rio Claro, SP, while research on the economic impact of infestations, population dynamics and other biological parameters began in Ribeirão Preto, SP. An attempt was made to establish an economic injury level. However, the varroa infestations developed much differently from what was known for Europe at that time. While initial infestations quickly reached many thousands of mites, more than 50 mites per 100 bees in many cases, they fluctuated seasonally, never were found to kill any colonies, and within a period of a few years, reached relatively low levels of about five mites per 100 adult bees. We were never able to demonstrate economically measurable damage, so treatments were not recommended or used, except experimentally. Nevertheless *Varroa jacobsoni* is found in all honey bee colonies, and the interesting contrast between the catastrophic situation in much of the rest of the world and the relatively uneventful coexistence between mites and bees found in Brazil has maintained our interest in investigating this mite and has stimulated considerable collaboration with researchers from other countries, especially Germany and the U.S.A. Since the research on varroa in Europe in the 80s was concentrated basically on finding ways to control this mite, much of the early information available on varroa biology and its interaction with honey bees, came from Brazil. *Varroa jacobsoni* has been the subject of numerous M.Sc. and Ph.D. thesis projects. Major research themes include cytogenetics, embryology, reproduction, brood cell invasion behavior, honey bee defensive behavior, comparisons between the development of infestations in Africanized versus European bees, honey bee aggression towards the mites, damaged mites, infested brood removal, the effect of climate and selection of more resistant or tolerant lines. Even though the lack of an important economic impact has eliminated any urgency towards dedicating resources to studying this mite, Brazilian researchers will continue to study *Varroa jacobsoni*, to determine how the bees in Brazil can survive without treatments, as part of a world-wide effort to find an effective solution that will eliminate the need to apply chemical controls.

Index terms: *Apis mellifera*, *Varroa jacobsoni*, tolerance, honey bee, Africanized

[3444] GEOGRAPHIC RANGE OF THE SPECIES OF *BOMBUS* LATREILLE (HYMENOPTERA, APIDAE) IN ARGENTINA

A. H. Abrahamovich[1] & N. B. Díaz[1], [1]Dept. Científico de Entomología, Museo de La Plata. Paseo del Bosque s/n 1900-La Plata, Argentina. E-mail: albertoa@museo.fcnym.unlp.edu.ar.

The species of the genus *Bombus* are well-known for their economic and sanitary importance, mainly by their role as pollinators of plant species of commercial value. In spite of this, the knowledge of these species in South America is scarce, and available information from certain geographic regions largely insufficient. Only two regional studies carried out in Brazil and Colombia offer us a partial knowledge of the Bumble-bees. Regarding to Argentina, one of the authors (AHA) assigned nine species to this country, eight belong to south american fauna and one is an european species recently recorded. The objective of the present contribution is to analyze the geographic range of each one of the nine species registered for this country and to give data about their relative abundance and basic ecological preferences. This study is based on an important number of available specimens from different argentinian institutions. Three species, *B. (Fervidobombus) atratus*, *B. (F.) morio* and *B. (F.) bellicosus* have a wide distribution; *B. (F.) atratus* is present in the majority of the argentinian provinces, *B. (F.) morio* occupy the northern of the country, and *B. (F.) bellicosus* the center of it. Other three species, *B. (Coccineobombus) baeri*, *B. (Robustobombus) tucumanus* and *B. (F.) opifex* can be considered typically andean and adapted to medium to high altitudes but showing a great tollerance to different hights; both first are mainly restricted to northwestern provinces and the last one is more widely distributed. The southwestern sector of the patagonian area is occupied by a single species, *B. (F.) dahlbomii*, well adapted to cold climates. The species less common is *B. (F.) brasiliensis*, which is restricted to the northeastern of Misiones province. Lastly, *B. (Megabombus) ruderatus* was introduced from New Zeland to Chile and probably from Chile to Argentina, where was recorded for two patagonian localities only. For all species, maps indicating localilties of the studied specimens, are presented.

Index terms: Apidae, *Bombus*, geographic range, Argentina

[3445] CYTOCHEMICAL AND HISTOPHYSICAL ASPECTS OF *APIS MELLIFERA* (HYMENOPTERA, APIDAE) WORKER VENOM GLAND SECRETION

R.M.M. Abreu[1] & R.L.M. Silva de Moraes[2], 1Dept. de Ciências da Natureza, Univ. Federal do Acre (UFAC), Campus Universitário, CEP 69.900-000, Rio Branco-Acre, e-mail: rusley@ms.rc.unesp.br; 2Dept. de Biologia, Inst. de Biociências, Univ. Estadual Paulista (UNESP), Av. 24-A, 1515, CEP 13.506-900, Rio Claro-SP, Brasil.

The venom gland in *Apis mellifera* workers consists of a free filament, leading to a thin-walled sac. The secretory cells on the walls of the two glandular portions correspond to Class III. The purpose of this paper is to analyse, through cytochemical (protein, polysaccharide and lipid detection) and topophysical (polarised microscopy) studies, aspects of the secretion from 14 and 40-day *Apis* worker venom glands. Cytochemical study showed that the venom gland secretory cells produce, apart from protein including a large amount of acid phosphate, lipids and acid and neutral polysaccharides. While acid polysaccharides enter the composition of the cuticle, the neutral polysaccharides and lipids are part of the constitution of the secretion, and the lipids may further enter the composition of the cuticle as well. Chronologically, the neutral polysaccharides seem to be synthesised later than the protein, i. e., in workers above 14 days old. At this age, lipid is also found in secretory cells, distributed through the cytoplasm, more concentrated in the cellular basal region. The venom gland secretion was found to be isotropic both in 14 and 40-day workers.
Index terms: topophysysical, polarized microscopy, protein, polysaccharide, lipid

[3446] ALLODAPINE BEES GAIN NESTING OPPORTUNITIES FROM AN ANT-*ACACIA* MUTUALISM

T. Aenmey[1] & S. M. Tierney[2], [1]Dept of Environmental, Plant and Animal Sciences, University of the Witwatersrand, Private Bag 3, Johannesburg, South Africa, Tracy@gecko.biol.wits.ac.za; [2]School of Biological Sciences, Flinders University of South Australia, GPO Box 2000, Adelaide, SA 5000, Australia, email Simon.Tierney@flinders.edu.au

Several of the African *Acacia* species are regarded as true myrmecophytes, producing greatly expanded swollen thorns used as domiciles by a variety of ants. This represents a mutualism, whereby ants gain nesting sites and Acacias receive anti-herbivore defence. The role of other invertebrate acacia thorn symbionts has received comparatively little attention. Here we examine nesting and social behaviour of allodapine bees (genus *Braunsapis*) in the Soutpansberg Range in northern South Africa. In this area, allodapines nest in the dead pithy stems of several woody and herbaceous plants as well as in the swollen thorns ('ant galls') of *Acacia karoo*. One *Braunsapis* species nests predominantly in *Acacia* thorns, whereas other species occur primarily in stems and twigs, suggesting some degree of niche partitioning. Brood rearing occurs year round and brood development is asynchronous, with most nests containing one egg and a variety of older immature stages. Most colonies of the thorn nesting species comprise more than one female, but maximum colony sizes are small, with very few nests containing more than three adult females. Per capita brood production in two-female colonies is two to three times higher than in single-female nests, but declines substantially in larger colonies, suggesting that the benefits of cooperative nesting saturate rapidly. The benefits of social nesting in most other allodapine bees are linked to group defence against predators-at-the-nest. Because this *Braunsapis* species nests in 'ant-galls', ant predation is expected to be substantial, raising the question of why maximum colony sizes are so small. The small internal size of thorns in *A. karoo* may lead to crowding as brood size increases, capping benefits to larger colonies. This is supported by the larger maximum colony sizes in other sympatric *Braunsapis* species which nest in dead stems, where ant predation pressure is expected to be lower, but where internal nest dimensions are not as limited.
Index terms: *Braunsapis*, Allodapini, predator pressure

[3447] THE INFLUENCE OF TERMITES ON DESERT SOIL PROPERTIES

W. AL-Houty, Department Of Biological Sciences – Faculty of Science – Kuwait University, E-mail: wasmia@kuc01.edu.kw

Soil porosity was reduced in absence of termites. More silt and sand were added to the soil in areas where termites were found. More organic carbon and organic matter were available in soils where termites had been active. There was a significant increase ($P = 0.001$) in some exchangeable cations such as calcium and magnesium, and slight increase in other cations. The differences in the concentration of potassium was highly significant ($P = 0.002$) between the soils with termites and those without them

[3448] UTILIZATION OF DIFFERENT CULTURE MEDIA FOR BEE SEMEN STORAGE (*APIS MELLIFERA*; HYMENOPTERA: APOIDEA)

R. Almeida[1], A.E.E. Soares[1] & P. Rosenkranz[2], [1]Dept. of Genetics, Univ. of São Paulo, Ribeirão Preto-SP, 14049-900, Brasil.; [2]Landesanstalt für Bienenkunde, Univ. Hohenheim, D-70593 Stuttgart-Germany. Financial support: FAPESP and DAAD/CAPES

With the advances of the instrumental insemination technique many researches have attempted to develop efficient methods for the *in vitro* semen storage using different kinds of diluents. The number of researches on honey bee semen maintenance is still low, thus the ain of this work was the utilization of some culture media for the process of semen storage in *Apis mellifera* bees. Honey bee semen was stored in green coconut water (*Cocos nucifera* L.) and in three different tissue culture media from Sigma: Medium 199, Minimum Essencial Medium Eagle and Cell Freezing Medium Glycerol in both refrigerator and freezer under different conditions. The spermatozoa activity was estimated under an optical microscope field after the samples be stored 1, 2, 5, 10, 15, 30 and 50 days. Also the spermatozoa viability in queens' eggs fertilization was evaluted by instrumental insemination and oviposition control. The commercial tissue culture media did not give such good results to semen preservation. The results showed that, although the stored spermatozoa maintained their motility up to 5 days, they did not migrate into of the spermatheca and all queens produced only drone brood. The results were more satisfactory when the green coconut water (natural medium) was used. The spermatozoa mixed with coconut water plus dihydrostreptomycin and maintained in the refrigerator (10°C) alive for a period of 30 days, but the spermatozoa motility strongly decreases after 15 days of storage. Nevertheless, when the up to 15-day-stored semen was used the eggs fertilization occured and both the queen's laying and the worker brood viability were highly satisfactory. It is known that coconut water presents the nutrients Na+ and K+ (important factors for the reversible suppression of sperm motility and longevity) also arginine and lysine (prolong the period of sperm motility) as natural composition. Thus the green coconut water may be an effective to allow establishing and maintaining of the genetic improvement programmes for *A. mellifera* bees.
Index terms: *Apis mellifera*, semen storage, culture media, coconut water.

[3449] FIELD EVALUATION OF A 0,5% HEXAFLUMURON BAIT (RECRUIT® II) FOR COLONY ELIMINATION OF THE SUBTERRANEAN TERMITE *COPTOTERMES HAVILANDI* (ISOPTERA : RHINOTERMITIDAE)

S.L. de Almeida[1], F.J. Zorzenon[2], J. Justi Junior[2] & M.R.Potenza[2], [1] Dow AgroSciences, R. Alexandre Dumas, 1671, CEP 04717-903 - S. Paulo, SP, BR. E-mail: salmeida@dow.com [2]Instituto Biológico, SP. Av. Cons. Rodrigues Alves, 1252, CEP 04014-002 - São Paulo, SP, BR.

Coptotermes havilandi is an important subterranean termite in the urban environment in Brazil. In this study the efficacy of a bait containing the chitin synthesis inhibitor hexaflumuron was evaluated for colony elimination of this termite species. For this purpose, we used a colony located in the Instituto Biológico area (near the main building of Instituto Biológico), in São Paulo, Brazil, with a defined foraging population of ca. 1.5 million foragers. The foraging population and territory of this target colony of *C. havilandi* was estimated using the Triple, Mark Release and Recapture Method (TMR) with a weighted mean model (Begon 1979, Su and Scheffrahn 1988). After characterizing the colony (population estimate and foraging territory), the hexaflumuron bait was introduced through in-ground stations active with termites from the target colony. Consumption of the bait matrix (visual evaluation) and termite activity was monitored. Baiting procedure was initiated on January 11, 1999. *C. havilandi* foraging ceased completely on March 19, 1999. Continuous monitoring showed no termite activity was found in the foraging territory 11 months after control suggesting that the *C. havilandi* colony was eliminated in a period of 67 days after first baiting. Total consumption of hexaflumuron was estimated to be about 11 g.
Index terms: termites, *Coptotermes havilandi*, hexaflumuron, baits, control.

[3450] NESTING BIOLOGY OF *TETRAPEDIA DIVERSIPES* KLUG (TETRAPEDIINI, APOIDEA)

I. Alves-dos-Santos, Dept. Ecologia Geral, Universidade de São Paulo, Cidade Universitária, 05508-900 São Paulo /SP, Brazil, isabelha@usp.br.

Tetrapedines are restricted to the New World. *Tetrapedia diversipes* bees are of moderate size, with black body and yellow pilosity on the hindlegs. They nest gregariously in cavities of wood. Few data are available about the nesting biology of this group. One nest aggregation of *T. diversipes* has been studied at the campus of the São Paulo University (23°30'S/46°30'W) in São Paulo. Bees activity was accompanied during two generations. Additional tree trunks were provided with orifices of 3-6mm diameter and deepness of 5 to 12cm. The tunnels were clad with a resistant paper, so that, the nests could be inspected periodically by getting out the paper roll. The females activity was accompanied during nest providing and nest construction. Registrated was, time that the female spend outside collecting material as well, time inside the nest to put the load out and manipulate each material. Pollen load from the scopa and from the nests were analyzed. Adult bee specimens and vacated nests were preserved dry, as well the immature and mature larvae in 70% ethanol. The observed *Tetrapedia diversipes* bees have two generations. The first generation begins their activity in November and last until end January, with a pick of activity in December. After ca. 8 weeks the bees from the first generation emerge. The second generation begin their activity end February and last until April, with a pick in middle March, when a birth boom is notable. The overwinter larvae and pupae stages take more than 6 months to emerge. The larvae consume their food rapidly. Two to three weeks after egg deposition we find mature larvae. Females leave the nest on short or long excursions and return loaded with pollen, oil or sand. These bees have good capacity to locate and recognize their nest upon return. Females use sand and oil to construct the cell walls, and they spend variable intervals collecting sources and inside the nest depending on which material they bring. Females provide the cells mainly with pollen from *Croton* flowers. The cells are arranged in linear series on the tunnel. Females spend between 2-5 minutes putting the pollen load out. On the contrary, females bringing oil to the nests rest about 20 minutes inside the nest, and females loaded with sand spend on average 12 minutes. The oil and sand material requires much more care and must be used immediately to surface the nest wall. Vacated cells from previous generations indicated that the nest served more than one generation.
Index terms: solitary bee, nest construction, nest provision, oilbee

[3451] VISITING BEES OF *EICHHORNIA AZUREA* FLOWERS (PONTEDERIACEAE) IN SOUTHEASTERN BRAZIL

I. Alves-dos-Santos, Dept. Ecologia Geral, Universidade de São Paulo, Cidade Universitária, 05508-900 São Paulo, Brazil, isabelha@usp.br.

Populations of *Eichhornia azurea* (Pontederiaceae) are composed of three floral morphs if legitimate pollinators are present. The floral morphs differ basically in style and stamen lengths. Legitimate pollination happens when flowers with long, mid or short styles receive compatible pollen from the long, mid or short anthers respectively. For the sexual reproduction, the plant needs a specialized pollinator (or more than one) to do the right pollen transference. Visitors of *E. azurea* flowers were sampled in 3 geographic isolate localities in São Paulo State: on the coast (Jureia), west (Pereira Barreto) and east (Sta. Cruz das Palmeiras) of the State. The visitors were caught with entomological net and observed during flower visiting. They were prepared with the mouthparts stretched ahead for examination on the proboscis. Ten different bee species were found visiting this plant. Four of them were considered generalist bees and not appropriate for pollination. Furthermore they were rare visitors. Another three species were considered opportunists because they just steal the pollen from the long-, sometimes also from the mid-, level anthers. Only three species were considered to be potential pollinators: *Ancyloscelis gigas, Paratetrapedia (Paratetrapedia)* sp and *Augochlora (Augochlora)* sp. The first species presents a very long proboscis covered with recurved hairs on the ventral side of the prementum, stipes, galea and labial palpi. Females use these proboscis' hairs to collect pollen mainly from the concealed anthers where the other visitors are not able to reach. This species was found previously in other localities and has been considered as legitimate pollinator and responsible for the maintenance of the 3 floral morphs on the plant population. The two other bee species were found just on the coast region, where the plant population lack the short styled morph. These bees were frequent visitors on the flowers, but *A. (Augochlora)* sp touch the long style only sporadically and seldom the mid one. On the other side, *P. (Paratetrapedia)* sp. make legitimate visitation, following the nectar guide orientation. Besides, this species has also a specialized proboscis covered with dense pilosity. Females use the pollenbrush to collect pollen, but the proboscis is of moderate size and not long enough to reach the bottom of the flower. At this plant population part of the short level anthers set is placed higher then usual inside the corolla. Bees of *P. (Paratetrapedia)* sp. species may exert influence on the pollen display inside the flowers.
Index terms: pollination, tristyly flowers, specialized bees, pollen harvest

[3452] BROOD-DEVELOPMENT OF THE THREE ACROMYRMEX SUBTERRANEUS (HYMENOPTERA, FORMICIDAE) SUBSPECIES

A. P. P. Andrade[1] & L. C. Forti[2], [1]Dept. Zoologia, IB-UNESP, P. O. Box 510, Botucatu, SP, 18618-970, Brazil. FAPESP (97/13596-4), E-mail btpaula@zaz.com.br; [2]Dept. Produção Vegetal, FCA-UNESP, P. O. Box 237, Botucatu, SP, 18603-970, Brazil.

The subspecies *A. subterraneus subterraneus, A. subterraneus brunneus and A. subterraneus molestans*, cause serious problems in agriculture. The biology of the subspecies is not well known. In this study the brood-development in five nests of the three subspecies was observed. The queens were isolated from the colonies and after oviposition the eggs were moved to little plastic pots with ten workers and 10 ml of fungus for their feeding. The pots were maintained at 24°C and 80% RH. One a other day the brood-development was observed. The duration of the egg, larval and pupae stage, until the worker development. The average period to the workers development was 62 days to *A. subterraneus subterraneus*, 70,2 days to *A. subterraneus brunneus* and 53,2 days to *A. subterraneus molestans*. The average period in days, for each stage was: *A. subterraneus subterraneus*, egg = 23,4; larvae = 22,2; pupae = 16,4; *A. subterraneus brunneus*, egg = 22,4; larvae = 26,2; pupae = 21,6 and *A. subterraneus molestans*, egg = 21,6; larvae = 17,8; pupae = 13,8. These results indicate a variation in time to the larval and pupae stage and, consequently, a difference in the brood development period of the three subspecies.
Index terms: *Acromyrmex subterraneus*, development, leaf-cutting ant.

[3453] NEST-ARCHITECTURE OF TWO *ACROMYRMEX SUBTERRANEUS* (HYMENOPTERA, FORMICIDAE) SUBSPECIES

A. P. P. Andrade[1] & L. C. Forti[2], [1]Dept. Zoologia, IB-UNESP, P. O. Box 510, Botucatu, SP, 18618-970, Brazil. FAPESP (97/13596-4), E-mail btpaula@zaz.com.br; [2]Dept. Produção Vegetal, FCA-UNESP, P. O. Box 237, Botucatu, SP, 18603-970, Brazil.

The objective of this research was to study the external and internal nest-architecture of *Acromyrmex subterraneus subterraneus* and *Acromyrmex subterraneus molestans*. Five nests of each subspecies were dug. Before the excavation, the nests were photographed and measured. During excavation the content of the fungus chambers was removed and the following measures were taken: depth, height and width of the chambers and depth of the chambers in relation to the soil level. The excavated nests were not deeper than 90 cm in the two subspecies. To *A. subterraneus subterraneus* subspecies, the following measures were obtained: depth in relation to the soil level - 10 to 25 cm; depth of the chamber - 20 to 90 cm; height of the chamber - 12 to 90 cm; width of the chamber - 28 to 90 cm. All the nests of this subspecies were completely underground. The external area of the nests varied from 0,27 to 3,96 m^2. In two nests of this subspecies were found three chambers with fungus. To the *A. subterraneus molestans* subspecies the following measures were obtained: depth in relation to the soil level - 1 to 17 cm; depth of the chamber - 25 to 80 cm, height of the chamber - 10 to 23 cm; width of the chamber - 13 to 45 cm. Only one nest of this subspecies was completely underground, in the other nests the external area was composed by soil and thatch. The fungus chamber was found below of the thatched area. Most of the nests of this subspecies was small, varying from 0,05 to 1,5 m^2. The largest nest showed three chambers with fungus. The data showed that, in spite of the little depth, the two subspecies construct their nests in a different way.
Index terms: *Acromyrmex subterraneus*, leaf-cutting ant, nest.

[3454] INFLUENCE OF THE PRESENCE OF *CARIOCAR BRASILIENSIS* (CARIOCARACEAE) ON THE DENSITY OF STINGLESS BEE NESTS (APIDAE: MELIPONINI) IN A SMALL FARM, JANUÁRIA, MG, BRAZIL

Y. Antonini & R. P. Martins, Laboratório de Ecologia e Comportamento de Insetos, Departamento de Biologia Geral, ICB,UFMG, Cx Postal 486 CEP: 31140-390 Belo Horizonte, MG, Brazil E-mail: antonini@mono.icb.ufmg.br

Highly eusocial bees frequently have colonies with a great number of individuals, that represent the main floral visitors and pollinators in tropical ecosystems. The stingless bees (Meliponini) have a great diversity in the neotropical regions. The majority of nests are found in previously existing cavities (hollows in trunks and roots of trees). Although most of the species don't need great spaces to nidify, some species do need a great diameter of the hollow to construct the nests. In an farming area, with great anthropic influence, where the *Cariocar brasiliensis* (Cariocaraceae), a tree species protected by law, is practically the only remaining tree species, nests of stingless bees were looked in roots and trunks of trees from March to December of 1999. At all, 104 nests of 10 species were located. The species with higher densities were *Melipona quadrisfasciata qudrifasciata* (0.32 nests/ha) and *Tetragonisca angustula* (0.22 nests/ha). The other collected species, (*Frieseomelita silvestri*, *Frieseomelita varia*, *Partamona cupira*, *Plebeia droryana*, *Scaptotrigona postica*, *Nannotrigona testaceicornis* and *Tetragona clavipes*) despite of having little exigencies concerning the nidification sites, presented a very low density, probably because their nests were heavily predate by the local people searching for the honey. Although *M. quadrifasciata* is a great size species, the great density of nests can be explained by the relatively great number of large trees (about 10 trees for ha) with a diameter great enough to support a colony and also by the difficulties of local people to locate the nests. These results show that although the environment is considerably damaged, it is still capable to support populations of stingless bees, probably because in that are there is a tree species protected by law.

[3455] PRELIMINARY SURVEY AND SPECIES COMPOSITION OF TERMITES IN SOME SITES OF THE CAMPUS OF THE "UNIVERSIDADE FEDERAL RURAL DO RIO DE JANEIRO", IN SEROPEDICA (RJ), BRAZIL

G. T. Araújo[1], E. L. Jacintho[1], L. O. Andrade[1], E. L. Aguiar-Menezes[2], J. K⊆e ek[3] & E. B. Menezes[1], [1]CIMP "CRG"/ UFRRJ, BR 465, km 7, Seropédica, RJ 23890-000, Brazil, E-mail ebmen@zaz.com.br; [2]Embrapa Agrobiologia, Caixa Postal 74505, Seropédica, RJ 23840-000, Brazil; [3]Univ. of Florida, Ft. Lauderdale REC, IFAS, 3205 College Ave., Ft. Lauderdale, FL 33314, USA.

Termites are considered useful insects in the nature by reducing fallen timbers and dead roots, trunks and branches. However, people have placed the wood of their dwellings in situations accessible to termites, and consequentially, they become a noxious insect. The campus of the "Universidade Federal Rural do Rio de Janeiro" (UFRRJ) located in Seropedica (RJ) with 3010 ha of landscape area and 131,346 m^2 of constructed area. There is a diversity of environments adequate for living of termites. However, these insects may assume a greater importance because the buildings are historical heritage. We started a study with aim of surveying the fauna of Isoptera in the UFRRJ in September 1998. Cellulosic materials, living trees, wooden posts, termite's nests and buildings were inspected to look for termites. Specimens were collected using carving knife, tweezers, brush, aspirator, ax and hoe. We also used wooden stakes as a trap, which were placed around the buildings and trees, and inspected periodically. Specimens were taken to the laboratory of the CIMP "CRG" / UFRRJ for identifying the species. Here we present preliminary results that refer to the survey of an area of 400 ha of the campus. Fifteen different species of termites were recovered. This preliminary survey also allowed us to differ the feeding behavior and habitats of termites collected. *Rugitermes* sp. and *Calcaritermes* sp. were found in small numbers on dry branches fallen in the ground. *Glyptotermes* sp. and *Cryptotermes havilandi* were found in association with living plants. *C. brevis* were found only attacking furnitures. *Coptotermes havilandi* and *Heterotermes tenuis* were collected from the wooden stakes. The former species was also damaging wooden structures of the buildings. Mounds of *Syntermes* sp. were frequentely found in degraded area. *Amitermes* sp. was found living together with *Syntermes* sp. *Anoplotermes* sp. and *Neocapritermes* sp. were feeding on decaying trunk fallen on the ground. *Proconitermes* sp. was found under dry feces in the field. Several gray mounds were found throughout the area, and was constructed by *Armitermes* sp. Its nests were also used by *Termes* sp. The most of the inspected trees supported a nest of *Microcerotermes* sp. Larger colonies of *Nasutitermes macrocephalus* were found in large arboreal nests. The most common species in the buildings were *Coptotermes havilandi* and *Cryptotermes brevis*. In the vegetative environments, *Armitermes* was found more frequently, and *Syntermes* sp. was the predominant species in degraded areas.
Index terms: Isoptera, *Coptotermes havilandi*, wooden stakes, feeding behavior

[3456] THE CELL PROVISIONING AND OVIPOSITION PROCESS (POP) IN SOME SPECIES OF *Partamona* (HYMENOPTERA, APIDAE, MELIPONINAE)

G.G. Azevedo[1] & R. Zucchi[1], [1]Departamento de Biologia, Faculdade de Filosofia, Ciências e Letras de Ribeirão Preto – Universidade de São Paulo. Av. Bandeirantes, 3900. Cep: 14040-901. Ribeirão Preto – SP, Brazil. E-mail: gigarcia@usp.br.

In the stingless bees (Meliponinae) the food provisioning and oviposition process (POP) proceeds along a behavioral sequence which involves: 1) construction of brood cells; 2) food provisioning of the cells; 3) oviposition in the cells by the queen; 4) sealing of cells. Despite these universal features, a wide variety of species-specific behaviors have been described, which have provided grounds for evolutionary comparisons. Our aim is to analyze comparatively the POP of different *Partamona* species: 1) *P. helleri*; 2) *P. sp.*$_1$; 3) *P. mulata*; 4) *P. vicina*; 5) *P. ailyae* and 6) *P. sp.*$_2$. Data collection was based on direct observations of behavioral traits, allied the use of a video-recorder. All the studied species share the same ethological syndrome CcPcBf, that is, the brood cells are constructed and provisioned sucessively (CcPc), the number of cells oviposited per POP was variable (1 to 3 cells), resulting in the facultatively batched POP type (Bf). During the preprovisioning stage the queen could be displaced from the cell by the workers which gradually form a circle around the cell. At the end of the preprovisioning stage, the queen is kept apart from this congestion until the first food provisioning in the cell occurs. These behaviors altogether characterize the *Partamona* species. The interactions between queens and workers were more ritualized than agressive. The post-provisioning stage was, in general, very short, except in the cases with worker oviposition and subsequent oophagy by the queen. In general, only one trophic egg was deposited at the upper rim of the cell. The sealing stage was similar in the species studied. Despite present considerable quantitative progress in the apprehension of POP details in many taxa, phylogenetic approaches on this subject remain largely speculative. Main reason for such stem on the evidence that very little is known on the infrageneric diversity of the POP, and because very high ethological diversity has been detected even in sytematically very stable genera. In fact, compared studies in *Tetragonisca*, *Scaura*, *Plebeia*, *Frieseomelitta* and *Tetragonula* have demonstrated wide variability of the POP traits in these genera, indicating cases of remarkable uncoupling between taxonomic and ethological traits. On the other hand, the studies performed in *Partamona* have demonstrated much more uniform POP traits , and the behaviors here described are good diagnostic for this taxon. The examples above signal to the necessity of approaching POP details by enlarging knowledge on its intrageneric diversity.
Index terms: Stingless bees, *Partamona*, social evolution

[3457] ALARM PHEROMONE COMPONENTS AND OPIOID SYSTEM ACTIVATION IN HONEYBEES

N. Balderrama[1], J. A. Núñez[2] & M. Giurfa[3], [1]Instituto de Zoología Agrícola, Ftad. de Agronomía, Univ. Ctral de Venezuela, (AP 4579), Maracay 2101, Aragua, Venezuela; [2]Depto. de Biología, Ftad. de Cs. Exactas y Naturales, UBA, Cdad. Univ., (1428) Buenos Aires, Argentina; [3]Institut für Neurobiologie, Freie Universität Berlin, Königin-Luise Strasse 28/30, 14195, Berlin, Germany. This work was supported by funds from the University of Buenos Aires (TW 43) to J. A. Núñez.

Stress analgesia via an opioid system is activated by isopentyl acetate, a major component of the sting alarm pheromone, in the honeybee. Since 2-heptanone, a substance produced by the mandibular glands of the workers, is assumed to be equally important as alarm pheromone, we tested whether both alarm substances were equally effective in eliciting the opioid based stress analgesia. We show that only isopentyl acetate induces stress analgesia and thus decreases the level of defensive responsiveness to a noxious stimulus. In contrast, 2-heptanone does not affect the responsiveness or, depending on its concentration, even increases it. Thus the former substance acts on the endogenous opioid system whilst the latter increases unspecifically the level of arousal for a potential danger.
Index terms: *Apis mellifera*, stress, analgesia, isopentyl acetate, 2-heptanone

[3458] WHAT MAKES AN ANARCHIST? THE DEVELOPMENT AND BEHAVIOUR OF ANARCHISTIC BEES (*APIS MELLIFERA*)

A. B. Barron & B. P. Oldroyd, School of Biological Sciences, Univ. of Sydney, Macleay Building A12, N.S.W. 2006, Australia, E-mail abarron@bio.usyd.edu.au.

In a normal honey bee (*Apis mellifera*) colony the queen dominates reproduction. Two mechanisms are known that maintain the sterility of the worker bees. First, the presence of a healthy, mated queen inhibits worker ovary development. Second, worker bees "police" each other. Workers will destroy worker-laid eggs and attack workers with developed ovaries. The result is that in a normal honey bee hive more than 99.9% of the eggs raised by the workers are the offspring of the single queen. We have been studying hives in which the suppression of worker reproduction has failed. In "anarchistic" colonies a proportion of workers develop ovaries and produce drone brood despite the presence of the queen. "Anarchistic" colonies were found by asking bee keepers across Australia to report hives which had drone brood above the queen excluder. By breeding from these hives, we were able to increase the penetrance of the anarchy phenotype. Our latest work used a series of cross-fostering experiments to identify the factors that influence the development of anarchistic bees and how the anarchists evade worker policing. The genotype of the queen, the workers and the hive environment all influence the expression of the anarchy phenotype. Worker-laid eggs are tolerated in an anarchistic hive because anarchistic workers are less effective at removing worker laid eggs than normal bees and anarchists lay eggs that are more "queenlike" than wild type worker bees. Anarchistic workers with developed ovaries still attract aggression from other workers, showing that anarchists cannot completely evade worker policing. Anarchistic workers benefit from increased personal reproduction, but the colony is disadvantaged. These opposing selective forces may maintain anarchy at a low level in the population.
Index terms: anarchy, worker policing, honey bee.

[3459] CASTE POLYMORPHISM IN LABORATORY COLONIES OF *COPTOTERMES HAVILANDI* (ISOPTERA, RHINOTERMITIDAE)

R.C. Barsotti[1] & A.M. Costa-Leonardo[1], Department of Biology, Universidade Estadual Paulista, Av. 24-A, 1515, Rio Claro-SP, 1506-900, Brazil. E-mail: raquelcb@rc.unesp.br. Financial support: FAPESP (96/7991-5)

Coptotermes havilandi is a species of termite that has great economic importance in Brazil. Although it is a serious pest in the state of São Paulo, their reproductive biology and polymorphism are not well known. To contribute to the knowledge of *C. havilandi* basic biology we present the developmental pathways of the worker and soldier lines in laboratory incipient colonies. The colonies were established from alates collected during swarming flights in Rio Claro, SP, Brazil. Samples of larvae, workers, presoldiers and soldiers from these incipient colonies were fixed in FAA and later transferred to 70% alcohol. The specimens of these samples were first classified in different categories by size. Subsamples from each category were then randomly selected for morphological and biometrical studies. The termite head, pronotum and tibia were measured with a calibrated ocular micrometer and the number of antennal segments were counted and analysed through scanning electron microscopy. The post-embryonic development of *C. havilandi* includes two larval instars which are totally white and without any sclerotization. First instar workers moult from 2nd instar larvae and worker line development includes at least five worker instars. The first instar workers present some transitional characters, their mandibles are well-developed and weakly sclerotized and their gut is dark because it already contains solid food. These first worker instars present 11/12 antennal segments while last instars show 14. Soldiers are monomorphic. Results from these incipient colonies suggest that soldiers originate from 2nd and 3rd worker instars but in large field colonies they also derive from 4th and 5th worker instars.
Index terms: termite, instars, developmental pathways.

[3460] RELATIVE ABUNDANCE AND EXPLOITATION OF AVAILABLE RESOURCES BY APID BEES (HYMENOPTERA: APOIDEA) IN AN URBANIZED AREA

L. R. Bego[1], P. Darakjian[2], M. R. Mechi[1] & V. L. I. Fonseca[2], [1]Dept. Biologia, F.F.C.L.R.P. - USP, Av. Bandeirantes, 3900, 14040-901, Ribeirão Preto – Brasil, E-mail lrbego@ffclrp.usp.br; [2]Dept. Ecologia, IBUSP, R. Matão - trav. 14, 321, 05508-900, São Paulo – Brasil.

In an urbanized area, São Paulo city Brasil, surveys of apid bees were conducted. The location contained many cultivated, exotic plant species, besides native vegetation. Analysis of samples obtained periodically during a year (July/85 to June/86) through the capture of bees on flowers showed a predominance of seventeen bees species, out of a total of twenty species. The higher percentage found were *Paratrigona subnuda* (28.3%), *Apis mellifera* (24.6%) and *Trigona spinipes* (24.1%). Other representative species were *Tetragonisca angustula angustula* (8.6%), *Plebeia emerina* (3.4%), *Bombus morio* (2.1%), *Nannotrigona testaceicornis* (1.9%) and *Partamona helleri* (1.7%). The apid species visited mainly *Ocimum sellowii, Thumbergia grandiflora, Grevillea banskii, Dombeya burgessiae, Calliandra twedii, Rhododendron indicum, Euphorbia millii* var. *splendens, Impatiens balsamina*, and others. Data obtained from July/81 to June/82 in the same area with similar vegetation showed some degree of similarity related to relative abundance (Knoll, 1990). The predominant species of bees found in that area were *Trigona spinipes* (30.2%), *Apis mellifera* (27.0%), *Tetragonisca angustula angustula* (15.9%), *Paratrigona subnuda* (7.9%), *Nannotrigona testaceicornis* (7.5%), *Plebeia emerina* (3,8%), *Plebeia droryana* (2.7%) and *Friesella schrottky* (1.9%). Around 57% of available resources were the same exploited by apid bees collected in 1985/1986.
Index terms: Apidae, relative abundance, bee/plant, floral preference

[3461] BIOLOGICAL PERFORMANCE OF SILKWORM (*BOMBYX MORI*) FED WITH LEAVES FROM THREE MULBERRY HYBRIDS (*MORUS* SP.) FERTILIZED WITH ORGANIC MATTER OR ORGANIC MATTER PLUS GYPSUM

N. C. Bellizzi[1,4], L. C. Marchini[2] & R. Takahashi[3], [1]Unid. of Jardim, UEMS, Av. 11 de Dezembro s/n, Jardim, MS 79240-000, BRA, E-mail: ncbellizzi@bol.com.br; [2]Dept. of Entomology, ESALQ, USP, Av. Pádua Dias 11, Piracicaba, SP 13418-900, BRA; [3]Dep. de Zootecnia, FCAV, UNESP, Via de acesso Paulo Donato Castellane, km 5, Jaboticabal, SP 14870-000, BRA. [4] Doctor Student of Dept. of Entomology, ESALQ, USP.

The biological performance of the silkworm (*Bombyx mori* L.) was studied on the summer and autumn of 1999, in Jaboticabal - SP. The statistical analysis was done in a factorial design with 3 mulberry hybrids: IZ 64, IZ 19/13 and IZ 56/4, and 3 fertilizations: T1 – control (without fertilization); T2 - fertilized with organic matter (2 kg of chicken manure/plant) and T3 - organic matter plus gypsum (2 kg of chicken manure + 250 g of gypsum/plant) in completely randomized blocks. The weight gain in the five instars of the silkworm (mg); duration of the five instars (h); duration of the four rests (h); silk glands weight gain of the of silkworm in the 3rd, 4th and 5th instars (mg); weight of the cocoons (g) and net silk content in the cocoons (%) were determined. The average weight gain of the silkworm, fed with the hybrid IZ 56/4 in the five instars were statistically higher than those fed with the other two hybrids. In term of the fertilization, the silkworm fed with leaves of the plants fertilized with organic matter plus gypsum (T3) and fertilized with organic matter (T2) were statistically superior the control (T1). The average duration of the instars of silkworm fed on IZ 56/4 leaves had shorter duration of the instars than those fed on IZ 64. This latter, by its turn, presented instar with shorter duration as compared to IZ 19/13. The silkworm fed with leaves of the T3 and the T2 presented duration of the instar inferior the T1. Silkworm fed with IZ 56/4 leaves had shorter duration of the rests than those fed on IZ 64. This latter, by its turn, presented rests with shorter duration as compared to IZ 19/13. The silkworm fed with leaves of the T3 and the T2 presented duration of the rests than those fed with the other two treatments. In the 5th instar the silkworm fed with leaves of the IZ 56/4 presented silk gland weight gain statistically higher than those fed with IZ 64 and IZ 19/13. The larvae fed with leaves of the T2 and the T3 were heavier than the T1. In the average weight of the cocoons, the silkworms fed with the IZ 56/4 leaves were superior that the IZ 64 and this superior that the IZ 19/13. In the fertilization, the larvae of the T3 leaves were statistically superior that the T2 and this was statistically superior that the T1. The average net silk content in the cocoons of the IZ 64 and IZ 56/4 were statistically superior that the IZ 19/13. For the results, the hybrid IZ 56/4 and organic matter plus gypsum was better to silkworm performance.
Index terms: biological performance, *Bombyx mori* L., organic matter, gypsum.

[3462] DEVELOPMENT AND COCOON YIELD OF SILKWORM (*BOMBYX MORI*) FED WITH LEAVES FROM MULBERRY (*MORUS ALBA*) FERTILIZED WITH LIMESTONE AND GYPSUM ASSOCIATED WITH NPK AND MICRONUTRIENTS

N. C. Bellizzi[1,4], R. Takahashi[2] & E. C. A. de Souza[3], [1]Unid. de Jardim, UEMS, Av. 11 de Dezembro s/n, Jardim, MS 79240-000, BRA, E-mail: ncbellizzi@bol.com.br; [2] Dep. of the Animal Science, FCAV, UNESP, Via de acesso Paulo Donato Castellane, km 5, Jaboticabal, SP 14870-000, BRA; [3]Dep. of the Soil and Fertilization, FCAV, UNESP. [4] Doctor Student of Dept. of Entomology, ESALQ, USP.

The influence of the NPK and micronutrients associated the limestone and gypsum in weight gain in 5th instar, cocoon weight and net silk content in the cocoons of the silkworm (*Bombyx mori* L.) was studied in spring, summer and autumn of 1996, in Jaboticabal - SP. The treatments follow the completely randomized blocks design with 5 repetitions, in the form: T_1 = control (without fertilization); T_2 = N, P and K; T_3 = micronutrients (Fe, Zn, Mn, B, Cu and Mo); T_4 = limestone; T_5 = limestone + NPK; T_6 = limestone + micronutrients; T_7 = gypsum; T_8 = gypsum + NPK and T_9 = gypsum + micronutrients. The fertilizations with N, P and K, for every tree assays, were realized follow the recommendation of the Okino (1982). The doses were: N = 30 g of the N /plant; P = 24 g of the P_2O_5/plant and K = 30 g de K_2O/plant. The fertilization with micronutrients utilized the product Nutrisan, in dose of the 4,5 g of the product/plant. The limestone was calculated for the method of the saturação por bases, in dose of the 4 t/ha. The gypsum follow the recommendation of the Sousa et al. (1995), for the soil texture, in dose of the 1800 kg/ha of the gypsum for soils of the medium texture. The results showed that in weight gain of the silkworm in 5th instar, the larvae fed with leaves fertilized with gypsum + NPK (2966 mg) were statistically superior (P<0,05) than those the control (2721 mg), limestone (2676 mg) and limestone + micronutrients (2729 mg). In average cocoon weight, the silkworm fed with leaves fertilized with gypsum + NPK (1,73 g) produced cocoons statistically superior (P<0,05) than those the control (1,60 g), NPK (1,60 g), micronutrients (1,64 g), limestone (1,59 g), limestone + NPK (1,64 g) and of the gypsum (1,63 g). In net silk content in the cocoons don't had differences between the treatments. Can be conclude

[3463] NUTRITIONAL INDICES OF SILKWORM (*BOMBYX MORI*) FED WITH LEAVES FROM THREE MULBERRY HYBRIDS (*MORUS* SP.) FERTILIZED WITH ORGANIC MATTER OR ORGANIC MATTER PLUS GYPSUM

N. C. Bellizzi[1,4], L. C. Marchini[2] & R. Takahashi[3], [1]Unid. de Jardim, UEMS, Av. 11 de Dezembro s/n, Jardim, MS 79240-000, BRA, E-mail: ncbellizzi@bol.com.br; [2]Dept. of Entomology, ESALQ, USP, Av. Pádua Dias 11, Piracicaba, SP 13418-900, BRA; [3]Dep. de Zootecnia, FCAV, UNESP, Via de acesso Paulo Donato Castellane, km 5, Jaboticabal, SP 14870-000, BRA. [4] Doctor Student of Dept. of Entomology, ESALQ, USP.

The nutritional indices in the 3rd, 4th and 5th instars of the silkworm (*Bombyx mori* L.) fed with leaves of the hybrids IZ 64, IZ 19/13 and IZ 56/4 fertilized with organic matter (2 kg of chicken manure/plant) or organic matter plus gypsum (2 kg of chicken manure + 250 g of gypsum/plant) or a control (without fertilization)were studied in summer and autumn of 1999. Was utilized the statistical analysis with fatorial design with 3 hybrids and 3 fertilization in completely randomized blocks. Analyzing the relative intake rate (RCR); relative metabolic rate (RMR); relative growth rate (RGR); feed efficiency measured from ingested biomass (ECI); feed efficiency from digested biomass (ECD) and apparent digestibility (AD). In the 3th instar, the hybrid IZ 56/4 was statistically superior the IZ 64 and IZ 19/13, in RCR; RMR and AD. Although the hybrids IZ 64 and IZ 19/13, were statistically superior the IZ 56/4 in RGR; ECI and ECD. In terms of the fertilization, the organic matter plus gypsum (T3) was statistically superior than those the control (T1) and the fertilization with organic matter (T2), in RCR; RMR and AD. Although the T1 and the T2, were statistically superior the T3 in ECI and ECD. In 4th instar, the hybrids IZ 19/13 and IZ 56/4 were statistically superior the hybrid IZ 64, in RCR and RMR. In RGR, the IZ 56/4 was statistically superior the IZ 19/13 and this was superior the IZ 64. In terms of fertilization, the T3 was statistically superior the T2 and this was statistically superior the T1 in RMR and AD. However in RCR and RGR, the T3 was statistically superior the T1. In ECD the T1 and T2 was statistically superior the T3. In 5th instar, don't have differences statistically between the hybrids in RCR, RMR, ECI and ECD. In RGR, the hybrids IZ 64 was statistically superior the hybrids IZ 19/13 and IZ 56/4. In AD, the IZ 64 was statistically superior the IZ 19/13. In terms of the fertilization, the T3 was statistically superior the T1 and the T2 in RCR and in RMR. In AD, the T3 was superior the T1. In RGR and ECD, the T2 was statistically superior the T3. In ECI, don't have differences statistics between the treatments.
Index terms: nutritional indices, *Bombyx mori* L., organic matter, gypsum.

[3464] RHYTHMICITY STUDIES OF THE CLEANING TASK PERFORMED BY WORKERS IN *SCAPTOTRIGONA* AFF *DEPILIS* (HYMENOPTERA, APIDAE, MELIPONINAE)

S. Bellusci[1] & M. D. Marques[2], [1]Depto. de Biologia, Faculdade de Filosofia, Ciências e Letras de Ribeirão Preto, USP, Av. Bandeirantes, 3900, cep 14040-901, SP, Brasil, E-mail bellusbe@usp.br; [2]Museu de Zoologia, Universidade de São Paulo, Av. Nazareth, 483, São Paulo, SP, Brasil.

The Apinae and Meliponinae show a kind of division of labor, whose sequence of tasks is performed according to the age of workers and the necessities of the colony. Moore *et al* (1998), studied the integration of circadian rhythms and division of labor on honey bees, concluded that young workers that performed tasks related to the brood and nest maintenance are arrhythmic, while the circadian rhythmicity would develop on the pre-forage phase reaching its maximum condition on the foraging phase. In this phse there is a concentration of this activity during the photophase and 'rest breaks' at night. In the pre-forage phase the workers continue their behavioral routines 24hours/day, however increasing in the frequence of rest intervals was observed. This work intends to characterize the ocurrence interval and the cleaning task periodicity of the colony performed by workers of *Scaptotrigona* aff *depilis*. The exit tube of *S.* aff *depilis* colony was observed during 3 days consecutive along 24 hours. Data collection was based on direct observation of behavioral traits and video recorded behaviours as well. The observations were done every 3 hours. Inside the laboratory, the colony was constantly maintened dark condition, 28°C and 65% relative humidity. Food was offered *ad libitum*. It was observed that workers carried the waste away in well delimited intervals. This behaviour occured from 10:00 to 16:00h in first two days, and in the last day this activity started from 4:00h and extended until 16:00h. This fact can be related to the 'maskarament' effect of experimental condition, because the exit tube was artificially blocked obstructing the access to external environment, therefore there was a large waste accumulation in the inner of the colony. By means of marked individuals, it could be noted that workers which carried waste belonged to a restrict group and, apparently, they went out the colony to perform this task exclusively. In the tasks performed before the colony cleaning, the workers did not leave the nest and, therefore, there was not direct contact with environmental cues. The fact of the workers of *Scaptotrigona* aff *depilis* performed the of the colony cleaning in very well delimited intervals can be related with the development of the circadian rhythmicity. This activity precedes the foraging and occurs during photophase only, as suggested Moore *et al* (1998), a development on the response level of the entraining signals during this phase.
Index terms: *Scaptotrigona* aff *depilis*, division of labor, rhythm, wast.

[3465] ERADICATION OF THE *Coptotermes havilandi* COLONIES BY CURATIVE AND PREVENTIVE TREATMENT OF INFESTED RESIDENTIAL BUILDINGS IN URBAN AREAS IN THE CITIES OF NITEROI AND RIO DE JANEIRO (RJ), BRAZIL

A. C. Bicalho[1], E. L. Jacintho[1], G. T. Araújo[1], E. B. Menezes[1] & E. L. Aguiar-Menezes[2], [1]CIMP "CRG"/ UFRRJ, BR 465 – km 7, Seropédica, RJ 23890-000, Brazil, E-mail ebmen@zaz.com.br; [2]Embrapa Agrobiologia, Caixa Postal 74538, Seropédica, RJ 23980-000, Brazil, E-mail menezes@cnpab.embrapa.br.

The Asian subterranean termite *Coptotermes havilandi* (Isoptera: Rhinotermitidae) was introduced in Brazil between 1915 and 1923. It is the most serious pest in urban areas in Brazil, mainly in its metropolises, such as São Paulo and Rio de Janeiro. The objectives of this study were to observe the behavior of *C. havilandi* foraging in buildings, and to evaluate the efficiency of the curative/preventive treatments for eradication of this termite. Residents of buildings located in Niteroi and Rio de Janeiro cities (RJ) were feared for your properties because termites were damaging them. They asked us for efficient control against the termites. After the inspections of the buildings, we detected the presence of *C. havilandi*. We observed that this termite moves upward into buildings by finding protected passage (e.g. conduit inlet) from the soil to the source of food (wood) or by making connecting earth tunnels. In the majority of the buildings, *C. havilandi* constructed secondary nests mainly in apartments of the top floor. In urban areas, subterranean termites are usually controlled by insecticides. We used these products as curative and preventive treatments. The apartments and the common areas of infested buildings were treated with a solution of the insecticide chlorpiriphos plus deodorized kerosene at the recommend dosage by the manufacturer, and applied by spraying and forced injection. Wooden stakes (pine) were placed strategically on the gardens and around the buildings. Every six months, the stakes were selected randomly and inspected up to five years. We observed that three buildings were reinfested by *C. havilandi* in the same year of the treatments. In the other six buildings, the colonies of *C. havilandi* were completely controlled, however, they started to be gradually reinfested 18 months later. The results showed that the guarantee of the termite control services usually provide to the consumers should not exceed more than 18 months, opposing the usual guarantee of five years.
Index terms: *Coptotermes havilandi*, curative/preventive treatment, guarantee service, infested buildings, wooden stakes

[3466] FORAGING BEHAVIOR OF THE SUBTERRANEAN TERMITE *COPTOTERMES HAVILANDI* (ISOPTERA: RHINOTERMITIDAE) IN RESIDENTIAL AREAS

A. C. Bicalho[1], E. B. Menezes[2], A. I. Ciociola[1] & E. L. Aguiar-Menezes[3], [1]Dept. de Entomologia, Univ. Federal de Lavras, C. Postal 37, CEP 37200-000, Lavras, MG, Brasil, E-mail acbicalho@yahoo.com, ciociola@ufla.br; [2]CIMP "CRG"/UFRRJ, CEP 23851-970, Seropédica, RJ, Brasil, E-mail ebmen@zaz.com.br, [3]Embrapa Agrobiologia, BR 465 KM 07, C. Postal 74505, CEP 23890-000, Seropédica, RJ, Brasil, E-mail menezes@cnpab.embrapa.br

Termites are the most important household insect pests in Brazil and *Coptotermes havilandi* is the most important urban pest and is by far the most destructive among all other species of termites introduced and established in Brazil. Despite their constant presence, research on their ecology and behavior is very scarce. Subterranean termites normally colonize in the ground and move upward into buildings searching for food (wood or any other cellulose product). Field studies of subterranean termites are typically carried out by using cellulose baits placed in the ground. The objective of this study was to evaluate the foraging behavior of *C. havilandi* using ground wood stakes. This study was carried out in Seropedica, state of Rio de Janeiro, Brazil from October, 1999 to January, 2000. Fourteen residences were selected, and 25 wooden stakes (*Pinus* sp.) measuring 5 by 5 by 28cm were driven 25cm into the soil in a 25m^2 area for each residence. Stakes were placed at 1m apart and monitored monthly. The local climate is characterized as tropical, warm and humid, hottest months (November to February) with temperatures ranging from 24 to 32 °C. Soil covering of the residential area is characterized by spontaneously grown natural vegetation (residence 10, 11 and 13) or trees with upper canopy more than 20m high such as mango (*Mangifera indica*), "casuarina" (*Casuarina* spp), "Jaca" fruit tree (*Artocarpus integrifoli*) and "angico branco" (*Anadenanthera colubina*) (residences 02, 03, 07, 08, 12 and 14). The topography is from 2 to 5% in acclivity and the soil characterized as sand-clay. Results demonstrates that *C. havilandi* forages the area in ascendant direction following the slope of the soil. It was found more than 70% infestation of the stakes by *C. havilandi*) during the hottest and most humid months, and in the shaded areas. The highest infestation levels recorded were 92, 88 and 80% for the residences 2, 3, and 7 respectively, in December, 1999.
Index terms: stake traps, covering vegetation, weather.

[3467] SELECTION OF DYES FOR MARKING THE SUBTERRANEAN TERMITE *COPTOTERMES HAVILANDI* (ISOPTERA: RHINOTERMITIDAE) IN LABORATORY

A. C. Bicalho[1], A. I. Ciociola[1] & E. B. Menezes[2], [1]Dept. de Entomologia, Univ. Federal de Lavras, C. Postal 37, CEP 37200-000, Lavras, MG, Brasil, E-mail acbicalho@yahoo.com, ciociola@ufla.br; [2]CIMP "CRG"/UFRRJ, CEP 23851-970, Seropédica, RJ, Brasil, E-mail ebmen@zaz.com.br

Termites are a serious economic problem in urban, suburban and rural areas in Brazil and little is known about their ecology and behavior, mainly with respect to their feeding behavior (forage). Marking techniques are required for foraging studies of termites. A dye marker must not cause substantial mortality (both immediate and delayed) and last long enough (at least, 7days) in order to allow data recording. This study was done to evaluate dye markers suitable for *Coptotermes havilandi*. Two histological dyes were used under laboratory conditions: Nile Blue A and Sudan Red 7B at 0.05, 0.25, 0.50 and 0.75%. The experimental scheme was a 2x4 complete randomized design with 9 treatments and 3 replications. Solvents for the dyes were 95% ETOH for Nile Blue A and acetone for Sudan Red 7B. Dye solutions were evenly poured onto a filter paper placed in a Petri dish, and allowed to evaporate for 24h. A total of 24 experimental units were prepared. Subsequently, 50 workers were introduced into each Petri dish and stored in a climatic chamber at 28 ± 1 °C and 97% RH. The workers were forced fed on treated paper for 24h followed by a transfer of 30 stained workers to a Petri dish containing a moistened filter paper. Observations were made every 24h and up to 168h. Stained workers were removed, and the number of dead and surviving ones recorded. Both dyes remained visible at all concentrations. Mortality of stained workers was around 100% after 4 days (24, 48, 72 and 96h) of feeding. There was no significant mortality at the lowest concentrations of dyes (0.05 and 0.25%), when compared to the highest ones (0.50 and 0.75%) after 24 h. The mortality rate of the workers in control was always lower than in the treatments at different concentrations. Although Nile Blue A and Sudan Red 7B exhibit good characteristics for a suitable marker for foraging studies of subterranean termites, they were not adequate markers for *C. havilandi*.
Index terms: mark-selection, mortality rate.

[3468] WOOD-CONSUMPTION RATE BY THE SUBTERRANEAN TERMITE *COPTOTERMES HAVILANDI* (ISOPTERA: RHINOTERMITIDAE) IN RESIDENTIAL AREAS

A. C. Bicalho[1], E. B. Menezes[2] & A. I. Ciociola[1], [1]Dept. de Entomologia, Univ. Federal de Lavras, C. Postal 37, CEP 37200-000, Lavras, MG, Brasil, E-mail acbicalho@yahoo.com, ciociola@ufla.br; [2]CIMP "CRG"/UFRRJ, CEP 23851-970, Seropédica, RJ, Brasil, E-mail ebmen@zaz.com.br .

The majority of tests to determine wood-consumption rates by subterranean termites have been made under laboratory conditions; however, they are limited due to underestimate the results. A suitable alternative is to develop field tests using wooden traps. We describe a method, which utilizes wooden blocks placed in the ground to monitor field-feeding activity of *Coptotermes havilandi* in residential areas. Our monitoring station is composed of PVC tube (15 cm of diameter by 15 cm of height) placed in a hole dug in the soil and covered by a PVC lid. A block made of seven 7 by 5 by 5 cm wooden pieces (*Pinus* sp.) 1 cm apart was placed inside the tube. These traps were set in three different sites (A, B and C) in a residential area in Seropedica, state of Rio de Janeiro, Brazil were used for each site. Termite activity was monitored monthly in three stations. Sixty days after setting up the stations, the blocks were taken to the laboratory and the termites present separated from wood and debris. The difference between the humid weight of the blocks by the date of setting up the stations and after three months of termite activity was used as an indicator of the feeding activity of the colony. The number of feeding days of termites in the stations compared to termite activity was used to evaluate the wood-consumption rate (g wood/station/day). The site "C" was discarded because there was no termite activity during the period of the study. The wood-consumption rate recorded for *C. havilandi* ranges from 1.03 to 3.43g/station/day for the site "B", and from 5.14 to 6.90g/station/day for site "A". The developed trap was considered suitable for field studies of this termite, allowing the obtaintion of results within 3 months.
Index terms: wooden traps, monitoring station, colony activity.

[3469] WORKERS OF THE POLYGYNOUS PONERINE ANT *GNAMPTOGENYS STRIATULA* DO NOT CARE PREFERENTIALLY FOR SISTER LARVAE

R. Blatrix & P. Jaisson, Laboratoire d'Ethologie Expérimentale et Comparée (CNRS 7025), Université Paris 13, 93430 Villetaneuse, France, E-mail: Pierre.Jaisson@leec.univ-paris13.fr.

Kinship theory (Hamilton 1964) applied to hymenopteran societies contribute to our understanding of the evolutionary origin of sociality. Hymenopteran haplodiploid sex determinism results in relatedness asymmetry: a female is more closely related to her sister than to her daughter. Consequently, under monogyny and monandry (one queen mated with one male per colony), a female gains benefit in rearing sisters in spite of reproducing herself. This benefit is lowered if several queens contribute to the progeny (polygyny) as in many ant species (Keller 1993). According to kinship theory, we might expect that a worker will tend preferentially full sisters in such societies. *Gnamptogenys striatula* is a polygynous ponerine ant from South America. We constituted artificial nests, each containing two nestmate matrilines of workers individually labelled and two matrilines of larvae, sisters of the workers. One matriline of larvae was dyed with fat red. As a consequence, each worker from an artificial nest had choice between tending sister larvae or non sister larvae. After several hours of direct observation, we found that workers did not care preferentially for sister larvae. Thus, the polygynous colony of *G. striatula* may be assimilated to a mutualistic society where all individuals co-operate through altruistic behaviour. An Hamiltonian process was at the origin of sociality among the ant ancestors. Further social evolution might have follow other ways which result in new emerging social systems, like mutualism.

Index terms: Formicidae, behaviour, polygyny, mutualism, nepotism

[3470] ANTIMICROBIAL COMPOUNDS FROM ANTS AND OTHER INSECTS AND THEIR ROLE IN THE EVOLUTION OF SOCIALITY

D.A. Briscoe, J.A. Mackintosh, J. M. Clarke, M.R. Gillings, D.A. Veal, & A.J. Beattie, Key Centre for Biodiversity and Bioresources, Dept of Biological Sciences, Macquarie Univ., NSW 2109, Australia.

Ants have two mechanisms of defense against microbial attack. The first is the secretion of anti-microbial compounds from the metapleural glands. These have been identified in a variety of species including the Australian Bull ant, *Myrmecia gulosa*. The importance of these secretions has been suggested by isolating males of this species, which do not possess the glands, from workers which do. After a few weeks isolated males have much larger microbial loads than those maintained with workers. We have also demonstrated a second line of defence in ants - an immune system. Bacterial challenge of Bull ant workers generated inducible O-glycosylated proline-rich antibacterial peptides. The presence of two anti-microbial defence systems in ants suggests the importance of microbial attack and invasion in their evolution and ecology. Indeed, the presence of powerful antibiotic systems in the other social insects, demonstrated by our group and others, suggests that elaborate anti-microbial systems were a pre-requisite for the evolution of sociality. We are continuing a comparative study of solitary, semi-social and eusocial insects in pursuit of this hypothesis.

Index terms: Antibacterials, Antifungals, Immunity, Colonies, Termites

[3471] INSURANCE AGAINST ORPHANING: A SOURCE OF FEMALE BIASED SEX ALLOCATION IN AN ALLODAPINE BEE

Nicholas J. Bull & Michael P. Schwarz, School of Biological Sciences, Flinders University of South Australia, GPO Box 2100, Adelaide 5001, Australia

Sources of population wide sex allocation bias have almost entirely been attributed to non-linear fitness interactions from intersexual or intrasexual interactions among siblings. Intra-sexual interactions, principally Local Mate Competition and Local Resource Competition, are the most widely reported sources of bias. Positive interactions are less well known, but include the Helper Repayment Model (applied to birds with helpers at the nest) and Local Fitness Enhancement (applied to the allodapine bee *Exoneura robusta*). In allodapine bees, brood are reared progressively throughout their development and are not enclosed within protective cells. They depend on the continued presence of adults for feeding and defence. If parental females die before all brood have become adults, older adult daughters will feed and protect their younger siblings. Therefore, because of the risk of orphaning, parents are expected to make the oldest brood member a daughter to ensure the survival of her younger siblings. This prediction was assessed by examining sex allocation and the order of brood development in the allodapine bee *Exoneura nigrescens*. Sex allocation in *E. nigrescens* is female biased with the strongest bias in the smallest clutches. The insurance model predicts that allocation should involve production of a daughter first, followed by unbiased allocation. Predicted and observed allocation patterns show very close agreement, supporting this model. Whether or not investment in the first 'insurance' daughter should be regarded as sexual investment is problematic. By helping to rear her younger siblings she adopts a 'worker-like' (and therefore non-reproductive) role. However, if she survives until the following season she is likely to become the colony's new queen (and therefore the primary reproductive). In analogy to the Helper Repayment Model, the insurance daughter does help to repay her own costs of production to the parent, but if she becomes queen in the following season, the aid she provides to her younger siblings is repaid to her in terms of a future worker force.

Index Terms: *Exoneura*, sex ratios, female biased sex ratios, allodapine bees

[3472] ATTRACTION/REPELLENCE OF SUBTERRANEAN TERMITES WITH PLANT EXTRACTS

E. A. Castiglioni[1], J. D. Vendramim[2] & S. B. Alves[2], [1]Cátedra de Cereales y Cultivos Industriales, Universidad de la República Oriental del Uruguay, Ruta 3 km 373, CP 60000, Paysandú, Uruguay, E-mail bbcast@eemac.edu.uy; [2]Departamento de Entomologia, Fitopatologia e Zoologia Agricola, Escola Superior de Agricultura "Luiz de Queiroz", Universidade de São Paulo, Av. Pádua Dias 11, Piracicaba, SP, Brasil, E-mail jdvendra@carpa.ciagri.usp.br.

Subterranean termite pests of sugarcane are difficult to locate and manage. Termite control using cardboard baits including toxicants is based on the utilization of substances which are not rejected by the insects after the initial attraction. These toxicants should also affect survival of individuals in the colony or affect their behavior in order to improve the control by other means (e.g., entomopathogenic fungi). Laboratory choice tests were carried out using different containers and techniques. Plastic containers, with or without agar, and containing cardboard disks, soaked or not with the test substance, were used in the experiments. Tests showed that termites can find the cardboard disks used as food source, and to choose between test products and control. Extracts from neem (*Azadirachta indica*) leaves and seeds, neem seed oil and an extract from seeds of *Trichilia pallida* were tested. Almost all of them were neutral or minimally attractive to insects, since signs of rejection were not observed. Insects showed some repellence to a 5% (w/v) extract of neem leaves in a test employing arenas without agar.

Index terms: *Heterotermes tenuis*, neem, *Trichilia pallida*, choice tests

[3473] EFFECTS OF PLANT EXTRACTS AND ENTOMOPATHOGENIC FUNGI ON SUBTERRANEAN TERMITES

E. A. Castiglioni[1], J. D. Vendramim[2] & S. B. Alves[2], [1]Cátedra de Cereales y Cultivos Industriales, Universidad de la República Oriental del Uruguay, Ruta 3 km 373, CP 60000, Paysandú, Uruguay, E-mail bbcast@eemac.edu.uy; [2]Departamento de Entomologia, Fitopatologia e Zoologia Agricola, Escola Superior de Agricultura "Luiz de Queiroz", Universidade de São Paulo, Av. Pádua Dias 11, Piracicaba, SP, Brasil, E-mail jdvendra@carpa.ciagri.usp.br.

Subterranean termites are important pests of sugarcane in Brazil. Characteristics such as subterranean life habits, difficult-to-find nests and social behavior make their control difficult. Recently, control focus has shifted to the use of attractive baits containing toxic substances. In order to increase termite mortality, the substance must not be highly toxic, but should be effective in the nest and transmissible among individuals in the colony. Some plant extracts have a slow action but are efficient for the control of several insect species. Social habits of termites could aid the transmission of fungal entomopathogens among individuals in the nest. The effects of aqueous extracts from different plant parts and plant species of Meliaceae on mortality and behavior of the subterranean termite *Heterotermes tenuis* were tested. Extracts were evaluated alone and associated with the entomopathogenic fungi *Beauveria bassiana* (strain 634) and *Metarhizium anisopliae* (strain 1037). High termite mortality was obtained in laboratory after insects fed for three days on cardboard disks treated with low concentrations (0.5-1.0% v/v) of a neem (*Azadirachta indica*) leaf extract (Nimkol-L). At 0.2% (v/v) the neem extract had synergistic effect with both fungal strains sprayed at two concentrations ($1x10^7$ and $5x10^8$ conidia/ml). An infusion (extract in boiled water) of neem seed had a low level of synergism with the fungi, although no signifficant mortality was observed with the plant substance alone in a 5% (w/v) concentration. The infusion affected the activity and the morphological aspect of the termites, probably explaining their increased susceptibility to the entomopathogens. Extracts (5% w/v) from different parts of *Melia azedarach* and *Trichilia pallida* did not cause signifficant effects on insect behavior or survival. Nimkol-L was compatible with both fungal isolates at 0.2% concentration. This product affected the fungi at the 1% concentration and totally inhibited the fungal development at the 5% concentration. At 0.5%, Nimkol-L was compatible with *B. bassiana* but affected growth of *M. anisopliae*.

Index terms: *Heterotermes tenuis*, neem, Meliaceae, *Beauveria bassiana*, *Metarhizium anisopliae*

[3474] ANOMALOUS TERMITE DIVERSITY PATTERN IN HISTORICAL FRAGMENTS OF AMAZONIAN SAVANNAS

R. Constantino[1] & O.F. DeSouza[2], [1]Dept. Zoologia, Univ. Brasília, Brasília, DF, 70910-900, Brazil, Email constant@unb.br; [2]Dept. Biologia Animal, Univ. Fed. Viçosa, Viçosa, MG, 36571-000, Brazil, Email og.souza@mail.ufv.br.

Amazonian savannas occur as islands in various parts of the Amazon, many of them being similar to the Cerrado of central Brazil. They do not have a clear association with climatic or pedologic conditions, and are best explained as relictual fragments of the savannas that covered a large part of the Amazon during the dry periods of the Pleistocene. These savannas are an excellent model to study the long-term effects of habitat fragmentation. As parte of larger project on effects of fragmentation on the biodiversity of the Cerrado, we are sampling termites in fragments of 3 size classes: 100 ha, 1000 ha and 10000 ha, at Vilhena, Rondonia State, Brazil. Three transects of 10 X 50 m were sampled in 3 fragments of different sizes. In total, 48 species were recorded, 26 in the 100 ha fragment, 13 in the 1000 ha fragment and 10 in the 10000 ha fragment. A regression analysis shows that the number of species decreases with fragment size ($p=0.019$, $r2=0.999$). The number of colonies sampled per transect (i.e., density) did not show any significant difference among sites. The species belong to families Kalotermitidae (1), Rhinotermitidae (3), Serritermitidae (1) and Termitidae (43), including Apicotermitinae (5), Nasutitermitinae (28), and Termitinae (10). The dominant genus was *Nasutitermes* (7 spp.), and *N. coxipoensis* the most frequent species, especially in the larger fragment. Other frequent species were *Armitermes euamignathus* and *Heterotermes tenuis*. The unexpected reverse correlation between diversity and fragment size is real and has to be explained by other factors. Based on a preliminary, qualitative assessment of the study sites, we concluded that two factors can explain most of this discrepancy: vegetation density and soil type. The smallest fragment is located on top of latosol, with high proportion of clay, while the others are located on sandy soils. This seems to be the main factor and some species are absent or rare in one soil type and very abundant in the other. Finally, the largest fragment has a lower vegetation density than the other two, being mostly grassland with fewer trees and shrubs, which may exclude arboreal nesters and wood-feeding species. The important conclusion is that, for total diversity, quality of the fragment may be more important than size.

Index terms: termites, diversity, savannas, Cerrado.

[3475] ADDITIVE PRIMER AND RELEASER EFFECTS OF BROOD AND QUEEN PHEROMONE ON ADULTS WORKERS IN THE HONEY BEE

Y. Le Conte, J.M. Bécard, Ch. Brillet, I. Léoncini & D. Crauser, I.N.R.A. Unité de Zoologie et d'Apidologie, Laboratoire de Biologie et Protection de l'Abeille, Site Agroparc, 84914 Avignon cedex 9, France, E-mail leconte@avignon.inra.fr.

In the honey bee *Apis mellifera*, queen and brood pheromones act on the social regulation of the colony. Individually, the two different pheromones have been shown to play both releaser and primer effects on behavior and physiology of adult worker bees. As in natural conditions those pheromones are produced simultaneously in the honey bee colony, we were interested to look at the additive or synergetic effects of the two pheromones when given together to the honeybees. Experiments were set up using standardized colonies including 2,000 bees to test effects of the two different pheromones given individually or together. We looked at effects of the two pheromones on adult workers, particularly on hypopharyngeal gland activity, on labial gland development, on ovaries development and the number of immatures laid by the workers, and also on age at first foraging of treated bees. We found clear additive effects of the queen and brood pheromones on those criteria. Possible mechanisms underlying effects of the pheromones on worker physiology will be discussed.

Index terms : *Apis mellifera*, brood pheromone, queen pheromone, chemical ecology.

[3476] MICROMORPHOLOGY OF A NEST OF *CORNITERMES CUMULANS* (KOLLAR) (ISOPTERA:TERMITIDAE)

M. I. Cosarinsky[1], 1. Laboratorio de Icnología, Museo Argentino de Ciencias Naturales, Angel Gallardo 470, (1405) Buenos Aires, Argentina.

The micromorphology of a nest of *Cornitermes cumulans* (Termitidae: Nasutitermitinae) has been qualitatively analized by means of thin sections studied with a petrographic microscope. These studies reflect different aspects of the building behavior of these mound-building termites: the materials utilized and their spatial arrangement in different sectors of the nest. In addition, the worker's hindgut content was examined and the mandible maximun opening was measured to infer the way in wich the building materials are reworked and carried to the nest. The building materials are basically soil mineral grains smaller than the mandibular maximun opening and fecal material similar to that found in the worker's hindgut. The groundmass (cementing mass) is composed of amorphous, organic, fine material and clay (fecal material). The skeleton of the outer and middle walls of the mound is composed of quartz grains of very fine to very coarse sand. The hive's skeleton is composed of plant residues, such as pieces of leaves and stems. Skeletons are composed of particles larger than those found in the worker's hingut and smaller than the mandible maximun opening, suggesting that they are carried with the mandibles. There are different types of microstructure: vughy structure in the outer wall, pellicular grain structure in the walls of the channels and vughs of the middle sector, and platy structurein the central hive, the inner sector of the nest. Some pedofeatures are easily recognizable, such as coatings or linings of organic matter on the internal surface of vughs and channels, intercalations or strands of organic matter crossing the outer casing, and lenticular acumulations of clayey-quartzose mortar in the inner sector of the nest. There are numerous fragments of insect cuticula included in the groundmass. Studies on termite nests, in which the metodology used in micromorphology of soils are applied, are very few and dealing with African and Australian species. This is the first report for a Neotropical species. Results may be useful not only for studies on termite behavior and systematics, but also for soil and agricultural sciences and insect paleoichnology.

Key words: Insecta, termites, buildings

[3477] DAMAGES CAUSED BY THE *NASUTITERMES* SPP. (ISOPTERA : TERMITIDAE) IN *ERIOTHECA CRENULATICALYX* (BOMBACACEAE) AT THE UNIVERSIDADE FEDERAL DA PARAÍBA, JOÃO PESSOA (PB), BRAZIL

A.J. Creão-Duarte[1]; A.G. Bandeira[1]; A. Vasconcellos[1]; R. Lima[1]; E.B. Menezes[2], [1]CCEN "DSE"/ UFPB, João Pessoa, PB, Brazil, E-mail creao@dse.ufpb.br; [2]CIMP "CRG"/ UFRRJ, BR 465 – km 7, Seropédica, RJ 23890-000, Brazil, E-mail ebmen@zaz.com.br.

The Nasutitermes genus is considered the main pest from the Termitidae family since 1997, in João Pessoa City, Paraíba State. It happens based in its attack and damage in constructions and other materials containing cellulose compounds, as trees. In this case, the termites' attack, firstly, the root system of the trees. After that, the tree will be injured and then it can allow the attraction of other insects. According with the UNESCO, João Pessoa is the second city in numbers of trees of the world. Among the trees from the statistics we can found the *Eriotheca crenulaticalyx*, native from the Atlantic Forest. Those trees are at the Universidade Federal da Paraíba Campus and they suffered the attack of the *Nasutitermes* spp. We were called there to inspect it. The conclusion that we got after the inspection was the presence of the *Nasutitermes* spp., the responsible by the first damages. But more insects were inside the tree: the *Chalcolepidius zonatus* (Coleoptera : Elateridae), the *Euchroma gigantea* (Coleoptera : Buprestidae) and the *Microcerotermes* spp. (Isoptera : Termitidae). The other insects, for sure, were attracted by facilities given by the *Nasutitermes* spp. We realized that the high incidence of the insects happens because of the absence of biodiversity at the Campus, as in the forest where the attacks don't happen. The accepted hypothesis is that the human being devastation cause ecosystem instability with the trees, in this case, they will be more susceptible to the insects' attack.
Index terms: *Nasutitermes* spp., Atlantic Forest, attraction, human being devastation, ecosystem instability

[3478] EPIGEIC ANT FAUNA OF AREAS WITH HIGH COPPER CONCENTRATION

E. Diehl-Fleig, M. E. de P. Lucchese, C. E. D. Sanhudo & Ed. Diehl-Fleig, Lab. de Genética: Setor de Insetos Sociais, C.C. da Saúde, Univ. do Vale do Rio dos Sinos. C.P. 275 São Leopoldo 93001-970 RS, Brasil. E-mail: ediehl@cirrus.unisinos.br.

Ants form a numerically abundant and species rich group of insects, which is generally found in high trophic levels and frequently in specialized niche. It has been suggested that richness and diversity of ants would be related to plant richness and diversity, and could also give an indication of the invertebrate fauna as well as the soil conditions. All the different members of the ant community thus could constitute a bio-indicator of environmental conditions. As part of a greater project, in this study the soil ants from copper contaminated areas were surveyed in Minas do Camaquã, municipality of Caçapava do Sul, RS. Three areas were used for ant collections: mine area, liquid reject area, solid reject area. An area 10 km away, Parque das Guaritas, presented normal concentrations of copper and therefore was considered as control. For each area three transects extending 100 m were designed, and at each 10 m sardine baits were distributed. At the same time, for all four areas direct collection were performed during 30 minutes (capture effort). The greatest number of morph-species was found for control area (N= 44), followed by mine area (N= 21), solid reject (N= 19) and liquid reject (N= 15). The data found indicate a negative relation between number of ant species and soil concentrations of copper.
Index terms: Formicidae, ant fauna, bio-indicator

[3479] MAINTENANCE OF SECONDARY NEST OF *COPTOTERMES HAVILANDI* IN LABORATORY

A. S. Diogo[1], E. B. Menezes[1] & E. L. Aguiar-Menezes[3], [1]CIMP "CRG" / UFRRJ, BR 465 – km 7, Seropedica, RJ 23890-000, Brazil, E-mail ebmen@zaz.com.br; [2]Embrapa Agrobiologia, Caixa Postal 74538, Seropedica, RJ 23890-000, Brazil, E-mail menezes@cnpab.embrapa.br.

Coptotermes havilandi (Isoptera, Rhinotermitidae) is an exotic species of subterranean termite that was introduced in Brazil between 1915 and 1923, and is one of the most destructive termites in this country, causing severe damage to foundation plates, joists, wall supports, and flooring. This species normally colonize in the ground and move upward into buildings. Policalic behavior is exhibit by this species; i.e., several nests may be constructed, which are called secondary nests. In December 12, 1999, a secondary nest of *C. havilandi* was found inside of a file-box in an apartment located at the top (8th) floor of a building in the Rio de Janeiro city. In order to observe the behavior and caste composition, we took the nest to the laboratory of the CIMP "CRG" / UFRRJ, in Seropedica city (RJ) where it was cut in the middle in two parts using a small saw. As a significant amount of eggs was found, the nest was placed in a round aluminous tray. Moistened paper towels were placed over the surface of the nest in order to keep a suitable relative humidity for the colony. However, the paper towels were used as food for the workers, and then, the nest was wrapped with aluminum foil and kept at 27°C and 85% RH. Observations were made daily. Although the supplementary reproductives were not found, the colony increased in numbers of nymphs within 3 months, and the workers constructed tunnels at the wall of the tray. It suggests that the workers kept their foraging behavior because there were still have newborn larvae and nymphs to be feed. Thus, we provide 30 moistened wooden pieces (*Pinus* sp.) of 1 by 1 by 2.5 cm as food, and we believe that they will be able to feed on them, and keep the colony lives for a longer time.
Index terms: *Coptotermes havilandi*, Rhinotermitidae, policalic behavior, caste composition

[3480] ESTIMATING RELATIVE DECLINE IN POPULATIONS OF SUBTERRANEAN TERMITES (ISOPTERA: RHINOTERMITIDAE) DUE TO BAITING

T. A. Evans, M. Lenz & P. V. Gleeson. CSIRO Entomology, GPO Box 1700, Canberra ACT, Australia, 2601. Email: theo.evans@ento.csiro.au

Although the utility of mark-recapture protocols is reduced for termite researchers, as they are unable to produce accurate population estimates of termite colonies, they might be employed usefully to estimate a relative change in colony size. This might be of particular use during baiting trials, when a decline in colony size is desirable. This possibility was tested using two Australian, mound-building, wood-eating, subterranean *Coptotermes* species: temperate *C. lacteus* and tropical *C. acinaciformis*. Three different toxins each with a different metabolic action, Hexaflumuron (chiton synthesis inhibitor), W-328 (juvenile hormone analogue that causes workers to moult into soldiers) and Sulfluramid (fluorine poison), were delivered in baits. Consumption of these baits was intended to decrease (but not eliminate) the population. Pre-and post-baiting single-mark-recapture protocols that used different markers were used to estimate these two population sizes. For *C. lacteus*, the number of termites retrieved from bait stations varied widely, resulting in no significant differences in the numbers of termites sampled between treatments in either the pre- or post-baiting protocols. There were significantly fewer termites sampled in the post baiting protocol (range of ~ 1,000 – 2,200) compared with the pre- (6,000 – 11,000), but this was found in controls as well, suggesting a seasonal change in forager numbers. Nevertheless, there was a significant decline in mark-recapture population estimates for *C. lacteus* from toxic-baited treatments (Hexaflumuron 3.0 ± 0.8%, W-328 9.4 ± 6.0 and Sulfluramid 17.9 ± 7.8) compared with control treatments, which did not decline significantly (108.5 ± 35.6%) (post-baiting population estimate as a % of the pre-baiting population estimate, mean ± std error). The results for *C. acinaciformis* followed a similar pattern, although this was not tested statistically as few colonies consumed bait sufficient to reduce the population. Consequently, estimating the relative decline in population size using mark-recapture protocols appears to be possible. However, results for any individual colony should be treated with caution, as post baiting mark-recapture population estimates could be much greater than those of pre baiting, despite consumption of bait in sufficient amounts to cause population decline.
Index terms: *Coptotermes*, Lincoln Index, mark-recapture, Neutral Red, Nile Blue A.

[3481] SEASONAL AND DAILY FORAGING ACTIVITY OF SUBTERRANEAN, WOOD-EATING TERMITES (ISOPTERA: RHINOTERMITIDAE AND TERMITIDAE)

T. A. Evans & P. V. Gleeson, CSIRO Entomology, GPO Box 1700, Canberra ACT, Australia, 2601. Email: theo.evans@ento.csiro.au

Little is known about the fluctuations, either seasonal or diurnal, in foraging activity of subterranean wood-eating species. This is due in part to their cryptic habits – unknown nest location or unknown feeding sites or both. To address this lack, the level of foraging activity (measured by numbers of foraging termites) was monitored in artificial feeding stations during summer and winter for two species of wood-eating, mound-building, subterranean termites in temperate Australia (latitude ~35° south). This allowed accurate identification of the nest and placement of artificial feeding stations and a large change in weather, especially temperature, between seasons and over the course of a day. In the first year of monitoring, stations were placed ~1 m from mounds only. These were sampled 3 or 6 hourly and the termites therein collected. Surprisingly, fewer termites were collected in the summer samples (7,857 ± 1,252 termites per drum) (mean ± std error) than the winter samples (30,778 ± 4,427). The daily pattern was less surprising. Relative values were used instead of absolute numbers due to large variation between colonies. In summer the fewest number of termites were collected around 0300h – 0600h, numbers increased to a plateau by 0900h, which was maintained until 1800h, after which numbers declined. In winter the pattern was similar, but the peak numbers were only maintained from 12h – 1500h. The second year of monitoring sought to explain the surprising seasonal difference in activity. Stations were placed ~1m and ~10m from the mounds. These were sampled at 0600h or 1500h, to coincide with peaks and troughs in termite numbers. In summer, there were fewer termites at 0600h than at 1500h, and at both times there were more termites in the distant drums: 0600h close 2,562 ± 421, far 6,104 ± 1,852; 1500h close 3,127 ± 841, far 6,530 ± 1,329. In winter, the situation was reversed, with more termites at 0600h than 1500h and many fewer in the distant drums: 0600h close 60,419 ± 6,702, far 11,025 ± 4454; 1500h close 33,137 ± 9,877, far 14,824 ± 5544. These patterns indicate that there is a seasonal and daily change in termite foraging, albeit much less marked than that seen for aboveground, harvesting termite species.

Index terms: *Coptotermes lacteus, Nasutitermes exitiosus,*

[3482] SUGAR SOLUTION LOADING AND UNLOADING IN THE ANT *CAMPONOTUS MUS* IN RELATION TO WORKER SIZE

P. Favre, R. B. Josens & W. M. Farina, Depto. de Biología, Ftad. de Cs. Exactas y Naturales, UBA. Cdad. Univ. (1428) Buenos Aires, Argentina. E-mail: walter@bg.fcen.uba.ar. This study was supported by funds from the university of Buenos Aires (JX59) to RBJ.

Ants of the genus *Camponotus* feed on insects and sugar solutions. In order to analyze the loading and unloading behavior of different sugar solution sources in relation to worker size, we measured foraging behavior variables at the food source and at the nest. Workers were conditioned to visit an arena where they found an artificial rate-feeder of sucrose solution. The feeder delivered 10 or 30 %w/w sucrose solution at both 0.24 and 0.96 microL/min. Single ants previously weighted were allowed to perform five visits to the feeder; feeding time and crop load were recorded. At the nest, the duration of the trophallactic contacts (mouth to mouth food exchanges) was recorded and the transfer rate, i.e. the speed at which the solution is transferred, was estimated. Higher feeding times were obtained with the lowest solution flow rate. Within each flow rate, feeding time increased with worker size. On the other hand, crop filling increased with worker size independently of concentration and flow rate, achieving a mean Burden of 1.3 (i.e., they loaded approximately the 30% of their body weight). The duration of trophallaxis was independent of solution concentration, flow rate and worker size. However, trophallactic transfer rate increased with body size, being independent of food source profitability. Our results suggest that in the range of flow rates and concentrations used, crop loading at the source and unloading at the nest depended mainly on worker size, since workers remained feeding until achieving a determined load irrespective of the profitability of the source.

Index Terms: *Camponotus mus*, crop load, trophallaxis, intake rate, size.

[3483] MONITORING TERMITES IN SUGAR CANE FIELDS IN GOIAS, BRAZIL: A PROFITABLE INVESTIMENT

P. M. Fernandes[1];R. A B. Soares[2];P. F.M. Oliveira[2]. C. Czepak[1] & V.R.S Veloso,[1]Universidade Federal de Goiás, Escola de Agronomia, c.p. 131, Cep. 74001-970, Goiânia –Go. *pmarta@terra.com.br* [2]Jalles Machado S/A Açúcar e Álcool, Goianésia-GO.

Several genus of termites, such as, *Procornitermes, Heterotermes, Syntermes, Neocapritermes, Coptotermes, Cornitermes, Anoplotermes, Parvitermes, Grigiotermes,* among others, are commonly found associate to sugar cane in Goiás, inducing farmers to apply insecticides for control without knowing the damage potential of these species. Since 1992 sugar cane fields belonging to the company Jalles Machado S/A, at Goianésia-GO, are being monitored to determine the infestation of termites in this crop, The sampling team was previously trained to sort the samples taking the main species of termites collected. The sampling is done using baits prepared with sugar cane stems. The sample is composed of two stems 40 cm long. Two or three samples/ha are planted and the evaluation is made about 30 days after planting. Based on percentage of infested samples and on the genus of the termites predominant is made the decision about insecticide application, including doses and areas to be treated. The sugar cane Company where this project has been conducted owes an area of 20,000 ha grown with sugar cane. From 1993 to 2000, an average of 2,982 ha/year was planted and monitored am 60% of this area was not treated with insecticides. During 1999/2000 out of 3,981 ha, 2,270 ha were not treated which resulted in a saving approximately U$ 187,000. The cost for monitoring was around US$ 2,400. The total net return from 1993 to 2000 was above US$ 800,000 without interference on crop yield.

Index terms: termites, monitoring, sugar cane, *Heterotermes, Procornitermes*

[3484] MYCOCEPURUS SMITHII IN PUERTO RICO: LIFE HISTORY OF A PHYLOGENETICALLY BASAL FUNGUS-GARDENING ANT

H. Fernández M. & S. A. Rehner, Dept. Biology, Univ. of Puerto Rico, P.O. Box 23360-San Juan P.R. 00931-3360, ic972735@upracd.upr.clu.edu

The Neotropical fungus-gardening ants (tribe Attini) comprise 200 spp. classified in 11 genera, of which there are five sub-groups, each of which practices a distinctive type of fungiculture. With the exception of some leafcutter ant species, little is known about the life histories of attine ants, particularly the phylogenetically basal species, or "lower" attines. Here we describe features of the life history of a lower attine ant, Mycocepurus smithi, from Puerto Rico. We present data on the process of colony foundation, ontogeny of young colonies, colony demography and production of sexuals. Additionally, we will describe and discuss several unique observations including: 1) the use by founding queens of their anterior wings as a platform on which the incipient fungal garden is established, 2) the presence of a glandular structure on the wings of females, 3) the occurrence of primary and secondary polygyny, and, 4) the curious absence of males in reproductive colonies.

[3485] SWARMING BEHAVIOUR OF THE ECONOMICALLY MOST IMPORTANT TERMITE, *COPTOTERMES HAVILANDI*, IN SOUTHEAST BRAZIL

M. V. Ferraz[1] & E. M. Cancello[1], [1]Museu de Zoologia, Univ. of São Paulo, Caixa Postal 42694, São Paulo, SP 04299-970, Brazil, E-mail marisavf@usp.br.

Coptotermes havilandi (Isoptera: Rhinotermitidae) is an oriental species of subterranean termite introduced in Brazil probably at the beginning of this century and recorded for the first time in the thirties. It is now considered the major wood pest in Southeastern Brazil. This species is widespread in the cities of São Paulo and Rio de Janeiro, and causes serious damage to wooden structures because of the lack of preventive measures. Nowadays it is also spreading to the interior of the country. Despite its great economical significance, very little is known on the behaviour of this species. In this study we report the swarming behaviour of *C. havilandi* in São Paulo, the city under the highest attack by this species in the New World. The work has been carried out along three years, since 1997, with a total of 106 sampled swarmings. We have also compared these results with data of 94 sampled swarmings from the Isoptera collection of the Zoological Museum (São Paulo University). In São Paulo, the swarming behaviour of *C. havilandi* presents a clear peak from August to October (end of the winter and beginning of the spring). In addition, this species is able to perform sporadic swarms along the year, with a clear interruption in May/June (during the autumn). The preferential time of swarming is around sunset, between 6:00 and 7:00 pm. Nevertheless, there are exceptions; swarms were observed from 5:00 pm to midnight. The sexual rate is near 1:1, with a non-significant majority of females. It was not observed any association between swarmings and environmental variables, such as temperature, relative humidity and precipitation, but the largest swarmings have been observed when conditions were: 22-27 °C, 35-71% RH and no rain.

Index terms: *Coptotermes havilandi*, Rhinotermitidae, subterranean termite, swarming behaviour, Brazil

[3486] SEARCHING FOR AN ACCURATE METHOD TO EVALUATE THE EFFICACY OF AN ACARICIDE IN THE VARROOSIS CONTROL

L. Floris, A. Satta, Dipartimento di protezione delle Piante Sez. Entomologia agraria, Università di Sassari Via E. De Nicola 07100 Sassari (Italy), E-mail ifloris@ssmain.uniss.it .

The efficacy evaluation of an acaricide against the mite *Varroa jacobsoni* in apiary trials is generally estimated by the "Percent efficacy": $E = 100[At/(At + Ar)]$, where *At* is the total number of mites collected in the bottom of the treated hives during the treatment; *Ar*, the number of residual mites, in the same hives, counted after a final additional treatment effected with another acaricide, or most rarely sacrificing colonies. No data from control hives are considered in this expression, with implications that may affect the results. More precisely, the main sources of error are due to: a) the weight of natural mortality (life cycle, defensive behaviour of the bees) that is not subtract from the total mite counted; b) the efficacy of the acaricide employed in the final treatment that is supposed constant, underestimating the actual problem of the varroa resistance to acaricide, already checked towards pyrethroids and organophosphorous; c) the variation in the mite population during the trial period, due to the reproductive rate of the mite and to immigration or emigration occurs, particularly when acaricides with prolonged action are employed, and when bee brood is present in the hives. To overcome the above limitations, a most accurate method is the so-called "Percent control" due to Abbott: $C = 100[(Sc-St + Ar)]$, where *Sc* and *St* are the percentages of surviving (mites) in the control and treated hives, respectively. *S* is computed from $S = 100(Y/X)$, where *X* and *Y* are the total number of the mites in the hive before and after treatment, respectively. Another possibility is offer by a modification of "Abbot's formula" for "Percent mortality" suggested by Henderson and Tilton: $M = 100[1- (XcYtlXtYc)]$. By these last two expressions, the variation in mite population causes by natural factors are measured in the control hives and considered to correct the evaluation of the efficacy, but many pratical difficulties for the design and analisys of the experiment are involved. The above methodological approaches were compared in apiary trials carried out in Sardinia (Italy) during the last years to evaluate the efficacy of some acaricide (Fluvalinate, Flumethrin, Amitraz, Oxalic acid) against *V. jacobsoni*. The results obtained showed statistical differences between the different methods, particularly when the efficacy was moderate or low.

Index terms: *Varroa jacobsoni*, treatments, natural mortality, apiary trials

[3487] DEMOGRAPHY OF *CAMPONOTUS PUNCTULATUS* ANTS ALONG A GRADIENT OF AGRICULTURAL DISTURBANCE AND THROUGH TIME

P. J. Folgarait[1], N. B. Gorosito[1], R. Pizzio[2], & J. Fernández[2], [1]Centro de Estudios e Investigaciones, Universidad Nacional de Quilmes, Roque Saenz Peña 180, 1876 Bernal, Bs As, Argentina, E-mail pfolgarait unq.edu.ar; [2]INTA-Mercedes, Casilla de Correo 38, 3874 Mercedes, Corrientes, Argentina.

Populations of the ant *Camponotus punctulatus* undergo demographic explosions after agricultural activities, changing their nesting behavior from making underground nests to building aboveground constructions. These conspicuous mounds covered with vegetation are hard-packed, very difficult to destroy, and are typically seen at the agricultural landscapes in northeastern Argentina. These anthills occur at greater densities in plots with greater agricultural soil disturbance. We have been studying for the past four years some demographic parameters of *C. punctulatus* anthills across an increasing gradient of soil disturbance: natural grasslands as controls, perennial sown pastures of *Setaria sphacelata* and *Digitaria decumbens*, and abandoned rice paddy fields. In each of the three replicates per land-use history we had two permanent transects of 150 m long and 6 m wide, from which we censused anthills every year. Our results showed that each land-use history type has its own dynamic in terms of *C. punctulatus* demography. The initial density (D) of recently abandoned (3 years) rice fields was 2000 anthills/ha. Their survivorship (S) varied across years; greater levels of colonizations (C) at one year were followed by greater levels of mortality (M) in the next. Consequently, the D increased first and decreased later to lower levels than initial: 1600a/ha. Around 40% of anthills survived < 1 year, 40% survived 1-2 years, and 55% survived 3 years. It took 2 years for small anthills to grow to medium size and 3 years to reach big sizes. Older (7 years since last ploughed) rice fields had an initial D of 1000a/ha and showed similar S and M through time. Although C varied across years, 90% of these anthills were dead within a year. 57% of the mounds survived 2 years and 43% of them survived for 3 years, therefore the D decreased reaching 600a/ha. Most anthills were big sized, the colonizers grew to this size in 3 years. 7-years old sown pastures had initial D of 150a/ha which increased slowly ending with 180a/ha. C and M were low across years. From new anthills, half died and half survived, but most mounds (78%) survived 3 years. Mounds were mainly big; it took around 1 year to change size categories. Natural grasslands had the lowest anthill D changing from 45a/ha initially to 12a/ha at the end. Most anthills were small-sized and few were old ones. New anthills colonized every year but died; only 15% of anthills survived >2 years. Our results showed that there were main differences in ant demography across land-use history types, however, agricultural disturbance per se promoted the development of these long-lasting mounds.

Index terms: agriculture, Argentina, land-use, pests, population parameters

[3488] INVASION OF URBAN BUILDINGS BY THE MOUND BUILDING TERMITE, *CORNITERMES CUMULANS* (ISOPTERA): REPORT OF TWO CASES OCCURRED IN THE SOUTHEAST OF BRAZIL

L. R. Fontes[1] & V. G. Martins[2], [1]SUCEN, R. Cardeal Arcoverde, 2878, 05408-003 São Paulo, SP, Brazil, E-mail: lrfontes@uol.com.br; [2]UNESP/CEIS, C. P. 199, 13506-900 Rio Claro, SP, Brazil.

Dry-wood and subterranean termites are the main pests of buildings in the SE region of Brazil. In the last group, *Coptotermes havilandi* inflicts the most severe damages and is the most common pest, although there are also infestations by species of *Heterotermes* (Fontes & Araujo, 1999). In the Northeast, species of *Nasutitermes* play the same role as pests as the subterranean termites. On the other hand, infestations by soil termites seem to be rare and are usually a consequence of building degradation by moisture and wood feeding fungi. Few cases are reported in the literature by Torales (1998) that showed infestations by *Cortaritermes fulviceps*, *Amitermes amifer* and *Termes* sp., in the Northeast of Argentina. We report here two cases of building invasion by a common mound building termite, *Cornitermes cumulans*, in the urban area of Rio Claro (22°23'S, 47°32'W; 620 m), São Paulo State. Its earth mounds are very common in pastures, road borders, lawns and other open lands. Case 1: October 1994. In a one-storey brick house, at the sunset, a lot of winged imagoes arose from a small hole located between a wall and the floor of a bathroom, surrounded by many workers and soldiers. Most walls and floors were tiled and in the outside of the house (almost 8m far from the bathroom) a small area of soil was covered by grass. No mound was found in the neighborhood in this occasion. Case 2: October 1999 to March 2000. In a one-storey brick building of the "Centro de Estudos de Insetos Sociais", at the University, a small mound made of red soil appeared at the base of a wood rabbet of an inner door, which was slightly damaged by moisture, close to a cold room. The mound was 18cm high and 12x8cm wide and some workers and soldiers constantly occupied the outer chambers. The floor of the building was tiled. Outside the building, 5m away, the soil was covered with grass but no mound was visible anywhere. CONCLUSION: both reported cases are not true infestation, since no visible damage was inflicted to the buildings. The termites just invaded the buildings from the nearby soil. In Case 1, they opened a hole for the swarming of the alates from a mature subterranean colony, in Case 2 apparently just to explore the area through small cavities in the base of a slightly rotten rabbet of a door. These cases show that (1) even in the absence of mounds there are subterranean colonies of *C. cumulans*, (2) which mature and produce alates and (3) explore the soil largely, including under large buildings. *C. cumulans* colonies are polycalic (Fontes, 1998), a feature that probably enables the termite to explore large territorial areas.

Index terms: urban infestation, building invasion

[3489] ANT ASSEMBLAGES (FORMICIDAE) IN THE PARQUE ESTADUAL XIXOVÁ-JAPUI, SÃO VICENTE-PRAIA GRANDE, SÃO PAULO

R.B.Francini [1], G. Gomes [2], V.C. Mota [2], F.A.Paradela [2], [1] Museu de História Natural, FAFIS, Univ. Católica de Santos, Rua Euclides da Cunha, 247, 11065-902, Santos, SP, Brasil, E-Mail francini@unisantos.com.br, [2] Curso de Licenciatura em Ciências Biológicas, FFCL, UniSantos. Financial support: IPEC-UniSantos.

The study area was inside Fortaleza do Itaipú (of the Brazilian Army). The samples were collected along a quasi-linear permanent transect marked at 10 m interval maintained in the field during all the study period. Techniques of manual collecting, standardized litter samples (1 m^2, 10 samples each 20 m; Winkler extraction) and standardized sardine and carbohydrate baits (10 samples each 10 m, altogether) were used. The data from June to December 1999 more random samples collected during 1988-89 by the first author showed the presence of 78 morphospecies of ants belonging the 6 subfamilies and 36 genera: Ponerinae (21 spp.; *Anochetus*, *Discothyrea*, *Ectatomma*, *Heteroponera*, *Hypoponera*, *Leptogenys*, *Odontomachus*, *Pachycondyla*, *Thaumatomyrmex*, *Typhlomyrmex*), Formicinae (9 spp; *Brachymyrmex*, *Camponotus*, *Paratrechina*), Dolichoderinae (8 spp; *Azteca*, *Dolichoderus*, *Linepithema*, *Tapinoma*), Pseudomyrmecinae (3 spp.; *Pseudomyrmex*), Myrmicinae (36 spp; *Acanthognatus*, *Acromyrmex*, *Aphaenogaster*, *Apterostigma*, *Atta*, *Cyphomyrmex*, *Crematogaster*, *Hylomyrma*, *Megalomyrmex*, *Octostruma*, *Pheidole*, *Procryptocerus*, *Rogeria*, *Smithistruma*, *Solenopsis*, *Strumigenys*, *Tetramorium*), and Ecitoninae (1 sp.; *Neivamyrmex*). Myrmicinae represented 46% of the species and *Solenopsis* sp. 35 occurred in 90% of the Winkler samples although 12 species (15%) appeared in only one sample. The species accumulation curves for the bait and litter standardized techniques showed an stabilization after the sixth monthly sampling. The correlation (Spearman R) between ant and richness versus 6 habitat characteristics (mass, volume and moisture content of litter, terrain inclination, degree of canopy cover using fish-eye photography and relative level of illumination) in each point (60 samples) was relatively low ($R=0.6298$; $t=6.17552$; $p < 0.00001$) for ants x mass. The data on ant diversity was compared with the data from habitat diversity calculated using Brillouin's equitability index for each sample. The results showed a weak correlation between the two series of diversity estimates. A PCA made on the joint matrix (ants + habitat) showed that the factors mass and volume of litter were important in the determination of the variance species diversity.

Index terms: Atlantic Forest, Winkler samples, sardine baits, carbohydrate baits, species richness.

[3490] FORAGING SUCCESS AND INDIVIDUAL LEARNING OF ORIENTATION AND TIMING IN *ECTATOMMA RUIDUM* (FORMICIDAE: PONERINAE)

N. M. Franz[1,2] & W. T. Wcislo[2], [1]Dept. of Entomology, Comstock Hall, Cornell University, Ithaca, NY 14853, USA, E-mail nmf2@cornell.edu; [2]Smithsonian Tropical Research Institute, Unit 0948, APO AA 34002-0948, USA, E-mail wcislow@tivoli.si.edu.

In recent years the foraging behavior of ectatommine ants has received increasing attention as a model system to address the relation between the cognitive abilities of an animal and its plasticity in the field. Foragers of the most extensively studied species *Ectatomma ruidum* have a rich repertoire of behaviors, e.g. gathering secretions from plants with extra-floral nectaries or treehoppers, collecting capituli from the eggs of walkingsticks, ambushing bees at nest entrances, stealing food from other ants or nests, stalking insects, and scavenging corpses. Laboratory studies show that they have well-developed cognitive abilities, and that at least some part of their repertoire is mediated by social ontogeny. We asked whether learning of place and time is relevant for individual foragers of *E. ruidum* in arguably the most general context of patchy resources on the forest floor, and if they use single- or multi-event past experience to modify their behavior. Our study utilized field observations and experimental trials with an intact colony in a naturally decorated foraging arena. Several traits of the behavior of focal individuals - including orientation, timing, sampling of foraging space, and the sequence of revisiting sites - were observed in relation to success at one foraging site as well as among two such sites. In the first experiment, termite nymphs were offered immediately during a training block and a recovery block, but termite replacement was delayed during an intermediate block. After one delayed prey capture in the intermediate block, the directional precision for the outbound movement as well as the outbound velocity for the subsequent trip decreased, whereas the nest time increased. The opposite result was obtained after one immediate prey capture in the recovery block. In the second experiment, the focal individuals foraged among two sites with different frequencies of prey success which were interchanged after several catches. Following this manipulation, significant modifications were observed in the sequence of revisiting sites and in the mean direction for the outbound movement - reflecting the relative success at each site. Thus, individual learning appears to facilitate an efficient exploitation of patchy resources by adjusting the sampling effort in a particular environment according to single-event past experience. Further research in ectatommine ants may address the ecological implications of learning and the cognitive structure that determines foraging decisions.

Index terms: cognitive ecology, foraging behavior, ponerine ants

[3491] The effects of electrical fields on the behaviour of ants

S. M. Gerty[1], J. J. Knapp[1], J. Holt[1], C. Martin[1], C. Power[1], P. Gaynor[2] & J. Hughes[2], [1]Division of Biodiversity and Ecology, School of Biological Sciences,. [2]Dept. Electrical Engineering, Univ. of Southampton, Southampton SO16 7PX, UK. E-mail: jjk@soton.ac.uk

It has been suggested that ants, in particular *Solenopsis invicta*, are attracted to electrical fields. It has been documented by various workers that *S. invicta* is "attracted" to electrical equipment, cables, traffic light control systems and even domestic appliances. Ants have been seen to congregate near to such equipment sometimes behaving very aggressively towards it, often being electrocuted in the process. Indeed *S. invicta* has caused serious damage in the USA. Previous attempts to investigate these phenomena have resulted in conflicting conclusions. Differences in experimental design, in the method employed to generate the electrical fields and in the behavioural responses measured have meant that such studies are difficult to interpret and impossible to compare. There remain many fundamental unanswered questions. Can the ants detect an electrical field? What is the response threshold? How are they affected by changes in polarity or field strength? This study set out to examine the effects of electrical fields on ant behaviour. We used intact colonies with nest chambers. The ants were allowed to become familiar with the experimental apparatus prior to application of the field. Two types of experiment were performed. Electrical fields were applied across an active foraging trail or in the foraging arena where ants were randomly searching. The effects of different field strengths, polarities and type of current were investigated. The results show that insects can not only detect fields but are in fact repelled. We suggest that the attraction observed in previous studies could be explained by weaknesses in their experimental set ups. These resulted in ants being electrocuted, which in turn triggered alarm responses, which then attracted other ants. The significance of our results in the context of *S. invicta* damage to electrical equipment will be discussed.

Index words: *Solenopsis*, ant behaviour, electrical fields

[3492] THE USE OF HONEYBEES (*APIS MELLIFERA*) AS INDICATORS FOR THE PRESENCE OF THE PHYTOPATHOGEN BACTERIUM *ERWINIA AMYLOVORA* IN THE ENVIRONMENT

S. Ghini[1], C. Porrini[2], A.G. Sabatini[3], S. Girotti[1], C. Bazzi[4], D. Cantagalli[5], F. Granetto[1], A Calzolari[6], [1]Ist. Scienze Chimiche, Univ. di Bologna, via S. Donato 15, 40126 Bologna I; [2]Ist. Entomologia "G. Grandi", Univ. di Bologna, via Filippo Re 6, 40126 Bologna I, E-mail cporrini@entom.agrsci.unibo.it; [3]Ist. Naz. Apic. via di Saliceto 80, 40128 Bologna I; [4]Ist. Patologia Vegetale, Univ. di Bologna, via Filippo Re 8, 40126 Bologna I; [5]Coop "La Carlina", via Cairoli 39, 44100 Ferrara I; [6]Servizio Fitosan. Emilia-Romagna, via di Corticella 133 40129 Bologna I.

Erwinia amylovora (EA) is the causal agent of fire blight, the most destructive bacterial disease of Rosaceous plants, especially pear, apple and ornamentals. It is known that honeybees are potential vectors of EA and movements of bee colonies have consequently been limited by law. In the Emilia-Romagna region, where EA was individualized in 1994, the use of honeybees as precocious indicators of the disease was tested. 5 sampling stations, each formed of three hives, were installed, in the middle as well as near the borders of the infected area. Pollen collected from the hives weekly (from April until July) was used as matrix. The pollen samples were examined in order to determine both, the presence of the bacterium and, by means of palinological analyses, the plant species visited by the bees. A molecular technique (PCR-ELISA) was developed to improve the specificity and detection limit of standard analytical methods. In detection threshold experiments with pure cultures, up to $3x10 \pm 4\%$ CFU per reaction tube, or up to $3.8x10^2 \pm 4\%$ CFU per gram of pollen were detected, when the chemiluminescent detection assay was used. Because of its specificity, sensitivity and fastness the assay was applied as a practical and reliable analytical method, especially for multiple sample routine detection of latent EA infections. At least one pollen sample from all the beehives placed in infected areas resulted positive to the test. A pollen sample collected from a bordering area, that did not appear contaminated, was found positive, and in this area the disease occurred some months later. Border areas hit by fire blight can therefore be constantly monitored using beehives, thus enabling to prevent the extension of the disease. Finally it can be stated that pollen is a good matrix, easy to handle and capable of monitoring the bacterial disease.

Index terms: biomonitoring, fire blight, vector.
(Research carried out within the Project A.M.A. and supported by the Ministry of Agricultural Politics. Contribution n. 69).

[3493] DIVISION OF LABOR IN *ECTATOMMA EDENTATUM* (HYMENOPTERA, FORMICIDAE)

Edilberto Giannotti[1, 4] **& William Fernando Antonialli Junior**[1, 2, 3], [1]Departamento de Zoologia, Instituto de Biociências, Universidade Estadual Paulista, Caixa Postal 199; 13506-900, Rio Claro, SP, BRASIL. [2]Bolsista CAPES – Coordenação do Aperfeiçoamento de Pessoal de Nível Superior. [3] e-mail: wfaj@rc.unesp.br. [4] e-mail: edilgian@rc.unesp.br.

Ectatomma edentatum is a Neotropical Ponerinae ant which colonies generally have less than 100 adults. We studied the behavioral division of work between queens and workers of this species in laboratory conditions. Two of the five colonies studied were polygynic ones, with 2 and 4 queens; the other three have one queen each. Each behavioral category of both castes was described by direct observation of the ants. The spatial position in the nest and the behavior of each individual was registered at 5 minutes intervals. The period of observation was one hour a day 3 times a week, for a total of 138 hours. A colony ethogram was constructed to determine comparatively the behavioral repertory of the two castes. Most of the members of colonies, including the queens, occupied the second chamber, which also contained the immature stages. Forty two behavioral categories were recorded for the workers, and 28 for the queens. These behavioral categories were grouped as: a) grooming, b) brood care, c) nourishment, d) nest defense, e) nest maintenance, and f) other behaviors. The comparison of the behavioral repertory of the two castes revealed that "ovipositing a fecunded egg" is an exclusive behavior of the queens, while the workers showed 15 exclusive behaviors. Queens were never seen foraging out of the nest. Twelve behaviors were common for both castes. Queens and workers spend most of the time in inactivity (43.47 and 37.23%, respectively). The dissection of the queens revealed that polygynic colonies have only one female with full developed ovaries which is the main egg layer of the group, a feature defining the social organization of colonies of *E. edentatum* as a functional monogyny.

Index terms: ants, behavior, behavioral repertory, ethogram, Ponerinae

[3494] RECRUITMENT IN HONEYBEES: HOW DO FORAGERS AND HIVEMATES INTERACT ACCORDING TO THE FOOD SOURCE PROFITABILITY?

M. Gil; P.C. Fernández & W.M. Farina, Depto. de Biología, Ftad. de Cs. Exactas y Naturales, UBA, Cdad. Univ., (1428) Buenos Aires, Argentina. E-mail walter@bg.fcen.uba.ar. This study was supported by funds from ANPCYT (PICT 98-03103) and from the University of Buenos Aires (JX 53) to WMF.

When foraging honeybees exploit a floral patch, the number of incoming hive-mates changes according to the food source's profitability in terms of sugar solution flow. On the other hand, recruitment mechanisms displayed by foragers such as dance, food exchange or pheromone release can be modulated according to this factor. The way in which both steps of the foraging activity are linked in the hive is the goal of this study. At the food source: the number of bees arriving at a rate-feeder that were recruited by individual foragers was recorded. Only the trained forager collected food. The rate-feeder offered a constant sugar solution flow (1, 2, 5.5 or 9 µl/min) along successive foraging bouts, during two hours. At the hive: we recorded the dancing and trophallactic giving behavior performed by the trained foragers as well as the different kinds of interactions between them and hive-mates that arrived at the source thereafter (recruits). The frequency of dance and trophallactic giving contacts of the trained foragers positively depended on the sugar solution flow. Concerning the interactions between foragers and the subsequently recruited bees, the proportion of recruits that followed dance and were involved in trophallactic *begging* contacts increased with profitability. No difference was found along with sugar solution flow in trophallactic begging time or the number of waggles *followed* by recruits. Finally, the arrival rate of recruits at the rate feeder increased according to the sugar solution flow. Thus, the modulation of these behavioral parameters along with sugar flow by the returning forager would increase the probability of transferring information to hive-mates.

Index terms: *Apis mellifera*, foraging, communication.

[3495]THE DIGESTIVE TUBE OF THE NEOTROPICAL GENUS *TAURITERMES* (ISOPTERA: KALOTERMITIDAE): COILING AND MORPHOLOGY

M.C. Godoy, Fac. de Cs. Exactas y Naturales y Agrim. Univ. Nacional del Nordeste. 9 de Julio 1449. 3400. Corrientes. Argentina. E-mail:mcgodoy@exa.unne.edu.ar.

The coiling patterns and morphology of the different parts of the digestive tube are of systematic value in termites. Thus, although in "lower termites" the gut anatomy is less varied than in the family Termitidae, some gut characteristics show notable variations among families and genera. The data concerning the neotropical genus *Tauritermes* contribute to enlarge the knowledge about the intestinal anatomy of the family Kalotermitidae, allowing to differentiate this genus from others within the family, by means of the analysis of the gut. The specimens studied were pseudergates of *Tauritermes taurocephalus* from Corrientes (Argentina), preserved in Duboscq-Brasil fixative. The gut was observed and drawn in situ and after the dissection of its components. The gizzard, ileum (P1) and enteric valve (P2) were mounted on glass slides. The main characteristics of the coiling of the gut in this genus are: oesophagus mediodorsal in the thorax, crop and gizzard deflected to the left in the abdomen at the level of the 1/2 abdominal segments, P2 placed ventro-laterally to the left, at the level of the 3/4 abdominal segments, limit between paunch (P3) and colon (P4) with an incomplete torsion. The morphology of the principal organs of the gut was determinate as follows: crop elongated with cuticle with pectinated scales, gizzard well developed, C/H index (C: length of columnar belt of the gizzard, H: head width) equal to 1/16, prominent teeth of folds II of the gizzard (double in size than those of the folds I), pulvilli I longer than the columns of the gizzard armature, stomodeal valve very long and without dilatation at its posterior end, midgut cylindrical, anterior coeca and mixed segment absent, eight Malpighian tubules inserted in two groups at the limit midgut- hindgut. Proctodeum divided in five segments, being the longest intestinal region: P1 and P2 short and cone-shaped; P1 slightly shorter than P2; limiting groove poorly marked; internal armature of both segments composed by six longitudinal swellings provided with small spines; P3 voluminous, with the attachment of P2 near to its end; P4 narrow; rectal valve without armature and rectum (P5) dilated with six rectal pads. The main characteristics observed in the gut of *Tauritermes* correspond to the pattern previously known for the family, but some comparisons can be established among this genus and other Kalotermitidae genera regarding to the features of some organs as the extent of the mesenteric arch, the structure of P1+P2, the P3-P4 union and the rectal valve armature.

Index terms: termites, gut characteristics, gizzard and enteric valve armatures

[3496] IMPACT OF ALIEN SOCIAL BEES ON TASMANIAN FLORA AND FAUNA

D. Goulson, J.C. Stout & A. Kells, Division of Biodiversity and Ecology, School of Biological Sciences, University of Southampton, Bassett Crescent East, Southampton, SO16 7PX, UK. Email: dg3@soton.ac.uk

Honeybees, *Apis mellifera*, have been introduced to nearly every country in the world. Recently bumblebees, *Bombus terrestris*, were introduced to Tasmania. The impact of introduced bees on native bee fauna is poorly understood. We attempted to assess the impact of this invasion. We examined whether *A. mellifera* or *B. terrestris* compete with native Tasmanian bees for floral resources. We also studied whether the introduced bees are improving pollination of introduced weeds, so increasing the invasiveness of the plants. Both *A. mellifera* and *B. terrestris* were far more numerous that native bees at study sites. Considerable niche overlap was evident between introduced and native species in terms of the flower species that they visited. They also foraged at broadly similar times, although the introduced bees began foraging earlier and *B. terrestris* continued to forage later in the evening. Nectar availability was greatest in the early morning, and by the time the native bee species began foraging nectar availability was considerably reduced. In at least some plant species this was partly due to the action of introduced bees since nectar levels in flowers from which bees were excluded were significantly higher than in flowers exposed to visitation. It was not possible to determine which of the introduced species was primarily responsible for suppressing nectar availability but the effect was presumably additive. Native bee species also appeared to be less efficient than either of the introduced species in terms of the rate at which they handled flowers. We conclude that there probably is exploitative competition between introduced and native bee species. The introduced bees are also increasing seed set in some introduced plant species; some plants were entirely reliant on selfing before *B. terrestris* was introduced. The Tasmanian flora has already been extensively invaded by numerous plants mainly from Europe, and improved pollinator services to these plants is likely to have negative effects on native flora. The long term consequences of the presence of these alien bee species are hard to predict, but it would seem sensible to try to prevent further range expansion of *B. terrestris* into mainland Australia.

Index terms: *Bombus terrestris, Apis mellifera,* introduction, competition

[3497] A NATIONAL PERSPECTIVE OF FOREST TREE PESTS IN SOUTH AFRICA

P. Govender [1,2], M. J. Wingfield [2], M. A. McGeoch [1] & C. H. Scholtz [1], [1]Dept. of Zoology & Entomology, Univ. of Pretoria, Pretoria, 0002, Republic of S. Africa; [2]Tree Pathology Co-operative Programme (TPCP), Forestry and Agricultural Biotechnology Inst. (FABI), Univ. of Pretoria, Pretoria, 0002, Republic of S. Africa.

The S. African forestry industry relies on a total of about 1,49 million hectares of intensively managed plantations. These are composed of exotic tree species, including those of *Pinus*, *Eucalyptus* and *Acacia mearnsii*. A complex of indigenous soil pests contributes to about a 23 % failure of all species of seedlings from reaching full establishment. This pest complex includes termites, tipulid larvae, millipedes, cutworms, whitegrubs, nematodes, wireworms, grasshoppers and crickets. Four exotic pests affect established *Eucalyptus* in South Africa. The eucalypt snout beetle, *Gonipterus scutellatus*, a defoliator, is under effective biological control but requires augmentation in the high altitude areas. The eucalypt tortoise beetle, *Trachymela tincticollis*, another defoliator, is also under effective biological control by an egg parasite. Two longhorn beetles, *Phoracantha semipunctata* and *P. recurva* damage the wood of stressed and recently felled trees. Parasitoids that attack the various life stages are being evaluated. All the wattle pests are endemic to South Africa. *Chaliopsis junodi* is the most economically important of the lepidopteran defoliators; while the wattle mirid, *Lygidolon laevigatum*, is the second most serious pest. Three indigenous lepidopteran pests, (*Imbrasia cytherea, Pachypasa capensis and Euproctis terminalis*) defoliate species of pines. All other pests are exotic. The economic impact of the pine weevil, *Pissodes nemorensis* and the pine woolly aphid, *Pineus boerneri*, and possible biocontrol options are being considered. The black pine aphid, *Cinara cronatii*, is under effective biological control, while the pine needle aphid, *Eulachnus rileyi*, does not appear to cause economic damage. The bark beetles, *Orthotomicus erosus* and *Hylastes angustatus* occasionally cause sporadic damage. The pine wood wasp, *Sirex noctilio*, has entered the country recently and has spread within the winter rainfall region. Various biocontrol efforts on the different life stages of *S. noctilio* represent an area of active research. There is now a gradual appearance of new and damaging pests that can reduce the productivity of plantations in S. Africa. This trend will continue with the increasing movement of people and products around the world.

Key words: soil pests, borers, defoliators, *Pinus*, *Eucalyptus*, *A. mearnsii*

[3498] DETERMINING THE ACTIVITY OF HARVESTER TERMITES IN THE ETOSHA NATIONAL PARK, NAMIBIA

S. Grube, Etosha Ecological Inst., P.O. Okaukuejo via Outjo, Namibia. E-mail: sgrube@iafrica.com.na

Commonly harvester termites in semi-arid and even arid regions of Southern Africa are considered the major cause for the loss of grazing. In order to take up counter measures against harvester termites it must be of paramount interest to know more details about the seasonal changes of their foraging activities and to find a reliable indicator for their presence and their activity. Up to now the occurrence of the small cone-shaped soil dumps of *Hodotermes mossambicus* Hagen (Isoptera: Hododermitidae) served as a kind of "early warning system" for the occurrence and extent of their surface activity, as these insects, living entirely subterraneously, do not create any other obviously visible structures above ground during their foraging activity. A few studies regarding the seasonal activity patterns of *Hodotermes mossambicus* conducted in the seventies and eighties in South Africa and in Zimbabwe concluded that there is a direct relation between the occurrence of soil dumps on the veld and the extent of the foraging activity of the termites as such and that the number of soil dumps could therefore serve as a reliable indicator for their foraging activity. Within the framework of a three-year-project on the influences and the effects of harvester termites in the Etosha National Park (ENP) in northern Namibia, with special consideration of their impact on soil systems and vegetation in addition to their role as competitors for grazing with game, a correlation between the temporal occurrence and the distribution of soil dumps of *H. mossambicus* and the frequency of the foraging activity could not be confirmed. First results established: (1) The highest foraging activity occurred during the rainy season between January and April when the naturally available biomass was high. (2) The highest number, i.e. density of dumps on all study sites occurred in July and August when the foraging consumption reached its lowest level on the baited sites. (3) Between March and July, i.e. towards the end of the rainy season and the onset of winter the foraging activity decreased continuously but the number of soil dumps actually increased. As yet the function of the soil dumps remains unclear; one tentative hypothesis, that the number of dumps may be related to the seasonal quality and thus necessary quantity of biomass harvested by the termites leading to greater excavations for more food storage underground needs further validation. Further studies of the seasonal activities of *H. mossambicus* during several vegetation periods on our widely distributed study sites in the ENP will provide details on the foraging activity patterns of this species and their role as "severe" competitors for grass with live stock and other grazing animals.

Keywords: Isoptera, *Hodotermes mossambicus* Hagen, soil dumps, foraging behaviour, seasonal activity

[3499] SYMPATRIC AND INTRASPECIFIC QUEEN-SIZE DIMORPHISM ASSOCIATED WITH QUEEN DISPERSAL STRATEGY OF JAPANESE ANT, *LEPTOTHORAX SPINOSIOR* FOREL

K. Hamaguchi[1], O. Takenaka[2] & K. Kinomura[3], [1]Insect Physiology Lab., Forestry & Forest Prod. Res. Inst., P.O. Box 16, Tsukuba Norin Kenkyu Danchi-nai, Ibaraki, 305-8687 Japan, E-mail hamaguti@ffpri.affrc.go. jp; [2]Primate Res. Inst., Kyoto Univ., Inuyama, Aichi, 484-8506 Japan; [3]Gifu-Aikawa High School, Gifu, Gifu, 501-3113 Japan

In some ants, sympatric queen body-size dimorphisms (macrogyne and microgyne) have been reported. Some of them were suggested to be associated with queen dispersal strategy, i.e. macrogyne is disperser and microgyne is non-disperser. Relationships between macrogyne and microgyne seem to involve various stages, e.g. intraspecific polymorphism, more or less reproductively isolated two forms and clearly distinct two species as microgyne is socially parasitic species of macrogyne species. Therefore, sympatric queen body-size dimorphism is an interesting subject that enables comparative studies on different dispersal strategies that might be connected to the sympatric speciation. However, the dispersal traits and the phylogenetic relationships of macrogynes and microgynes of most of the queen dimorphic species are not known yet. Here, we present the results of our study on the queen body-size dimorphism in *Leptothorax spinosior* carried out at the bank of Nagara River in Gifu Prefecture, Japan. An attempt was made to investigate the type of dispersal and other reproductive traits of two forms, based on microsatellite DNA analysis. Macrogynes were suggested to be dispersal type that found nests solitarily after a nuptial flight, whereas, microgynes were non-dispersal that return to their natal nest after mating. Intracolonial relatedness among workers of microgyne colonies was significantly lower than that of macrogyne colonies due to the co-existence of multiple reproductive queens in microgyne colonies. We also examined whether there is any reproductive isolation between two forms by the investigation of the relationships of body-size between mother queens and daughter alate females and molecular phylogenetic analyses. Although there was the tendency that macrogyne colonies produced macrogynous alate females and microgyne colonies produced microgynous alate females, a fair portion of colonies produced the opposite types of alate females. No divergence was detected between two forms in some regions of mtDNA and rDNA. Hence, the sympatric concurrence of queen-size dimorphism in *Leptothorax spinosior* was considered not due to the co-habiting of two different species. The investigation on the probability that they might be in the first step of sympatric speciation and weak reproductive segregation has already taken place within a species is under progress.

Index terms: macrogyne, microgyne, microsatellite DNA, molecular phylogeny,

[3500] NUTRIENT FLOW AND NUTRITIONAL HEIRARCHY IN ANTS

L. M. Hooper-Bùi[1] & M. K. Rust[2], [1]Department of Entomology, 402 Life Science Building, Louisiana State Univ. Baton Rouge, LA, USA 70803. E-mail: Lhooper@agctr.lsu.edu; [2]Department of Entomology, University of California, Riverside, CA USA 92521. E-mail: Mikerust@mail.ucr.edu

Radio-labeled sucrose, casein and casein mixed with sucrose were fed to large laboratory colonies of Argentine ants, *Linepithema humile* to investigate the distribution of nutrients among the castes. Argentine ant queens exhibited a nutritional hierarchy. About 10% of the queens in the colony were nutritionally dominant receiving up to 13 times more food than the other queens. Queens and males were fed the majority of sucrose collected by foragers (75%) even though they represent a small proportion of the colony. Males were fed large amounts of both sucrose (15%) and casein (17.5%). The larvae were not fed sucrose within 4 h and only small amounts after 48h. All castes were fed casein with larvae receiving about 59.7% of the total collected by foragers. Workers detected small amounts of protein as low as 10 ppm in sucrose solutions and preferentially fed these solutions to the larvae. We marked newly produced eggs in queens using 20 mg/ml 5-bromo-2'-deoxyuridine and feed queens radiolabeled nutrients. Egg production in queens was strongly correlated with casein ingestion.

Index terms: *Linepithema humile,* food distribution, trophallaxis, foraging

[3501] MOLECULAR CLONING OF A PROTHORACICOSTATIC PEPTIDE (PTSP) IN THE LARVAL BRAIN OF THE SILKWORM, *BOMBYX MORI*

Y.-J. Hua[1,2], Y. Tanaka[2] & H.Kataoka[3], [1]Inst. Nuclear-Agricult. Sci., Zhejiang Univ., 310029 Hangzhou, China, E-mail yjhua@zju.edu.cn; [2]Lab of Bioactive Substances, Natl. Inst. of Seircul. & Entomol. Sci., 305-8634 Tsukuba, Japan; [3]Dept. of Intergrated Biosci., Graduate School of Frotier Sci., Tokyo Univ. 113-0032 Tokyo, Japan

Ecdysone secreted by the prothoracic gland (PG) plays a central role in the insect metamorphosis as molting hormone, which biosynthesis is considered to be stimulated by prothoracicotropic hormone (PTTH). Recently, we have identified a prothoracicostatic peptide (PTSP) from the brain of the silkworm, *Bombyx mori*. PTSP strongly inhibited ecdysteroidogenesis in the PGs of spinning larvae, and simultaneous application of PTSP and PTTH to the PGs of the feeding larvae inhibited the PTTH-stimulated ecdysteroidogenesis. These results indicate the importance of PTSP in the regulation of ecdysteroidogenesis. Using RT-PCR and 5'-RACE we have cloned PTSP cDNA from *B. mori* brain. The predicted open reading frame encoded 288 amino acids including five repeats of PTSP and five other structure-related peptides. Some related peptides also showed prothoracicostatic activity in the *in vitro* bioassay. Northern blot analysis indicated that PTSP gene is expressed mainly in the brain.
Index terms: Bombyx mori, ecdysteroidogenesis, prothoracicostatic peptide, cDNA

[3502] GENETIC VARIABILITY AND POPULATION STRUCTURE OF THE FORMOSAN SUBTERRANEAN TERMITE IN HAWAII

C. Husseneder & J. K. Grace, Dept. of Entomology, Univ. of Hawaii at Manoa, 3050 Maile Way, Gilmore 310, Honolulu, Hawaii 96822, USA

Coptotermes formosanus (Isoptera: Rhinotermitidae) is an important introduced pest species in Hawaii. It is generally assumed that a limited number of introductions and the occurrence of genetic bottlenecks have caused a lack of genetic variation in the Hawaiian *C. formosanus* population. Genetic markers were applied to test this hypothesis and characterize the genetic variability and population structure of *C. formosanus* on Oahu (Hawaii). Multilocus DNA fingerprinting revealed the entire hierarchy of genetic similarities between and within Oahu's termite colonies. (1) The genetic background of the population, based on the genetic similarity between unrelated termites, falls in the range of natural populations. (2) The relatedness between field colonies across all locations is low (r = 0 to 0.21). (3) The relatedness within field colonies lies in the magnitude of the relatedness within artificially outbred laboratory colonies (r = 0.47 to 0.64) and was significantly lower than the genetic similarity within laboratory colonies derived from pairs of siblings (r = 0.71 to 0.76). These results do not support the assumed lack of genetic variability in Oahu's *Coptotermes* population. The significance for the classification of colony membership as well as the understanding of the patterns and processes defining the population structure are discussed.
Index terms: *Coptotermes formosanus* (Isoptera: Rhinotermitidae), DNA fingerprinting, molecular biology

[3503] CHEMICAL STRUCTURE AND PROPERTIES OF SILK PROTEINS PRODUCED BY THE SILKWORMS REARED UNDER ARTIFICIAL DIET/ASEPTIC CONDITIONS

H.Ito[1], T.Imamura[2], H.Sasaki[3], N.Donkai[3] & H.Mori[4], [1]Heian Jogakuin College, Nampeidai, Takatsuki, Osaka 569-1092, Japan, E-mail ito@tk.heian.ac.jp; [2]Inst. of Aseptic Sericulture, Kyoya Co.Ltd., Kuze-Tsukiyama, Minami-ku, Kyoto 601-8203, Japan; [3]Niigata Women's College, Ebigase, Niigata 950-0806, Japan; [4]Kyoto Institute of Technology, Matsugasaki, Kyoto 606-0962, Japan.

Silkworm (*bombyx mori*) eats only mulberry leaves and produces a cocoon. But it is now possible to rear silkworms with only artificial diet which has been developed in Japan. In this study, we investigated chemical structure and properties of silk proteins produced by the silkworms reared on an artificial diet under aseptic condition (A), and compared them with those on a mulberry leaf diet (M). To this end silkworms (*Bombyx mori*: *Kinshuu* x *Shougetsu*) were reared on an artificial diet which contains tofu-cake as a main component, under aseptic conditions which had been established by sterilizing eggs, artificial diet and rearing environment. Two types of cocoons (A and M) were used as original sample materials. Yellowing behavior of both cocoons were examined after UV light irradiation. The degree of yellowing of the A cocoon is much lower than that of M cocoon. Dissolution behavior of the A sericin in hot water is different from that of the M sericin; the amount of A sericin dissolved (28%) is higher than that of M (24%), and the dissolution rate of A sericin is also higher. Both A and M sericins were separated into 4 fractions according to the dissolution rate in hot water, and the amino acid composition (AAC) of each fraction was determined. Although the AAC of unfractionated A sericin is almost the same as that of M sericin, the AACs of the fractionated sericin from the A sample are distinguished from those from the M sample. AACs of the A and M fibroins were also evaluated and found to be almost identical. The X-ray diffraction pattern of the A fibroin is almost the same as that of M fibroin. Dyeing behavior with acid dye (CI Acid Orange 7) was evaluated at pH 3.9. Acid dye uptake of the A sericin was higher than that of M sericin, but almost the same for the A and M fibroin samples. Mechanical as well as rheological properties of fiber samples were also evaluated. The artificial diet used in this study affects the chemical compositions, structure and properties of sericin proteins, but does a little those of fibroin proteins.
Index terms: *Bombyx mori*, tofu-cake diet, silk fibroin, silk sericin

[3504] ADAPTATION OF THE SUBTERRANEAN TERMITE *COPTOTERMES HAVILANDI* (ISOPTERA: RHINOTERMITIDAE) TO THE INTERIOR OF BRAZIL

E. L. Jacintho[1], A. C. Bicalho[1], A. S. Diogo[1], I. T. Ferreira[1], E. B. Menezes[1] & E. L. Aguiar-Menezes[2], [1]CIMP "CRG"/ UFRRJ, BR 465 – km 7, Seropédica, RJ 23890-000, Brazil, E-mail ebmen@zaz.com.br; [2]Embrapa Agrobiologia, BR 465 – km 7,Caixa Postal 74505, Seropédica, RJ 23980-000, Brazil, E-mail menezes@cnpab.embrapa.br.

Subterranean termites are one of the most feared household insects in urban and suburban areas because of the economic damage done by these insects to the dwellings. *Coptotermes havilandi* is an exotic species of subterranean termite introduced in Brazil between 1915 to 1923 through the city of the Rio de Janeiro. From this city, *C. havilandi* spread throughout the littoral regions of Brazil where the warm temperature and high relative humidity make an ideal environment for the development of this species, occurring with high incidence of infestation in these regions. However, the infestations of *C. havilandi* are widespread. In this study, we recorded the adaptation capacity of this species to different regions of Brazil, including cities located in the interior of the country. In December 1998, we found *C. havilandi* causing serious damage to the Equatorial Hotel in Belém (PA). In 1991, we detected *C. havilandi* damaging the electric wires, wooden structures such as posts, railway sleeper, and timber constructions (e.g. stations, signal boxes, worker's home) of the railway station in the Tubarão Port, which belongs to the "Companhia Vale do Rio Doce (CVRD)" and located in Vitória (ES). Recently, we found *C. havilandi* attacking a palm on the garden of the tourist information center (ENCETUR) of Fortaleza (CE). All these cities are located in the coastal region of Brazil. However, in 1991, we also detected the infestation of *C. havilandi* in all extension of the railway of Tubarão Port/CVRD that goes on the interior of the state of Minas Gerais. High incidence of infestation occurred in Governador Valadares (MG). In February 2000, *C. havilandi* was collected from a palm planted in the municipal park of Viçosa (MG). This facts is showing to us that *C. havilandi* decide to change its life, and is leaving to the countryside of Brazil instead of living on the Atlantic Coast forever.
Index Terms: *Coptotermes havilandi*, geographical distribution, countryside adaptation.

[3505] EXAMINING THE GENETIC CONTROL OF DANCE IN HONEY BEES (*APIS MELLIFERA*)

R.N. Johnson[1], B.P. Oldroyd[2], & R.H. Crozier[1], 1: Department of Tropical Biology, James Cook University, Townsville Qld, 4811, Australia: E-mail: rjohnson@bio.usyd.edu.au. 2: Department of Biological Sciences, University of Sydney, Sydney NSW, 2006, Australia

It has been established for some time now that the famous waggle dance observed in honey bees (von Frisch, 1993) is likely to be controlled by a few genes possibly with multiple alleles (Rinderer & Beaman, 1995). We have hybridised two subspecies that exhibit different dance phenotypes, *Apis mellifera ligustica* and *Apis mellifera carnica*. We then backcrossed the F1 generation to males from the recessive dance phenotype. When fed at a discriminating distance there is segregation of dance behaviours into the two parental types. It is hoped that a candidate gene approach, combined with differential display techniques using cDNA libraries, will reveal those differences between individuals of different dance phenotypes and hence allow characterisation of the waggle gene.

Index terms: behaviour, waggle gene, molecular analysis

References: Frisch, K. von (1993). *The dance language and orientation of bees.*, reprinted by Harvard University Press, Cambridge, Massachusetts.

Rinderer, T. E. & Beaman, L. D. (1995). Genic control of honeybee dance language dialect. *Theor. Appl. Genet.* 91(5), 727-732.

[3506] FORAGING POPULATION AND TERRITORY OF THE SUBTERRANEAN TERMITE *COPTOTERMES HAVILANDI* (ISOPTERA : RHINOTERMITIDAE) BY THE TRIPLE MARKED RECAPTURE METHOD IN AN URBAN AREA

J. Justi Junior[1], M. R. Potenza[1], F. J. Zorzenon[1] & Almeida, S. L. de[2], [1]Laboratório de Artrópodes - Instituto Biológico, SP. Av. Cons. Rodrigues Alves, 1252, CEP 04014-002 - São Paulo, SP, BR. E-mail: justi@biologico.br; [2] Dow AgroSciences Ltda., R. Alexandre Dumas, 1671, CEP 04717-903 - S. Paulo, SP, BR. E-mail: salmeida@dow.com.

Termites are economically important pests in urban areas causing millions of dollars of damage in the world. About 200 termite species are known in Brazil and biological and ecological information is rare. The objective of this essay was to determine some biological parameters of one colony of *Coptotermes havilandi* in an urban environment, defining its foraging population and corresponding foraging territory. The selected area was the Instituto Biológico, main building, in São Paulo City, Brazil, severely attacked. The methodology used was the Triple Mark and Release Method (TMR) with a weighted mean model (Begon 1979, Su and Scheffrahn 1988). The method consists in three cycles of capturing, marking and releasing part of the termite population, calculating proportion between marked and unmarked termites. "Nile Blue A" was the dye used to mark the foraging termites. Workers, pre-alates and soldiers were counted and weighted. After marked with the dye, blue termites were counted and released back to the monitoring traps. Then, it was observed the occurrence of blue termites in several points (wooden stakes and underground monitoring stations) around the building, to determine the foraging area. Through mathematic model was possible to estimate the population. The results showed that the estimate foraging population of the *C. havilandi* colony studied was 1,430,189 ± 280,763 insects. The average insects weight were: workers - 0,003110 ± 0,000432 g and soldiers - 0,002859 ± 0,000155 g. The proportion between workers and soldiers was 8,3.
Index terms: termites, *Coptotermes havilandi*, ecology, foraging area, foraging territory

[3507] FORAGING POPULATION AND TERRITORY OF THE SUBTERRANEAN TERMITE *HETEROTERMES TENUIS* (ISOPTERA : RHINOTERMITIDAE) BY THE TRIPLE MARKED RECAPTURE METHOD IN AN URBAN AREA

J. Justi Junior[1] , M. R. Potenza[1], F. J. Zorzenon[1] & Almeida, S. L. de[2], [1] Laboratório de Artrópodes - Instituto Biológico, SP. Av. Cons. Rodrigues Alves, 1252, CEP 04014-002 - São Paulo, SP, BR. E-mail: justi@biologico.br; [2] Dow AgroSciences Ltda., R. Alexandre Dumas, 1671, CEP 04717-903 - S. Paulo, SP, BR. E-mail: salmeida@dow.com.

Termites are economically important pests in urban areas causing millions of dollars of damage in the world. About 200 termite species are known in Brazil and biological and ecological information is rare. The objective of this essay was to determine some biological parameters of one colony of *Heterotermes tenuis* in an urban environment, defining its foraging population and corresponding foraging territory. The selected area was the Hebraica Club, in São Paulo City, Brazil, were infestation was presented in gardens areas, trees and buildings. The methodology used was the Triple Mark and Recapture Method (TMR) with a weighted mean model (Begon 1979, Su and Scheffrahn 1988). The method consists in three cycles of capturing, marking and releasing part of the termite population, calculating proportion between marked and unmarked termites. "Nile Blue A" was the dye used to mark the foraging termites. Workers, pre-alates and soldiers were counted and weighted. After marked with the dye, blue termites were counted and released back to the monitoring traps. Then, it was observed the occurrence of blue termites in several points (wooden stakes and underground monitoring stations) around the building, to determine the foraging area. Through mathematic model was possible to estimate the population. The results showed that the estimate foraging population of the *H. tenuis* colony studied was 802,193 ± 41,098 insects. The average insects weight were: workers - 0,004238 ± 0,000348 g; pre-alates - 0,004926 ± 0,000476 g; soldiers - 0,004823 ± 0,000809 g. The proportion between workers and soldiers was 64,6.
Index terms: termites, *Heterotermes tenuis*, ecology, foraging territory, foraging population

[3508] DOES EATING MORE MAKE YOU TOUGH? THE EFFECT OF NUTRITION ON THE DEVELOPMENT OF SOCIAL WASPS

I. Karsai & J. H. Hunt, Dept. of Biology, Univ. of Missouri-St. Louis, St. Louis, MO 63121, USA. E-mail bioikars@jinx.umsl.edu.

Polistes metricus paperwasps were reared in the laboratory under three different levels of protein (caterpillar) feeding: restricted, ad libitum, and ad libitum plus daily hand feeding of 4th and 5th instar larvae. Offspring of restricted-protein colonies were smaller than those of the other two treatments, but there was no significant allometric change in morphology between treatments. Offspring of restricted-protein colonies did not tolerate cold as well as offspring of the other two treatments, i.e., offspring of better-fed colonies lived longer at 5 degrees celsius than the offspring of restricted-protein colonies. No difference was detected in the sex allocation strategies of the three groups. Larger gynes and males should be able to better cope with environmental stress due to their larger reservoirs of stored nutrients. However, further studies will be required to reveal the full nature of paperwasps' adaptive responses to nutrition variability in the environment.
Index terms: *Polistes metricus*, larval feeding, cold tolerance

[3509] LEAFCUTTING ANTS AS PESTS IN *ARAUCARIA* CULTURES: DIET PREFERENCE BIO-ASSAY UNDER LABORATORY CONDITIONS

C. Klingenberg[1,2], L.C. Forti[1] & W. Engels[2], [1]Depto. de Produção Vegetal, Defesa Fitossanitária, FCA, UNESP, Cx.p. 237, 18603-970 Botucatu, SP, Brazil; [2]Zool. Inst., Uni. Tübingen, Auf der Morgenstelle 28, 72076 Tübingen, Germany, E-mail: christiana.klingenberg@student.uni-tuebingen.de

Araucaria angustifolia is, in the southern Neotropics, the oldest and the most important tree species of the Brazilian Atlantic rain forest. After years of forest clearance only remnants of this unique ecosystem are left. On the mountains of the Serra Geral in Rio Grande do Sul a forest reserve has been established. In previous reforestation experiments , leafcutting by ants of the genera *Atta* and *Acromyrmex* destroyed seedlings of *Araucaria angustifolia* in monocultures. In order to solve this severe problem of reforestation with an important native tree, we bioassayed the attractiveness of *Araucaria* needles of trees of different age to foraging leafcutter ants. Comparative tests were carried out with workers of laboratory colonies of different ant species. We found that the ants preferred to cut fresh leaves. Therefore, the protection of young trees should be taking into consideration more than the old ones. In addition we found that leafcutting ants preferred exotic plants to native shrubs and trees. We conclude that, in *Araucaria* reforestation programs, plantations with a mixture of native and exotic trees instead of monocultures could be a promising alternative to avoid damage of the seedlings.
Index termes: *Araucaria angustifolia*, reforestation problems, leafcutting ants, *Atta*, *Acromyrmex*, diet preference bioassay.

[3510] STRUCTURAL ANALYSIS OF THE Z CHROMOSOME IN *BOMBYX MORI* BY USING THE BAC LIBRARY

Y. Koike[1], T. Shimada[1], M.G. Suzuki[1], K. Mita[2], S. Maeda[3], K. Osoegawa[4], P. DeJong[4], [1] Dept. of Agric. Environ. Biol., Univ. of Tokyo, Yayoi 1-1-1, Bunkyo-ku, Tokyo 113-8657, JAPAN, E-mail ykoike@nirs.go.jp; [2] Natl. Inst. Radiol. Sci., Anagawa 4-9-1, Inage-ku, Chiba 263-8555, JAPAN; [3]The Institute of Physical and Chemical Research (RIKEN), Hirosawa 2-1, Wako, Saitama 351-0198, JAPAN; [4]Children's Hospital Oakland Research Institute, Oakland, CA94809-1809, USA.

Composition of sex chromosome of the silkworm, *Bombyx mori*, is ZZ in the male and is ZW in the female. Since it is known that the genes located on Z chromosome are not controlled by the dosage compensation in *B. mori*, we suppose that the functions of the gene of Z chromosome may be different function from those on autosome. In order to know what kinds of genes exist on Z chromosome, we have intended to analyze the structure of Z chromosome in a long range by the Construction of BAC contigs. The BAC library was estimated to have 170 kb inserts in average with 11 times redundancy of the genome size (530 Mbp). The high molecular weight DNA was extracted from the posterior silk gland at 5th-instar larvae of strain p50 (Daizo), and was partially digested with *Eco*RI. The fragments of 50-220 kb were size-fractionated by the pulse-field gel electrophoresis and ligated with the BAC vector, pBACe3.6. First, the BAC clones including an initial marker, *Bmper* or *Bmkettin* or *T15.180a*, which have already been known to locate on the Z chromosome, were screened by the hybridization. The BAC end sequences of those clones were determined and used as the probes in the next hybridization. We are now proceeding to extend the BAC contigs with primer walking. On the other hand, our EST database contains more than 20,000 cDNAs derived from various tissues of different developmental stages. At present, about 7,600 independent ESTs were identified. These cDNA clones were dotted to on HDR filters. In order to identify the EST markers located on the BAC clone, the EST HDR filter was hybridized with the labeled BAC clone.
Index terms: *Bombyx mori*, BAC, Z chromosome, HDR filter, EST.

[3511] NEW FINDINGS OF NYMPH- SOLDIER INTERCASTES OF *NASUTITERMES AQUILINUS* (ISOPTERA, TERMITIDAE, NASUTITERMITINAE)

E. R. Laffont & G. J. Torales, Fac. de Cs. Exactas y Naturales y Agrimensura. Univ. Nacional del Nordeste. 9 de Julio 1449. 3400. Corrientes. Argentina. E-mail: erl@exa.unne.edu.ar.

The intercastes are not common within Isoptera societies. Soldiers with wing pads, whose heads remain to this caste but the thorax resamble to sexual nymphs, appear sometimes in lower termite genera. Among the family Termitidae, soldier- nymph intercastes have been described in various genera (*Microcerotermes, Termes, Tumulitermes, Amitermes, Drepanotermes, Nasutitermes*), as well as soldier- worker intercastes (*Nasutitermes*), which are more uncommon. The intercastes may be originated in natural conditions, experimentally (Kalotermitidae and Rhinotermitidae) or as a consequence of parasitism. *Nasutitermes aquilinus* is a neotropical arboreal termite distributed in Argentina, Paraguay and Brazil, and commonly found in native and implanted woody plants. On this paper, new findings of soldiers-nymph intercastes of *N. aquilinus* are reported, with morphometric data and comparisons with nymphs and soldiers from the same colony. The individuals came from an arboreal nest on an *Eucalyptus* sp tree, from an urban house of the city of Corrientes, Argentina. Intercastes, nymphs, major and minor soldiers (fifteen individuals of each category) were measured under stereomicroscope with an ocular micrometer. The considered morphometric characters were: total body- length (TBL), length of head with rostrum (LHR); length of head without rostrum (LHW), maximum width of head (MWH), height of head excluding postmentum (HH), maximum length of pronotum (MLP), maximum width of pronotum (MWP) and length of hind tibia (LHT). The length of wing pads was measured in intercastes and prealates. The number of antennal segments was also recorded. According to its morphological characteristics, the intercastes were separated in two groups. The individuals of the Group I were rather similar to nymphs: broad head, short nasus, fully pigmented eye spots, antennae with 14 and 15 segments (50% of the individuals in each category), well developed wing pads and abdomen with abundant fat tissue. On the contrary, the group II individuals were more similar to soldiers, on the size and form of the head-capsule, the development of nasus and the abdominal features. Antennae with 14 segments were found in 80% of these intercastes, while the rest of them had 15 segments. In spite of the reported differences, the individuals of both groups were closer to major soldiers considering the cephalic characters (LHR, LHW, MWH, HH) and to sexual nymphs regarding the measurements of TBL, MLP, MWP and LHT.
Index Terms: Termites, intermediate forms, morphometric characters

[3512] PRELIMINARY INVENTORY OF ISOPTERA FROM NATURAL PROTECTED AREAS OF NORTHEAST ARGENTINA

E.R. Laffont[1], G.J.Torales[1], J.M. Coronel[1], M.O. Arbino[1] & M.C.Godoy[1], [1]Fac. de Cs. Exactas y Naturales y Agrimensura. Univ. Nacional del Nordeste. 9 de Julio 1449. 3400. Corrientes. Argentina. E-mail: moarbino@arnet.com.ar.

Since 1996, qualitative termite sampling within natural protected areas of the northeast region of Argentina has been developed. The results showed in this paper correspond to the 1996-1999 period, in the Chaco National Park (province of Chaco), Iguazu National Park (province of Misiones) and Mburucuya National Park (in formation process, province of Corrientes). The recorded genera were: *Rugitermes* and *Tauritermes* (Kalotermitidae); *Heterotermes* (Rhinotermitidae); *Amitermes, Anoplotermes, Cornitermes, Cortaritermes, Diversitermes, Microcerotermes, Nasutitermes, Neocapritermes* and *Termes* (Termitidae). In the Chaco National Park, *Heterotermes tenuis* and *Microcerotermes strunckii* were found in the *Schinopsis balansae* forest ("quebrachal"). *Nasutitermes aquilinus* colonizing *Anadenanthera macrocarpa* and *Tauritermes taurocephalus* on *Caesalpinia paraguariensis*, were located in the strong forest ("monte fuerte"). *Amitermes amifer* was found in dead wood. In the Iguazu National Park, the inspection of the areas surrounding the main trails, allowed to detect some criptical Termitidae (*Anoplotermes cingulatus, Diversitermes diversimiles* and *Neocapritermes opacus*) living in decaying wood. Among the Kalotermitidae, *Rugitermes rugosus* occupied dead branches of *Patagonula americana*. In the Mburucuya National Park, the human activities previous to the creation of the Park produced important disturbance to the communities of woody plants and *Butia yatay* palm trees, with a decrease of arboreal termites and an increase in the nests of mound-builders species. In the hygrophilic forest with *Ocotea acutifolia* (typical species), *Nasutitermes aquilinus* was found on living trees and dead wood. The non-arboreal species *Cornitermes cumulans, Cortaritermes fulviceps* and *Termes saltans* were mainly located in the savanna of *Andropogon lateralis* and *Elionurus muticus* with *B.yatay*. Epigeal nests of *Termes saltans* were present not only in the *S.balansae* forest, but also in the community of *B.yatay* palm trees, where mounds of *Cortaritermes fulviceps* are abundant. *Neocapritermes opacus* was occasionally found inside the nests of the last species.
Index Terms: Termites, native vegetation, National Parks

[3513] EFFECT OF TOXIC-BAITS ON THE ANT COMMUNITY STRUCTURE IN AN AREA OF *EUCALYPTUS SPP.* PLANTATION

J. F. S. Lopes[1] & L. C. Forti[2], [1]Dept. Zoologia, IB-UNESP, P. O. Box 510, Botucatu, SP, 18618-970, Brazil. E-mail julianelopes@usa.net; [2]Dept. Produção Vegetal, FCA-UNESP, P. O. Box 237, Botucatu, SP, E-mail luizforti@fca.unesp.br, 18603-970, Brazil.

Ants are numerous and predominat organisms in the great majority of terrestrial ecosystems. Acting on many thophic levels, it is possible to find, in the same habitat, many different species, including ones considered to be pests and others to be potential pest control agents. Researches on the collateral effects of insecticide, as well as on the development of selective substances which minimize this effect on benefic organisms, have got mowadays more emphasis and interest from researches all over the world. In areas of *Eucalyptus spp.* plantation, it is observed the ocurrence of a relatively constant ant fauna, with dominance and hierarchy realtionships well defined. In these areas, it is also common the practice of toxic chemical baits application to control the leaf-cutting ant species. Therefore, the current work aimed at investigating the influence of the commercial toxic bait Mirex-S Max N.A.® (sulfluramid 3g/kg), using three different methods, on the ants community structure. To get data about the fauna, five samplings were done; one of them was done before the bait application. The results were obtained by comparing the diversity and evenness indexes on the previous sampling and on the fourth post-application samplings. There was a significant statistical difference after 60 days from the bait application, and the results indicated an increse on the diversity and evenness indexes on the areas where there wasthe application of localizedbaits and micro bait-station (MIPIS). On the sampling done after the 90th day of bait application, it was noticed that only one diversity index was significantly bigger. On the other hand, on the sampling of 120-days pos-application, it was impossible to state differences between the indexes observed on the treatment-areas and the control-areas. It is thus relevant to suggest that the effect of commercial toxic bait Mirex-S Max N.A.® (sulfluramid 3g/kg) appication on the ants community structure is merely indirect, probably because of dominant pest species (*Atta sp.*) decrease.

[3514] EFFECTS OF TOXIC BAITS ON NON-TARGET ANT SPECIES

J. F. S. Lopes[1] & L. C. Forti[2], [1]Dept. Zoologia, IB-UNESP, P. O. Box 510, Botucatu, SP, 18618-970, Brazil., E-mail: julianelopes@usa.net; [2]Dept. Produção Vegetal, FCA-UNESP, P. O. Box 237, Botucatu, SP; E-mail: luizforti@fca.unesp.br, 18603-970, Brazil.

The use of toxic baits with sulfluramid to control the species of leaf-cutting ants in Brazil has been a constant fact, due to its economic viability, application easiness, good eficiency and lower residual period in environment. However, its application effects on non-target ant species are rather unknown. This work aims to investigate the effects of commercial toxic bait Mirex-S Max N.A.® (sulfluramid 3g/kg), on the non-target ant species which are present in a commercial area of *Eucalyptus spp.* The control of *Atta spp.* at the experimental area used threee different application methods: systematical distribuition, located distribuition and micro bait-station (MIPIS). Each method was applied into six plots and there was no toxic baits application to the control plots. The evaluation of the effects of bait applications was done comparing the standard number of subjects from non-target ant species present on the pre-treatment sampling to the number obtained on the four post-treatment samplings. The results demonstrated that there was a significant reduction on the *Atta spp.* population turnig evident the effective population control. Although some non-target ant species have present relevant statistical diferences on the post-treatment samplings, in the last one (120 days) only three genera (*Monomorium, Camponotus* and *Brachymyrmex*) showed effectively a significant reduction on the populaton. The genera *Pheidole* and *Pachycondyla* presented a relevant increase on population. As concern to the genera *Ectatomma, ponera* and *Odontomachus*, it was not possible to observe relevant statistical differences in any of proposed treatments. Generally, it was possible to verify that the toxic bait Mirex-S Max N.A.® (sulfluramid 3g/kg) has got no harmful effects on the non-target ant species which are present in the selected area. A re-establishment trend on the populations levels, before 120 days from the baits application, was also observed.

[3516] OCCURRENCE OF SWARMS OF AFRICANIZED BEES AND WASP NESTS IN THE METROPOLITAN REGION OF CURITIBA, STATE OF PARANA, BRAZIL

S. R. Malkowski[1], [1]Divisão de Museu de História Natural Capão da Imbuia, Secretaria Municipal do Meio Ambiente, Prefeitura Municipal de Curitiba. Rua Benedito Conceção 407, 82.810-080 Curitiba, Parana State, Brazil. E-mail solang@bsi.com.br

The frequency of occurrence of swarms of africanized bees – *Apis mellifera* (Hymenoptera, Apidae) and wasp nests (Hymenoptera, Vespidae), has increased in areas inhabited by humans, as a result of deforestment caused by the growing urbanization process. Both migratory and stationary bee swarms, as well as wasp nests, cause worries and even panic when detected by the population, as they may represent danger as a result of the stings that can be applied. Accidents with bees and wasps can result in death, depending upon the degree of sensitivity of the injured person and/or the number of stings received. This study aims to present results of four years of accompaniment of this problem in the metropolitan region of Curitiba. The obtained data represent the number of requests for attendance of rescues coming from the population. The geographic unit used for the mapping was the district or locality. These occurrences were recorded during the years 1996 (196 cases), 1997 (360), 1998 (194) and 1999 (335). A larger incidence occurred from August to February, which corresponds to the warmest period of the year. The migratory swarms are more frequent from August to December. The data of temperature, humidity and precipitation are being correlated. Through mapping, was verified that a similar distribution pattern exists in the appearance of swarms. Amongst the six species of wasps collected in rescues, *Polybia (Trichothorax) ignobilis* and *P. (Myraptera) scutellaris* are the commonest. The other species are *Brachygastra lecheguana, Agelaia multipicta multipicta, Polybia (Myraptera) occidentalis* and *Polistes* sp.

Index terms: swarms, *Apis mellifera,* wasp nests, danger in urban areas.

[3517] STINGLESS BEES OF THE PARANA STATE ASSOCIATION OF BEEKEEPERS

S. R. Malkowski[1] & S. R. Gonzaga[2], [1]Divisão de Museu de História Natural Capão da Imbuia, Secretaria Municipal do Meio Ambiente, Prefeitura Municipal de Curitiba. Rua Benedito Conceição 407 CEP 82.810-080 Curitiba, Parana State, Brazil. E-mail solang@bsi.com.br; [2]Associação Paranaense de Apicultores. Rua Mário Beraldi 380, 82.650-490 Curitiba, Parana State, Brazil.

The need to implement preservation programs for social indigenous stingless bees becomes increasingly necessary. based upon this premise, during the last decade the Parana State Association of Beekeepers (Associação Paranaense de Apicultores - APA) has been implanting melyponaries in its headquarters in the metropolitan area of Curitiba. the main objective is being achieved through the development of research that concerns biology and management, viz.: artificial feeding, honey extraction, division of colonies, transference to artificial nests and protection mechanisms against natural enemies. At the same time are being carried out activities of environmental education consisting of oriented visits of schoolchildren and community members in general, the lending of didactic material and uttering of lectures. Besides are administered courses of basic melyponiculture directed to students and keepers of stingless bees. In brazil are known approximately 400 species of meliponinae and in Parana occur about 30 species. At this moment the breeding stock consists of 373 colonies belonging to 13 species (3 meliponini and 10 trigonini). The most abundant species is *Melipona Quadrifasciata*, with *m. Quadrifasciata Quadrifasciata* (130 colonies) and *Melipona Quadrifasciata Anthidioides* (140). the other species are *M. Marginata* (10), *Plebeia Remota* (34), *p. emerina* (35), *p. droryana* (7), *p. juliani* (3), *P. Mosquito* (1), *P. Saiqui* (1), *Scaptotrigona Bipunctata* (5), *Tetragonisca Angustula* (3), *Nannotrigona Testaceicornis* (2) and *Friesella schrottkyi* (2). Later on, it is pretended to start a program towards the reintroduction of nests in areas that are appropriate for keeping these bees.

Index terms: stingless bees, melyponary, associação paranaense de apicultores – apa.

[3518] GENETIC MECHANISMS CONTRIBUTING TO DIFFERENCES IN COLONY GROWTH RATES BETWEEN AFRICAN AND EUROPEAN HONEY BEES

L.M. Mccoy, J.H. Fewell & J.F. Harrison, Department of Biology, Arizona State Univ., Tempe, AZ 85281-1501, USA

The difference in competitive success between African *(Apis mellifera scutellata)* and European *(Apis mellifera ligustica)* honey bees has been linked to colony level differences in behavior and physiology. Each subspecies demonstrates a life history strategy that reflects the selective pressures of their respective evolutionary histories. African colonies focus their energies towards maximizing colony growth to counter frequent predation and unpredictable resource availability, while European colonies focus their energies on sequestering resources for survival during winter. These colony level differences are clearly a result of genetic differences between the subspecies. However, the respective role of genetics and environment in determining the competitive success of a colony have not been separated in colony level experiments. To discover the genetic basis for colony level differences between African and European honeybees, we co-fostered individually marked, newly emerged individuals of each genotype in a common hive environment. This allowed us to equalize the hive environment experienced by each genotype so that observed differences in behavior and physiology could be directly attributed to genetic differences between the subspecies. We hypothesized that either African honeybees would show a preference for performing tasks associated with increasing colony growth, or that African honeybees would show a higher work effort. In addition, we hypothesized that African honeybees would show a higher mass specific metabolic rate, because work output often correlates with metabolic rate. This experiment was divided into two parts; in the first part we looked for genetic differences in the performance of in-hive tasks associated with colony growth., in the second part we looked for genetic differences in the performance of foraging tasks. We also collected metabolic data during both experiments. African and European honeybees did not differ in their performance of in-hive tasks associated with brood production. African honeybees did not show a preference for tasks associated with brood production, a higher overall work effort, or a higher mass specific metabolic rate. However, African and European honeybees did differ in their preference and work effort associated with foraging. African foragers showed a genetic preference for collecting pollen, a higher work effort, and a higher mass specific metabolic rate. This suggests that the competitive advantage of African honeybees over European honeybees is due to a relatively small set of genetically based behavioral and physiological traits expressed only in foraging age workers.

Index Terms: *Apis mellifera*, foraging, behavior, honeybee, metabolic rate

[3519] EFFECTS OF METHOPRENE ON SILKWORM, *BOMBYX MORI* (LEPIDOPTERA: BOMBYCIDAE)

J. E. Miranda[1], S. A. De Bortoli[1] & R. Takahashi[2], [1]Depto. de Fitossanidade, Fac. Ciências Agrárias e Vet., Univ. Est. Paulista, Via de Acesso Prof. Paulo Donato Castellane, s/n, 14884-900, Jaboticabal, SP, Brasil, E-mail miranda@fcav.unesp.br, FAPESP Fellowship; [2]Depto. de Zootecnia, Fac. Ciências Agrárias e Vet., Univ. Est. Paulista, Via de Acesso Prof. Paulo Donato Castellane, s/n, 14884-900, Jaboticabal, SP, Brasil.

The juvenile hormone analogues (JHA) have been tested as insect growth regulators in *Bombyx mori* , seeking the increment of the silk production. These chemical products, when applied in small or moderate doses, promote prolongation of the last larval instar. The present work sought the understanding of the physiologic consequences in the silk production of silkworm strain C115xN108 face to the application of the JHA methoprene, through the determination of its effects on the larval development, cocoon production and fertility. The topical application of methoprene at 48th hour after the fourth ecdysis in the dorsal integument of the 2nd thoracic segment with doses starting from 1nl promoted larval prolongation; doses starting from 100nl determined the formation of non-spinning larvae (dauer larvae) and the consequent death without reaching the next developmental phase. Significant increases in the weight of the silkgland happened with applications of doses starting from 1nl. Dose of 10 nl of methoprene promoted increase of the cocoon and silk weight, however that occurred mainly due to the increase of the pupal weight. The embryogenesis was affected negatively ($P<0,05$) by the applications starting from 1nl of methoprene.

Index terms: JHA, juvenile hormone, larval development

[3520] EFFECTS OF PYRIPROXYFEN ON THE LARVAL DEVELOPMENT, THE COCOON AND SILK PRODUCTION OF *BOMBYX MORI* (LEPIDOPTERA: BOMBYCIDAE)

J. E. Miranda[1], S. A. De Bortoli[1] & R. Takahashi[2], [1]Depto. de Fitossanidade, Fac. Ciências Agrárias e Vet., Univ. Est. Paulista, Via de Acesso Prof. Paulo Donato Castellane, s/n, 14884-900, Jaboticabal, SP, Brasil, E-mail miranda@fcav.unesp.br, FAPESP Fellowship; [2]Depto. de Zootecnia, Fac. Ciências Agrárias e Vet., Univ. Est. Paulista, Via de Acesso Prof. Paulo Donato Castellane, s/n, 14884-900, Jaboticabal, SP, Brasil.

The administration of juvenile hormone analogues (JHA) in immature insects has been promoting physiologic and biological changes. The growth is favoured due to the prolongation of the feeding period. However, excessive doses take to the formation of "dauer larvae", which do not accomplish the pupal metamorphosis. Some of these products can also present deleterious effects in the fecundity. The determination of the physiologic effects of pyriproxyfen on the larval development, the cocoon and silk production of silkworm, *Bombyx mori* , was the objective of the present work. Pyriproxyfen 0.1, 0.2, 0.4, 0.6, 0.8, and 1 pl/5µl of solution, in topical application on the 2nd integumental segment thoracic of the larvae, at 48th hour after the fourth ecdise, with the use of a microapplicator model Burkard 900-x. The adopted statistical procedure was a randomized block design (ESTAT Program) and the Duncan's multiple range test was used to determine the statistical significance; the mortality was related to the doses through the analysis of Probit by the Polo PC Program. Although the weight gains of the treated larvae were not differentiated from those obtained by the untreated larvae, pyriproxyfen 0,1 - 1 pl influenced positively the cocoon and silk production, probably through the increase of weight of the silkglands, responsible for the silk proteins synthesis. Nevertheless, the tested strip of doses was shown innocuous to the survival of the larvae.

Index terms: JHA, neotenin, silkworm

[3521] EFFECTS OF TOPICAL APPLICATION OF FENOXYCARB AT DIFFERENT DOSES ON SILKWORM, *BOMBYX MORI* (LEPIDOPTERA: BOMBYCIDAE)

J. E. Miranda[1], S. A. De Bortoli[1] & R. Takahashi[2], [1]Depto. de Fitossanidade, Fac. Ciências Agrárias e Vet., Univ. Est. Paulista, Via de Acesso Prof. Paulo Donato Castellane, s/n, 14884-900, Jaboticabal, SP, Brasil, E-mail miranda@fcav.unesp.br, FAPESP Fellowship; [2]Depto. de Zootecnia, Fac. Ciências Agrárias e Vet., Univ. Est. Paulista, Via de Acesso Prof. Paulo Donato Castellane, s/n, 14884-900, Jaboticabal, SP, Brasil.

Fenoxycarb is a juvenile hormone analogue (JHA), active in a great number of insects. When applied at very small doses, it determines the syndrome of the permanent larvae, which prevents the larval metamorphosis. In these work, fenoxycarb was administrated at different doses (0, 100 fg, 1 pg, 10 pg, 100 pg, 1 ng and 10 ng of i.a./10 ml of ethanol) in *Bombyx mori* , in order to determine its effects on the larval development, cocoon production and fertility. The JHA was topically applied on the 2nd thoracic segment of the larvae, at 48th hour after the beginning of the 5th instar, with a microapplicator Burkard 900-x. A direct correlation was verified between the utilised doses and the 5th instar period, and from 1 ng the increase on the duration of the instar was shown well accentuated, taking to the formation of "dauer larvae". No effects on the weight gain were evident. Fenoxycarb 10 pg and 100 pg resulted in the largest values of silkgland weights. Doses till 1 pg don't affect the cocooning, but doses up 10 pg promote deleterious effect so much accentuated as the doses were increased, and doses up 1 ng prevent the cocooning of all the insects. Positive effect can be verified on the cocoon and silk production due to application of fenoxycarb 100 fg and 1 pg on the insects, although it has also been evident an increase in the pupae weight, proportionally larger than the increase in the silk rate. The adults' reproductive capacity was negatively affected by fenoxycarb in doses equal or higher than 10 pg.

Index terms: JHA, neotenin, larval development, fertility

[3522] MORPHOLOGICAL DESCRIPTION OF THE CATERPILLAR OF *BOMBYX MORI* (LEPIDOPTERA: BOMBYCIDAE) WITH THE USE OF SCANNING ELECTRONIC MICROSCOPY

J. E. Miranda[1], A. T. Murata[2], J. M. dos Santos[1], S. A. De Bortoli[1] & R. Takahashi[3], [1]Depto. de Fitossanidade, Fac. Ciências Agrárias e Vet., Univ. Est. Paulista, Via de Acesso Prof. Paulo Donato Castellane, s/n, 14884-900, Jaboticabal, SP, Brasil, E-mail miranda@fcav.unesp.br, FAPESP Fellowship; [2]Depto. de Biologia, Fac. Filosofia, Ciências e Letras de Rib. Preto, Universidade de São Paulo, Av. dos Bandeirantes, 3900, 14040-901, Ribeirão Preto, SP, Brasil; [3]Depto. de Zootecnia, Fac. Ciências Agrárias e Vet., Univ. Est. Paulista, Via de Acesso Prof. Paulo Donato Castellane, s/n, 14884-900, Jaboticabal, SP, Brasil.

The order Lepidoptera contains more than 100,000 species disposed in more than 100 families of insects. Considering its abundance, the larvae of Lepidoptera are not well-known. *Bombyx mori* (Lepidoptera: Bombycidae) is one of the species of this order that stand out as frequent object of studies in physiology, morphology, nutritional ecology and biology, besides its economic importance for the production of silk cocoons. However, few detailed studies of the external structures of this species have been described. This work had as objective the morphologic description of the larva of *B. mori*, with the aid of the scanning electronic microscopy. Specimens were fixed with 3% glutaraldehyde in 0.05 M potassium cacodylate buffer, pH 7.4, at 8ºC overnight, followed by washing with the same buffer for 1 h. The specimens were then fixed with 2% OsO_4 in the same buffer at 8ºC by 12 h, followed by washing as above and dehydration in a routine, graded ethanol series. Soon after, specimens were dried by the critical point dryer, being used the carbon dioxide as transition liquid. Specimens were submitted to gold-palladium metalization. Later on, the samples were examined in scanning electronic microscope JEOL JSM 25SII and the material was documented as electronmicrographies. Morphologic details of the head, thorax and abdomen were described and discussed.
Index terms: SEM, Insecta, silkworm, morphology

[3523] MASS-PRODUCTION OF PORCINE INTERLEUKIN-2 IN *BOMBYX MORI*

M. Miyazawa[1], S. Inumaru[2], T. Kokuho[2] & T. Arakawa[1], [1]Dept. of Insect Technology, Natl. Inst. of Sericultural and Entomological Science, 1-2, Ohwashi, Tsukuba City 305-8634, JAPAN, E-mail miyazawa@nises.affrc.go.jp ; [2]Dept. of Biological Product, Natl. Inst. of Animal Health, 3-1-1, Kan-nondai, Tsukuba City 305-0856, JAPAN.

Recently, the mass-production of rare proteins of medical or nutritional importance has received a great deal of attention, and much effort is being paid on the development of efficient production techniques. Maeda et al. developed a vector from a nuclear polyhedrosis virus (NPV) infecting a silkworm, *Bombyx mori*. The recombinant virus replicates in silkworm larvae, and the recombinant protein products accumulate in the larval hemolymph; the target proteins are extracted from the hemolymph. We aim at the development of an economically-sound system for large scale protein production using silkworm. One of the important technique necessary for the establishment of such a production system is a wide use method for efficiently extracting the insect hemolymph. Insect, once frozen and melted, usually shrink in size. We took advantage of this phenomenon to develop a mass extraction method. From 500 silkworm larvae, we obtained 390 ml of hemolymph. We have applied this extraction method to a mass-production of porcine interleukin-2 (poIL-2). In order to construct poIL-2 recombinant viruses, AcNPV and hybrid virus (HyNPV) were prepared. Infection into silkworms were carried out under the several condition. The SDS-PAGE showed that the recombinant poIL-2 was expressed 1-3 mg/ml in hemolymph. It was 7 to 20 times as much as that of the cell culture systems. Bioactive estimation using MTT method with CTLL-2 cell indicated that recombinant poIL-2 in transgenic hemolymph had biological activities. Our findings demonstrate that the production efficiency is equal to the yield with transgenic livestock. In addition, this system is highly suitable for the production of small proteins, such as cytokines, toxins and hormones, because hemolymph of silkworm seldom have proteins below 20 kDa.
Index terms: Mass-production, porcine IL-2, silkworm, extraction, hemolymph.

[3524] INTERNAL ARCHITECTURE OF *ATTA BISPHAERICA* NESTS (HYMENOPTERA; FORMICIDAE)

A. A. Moreira[1] & L. C. Forti[1], [1]Dept. Produção Vegetal, FCA-UNESP, P. O. Box 237, Botucatu, SP, 18603-970, Brazil., E-mail: luizforti@fca.unesp.br.

The nests architecture study of genus *Atta* leaf cutting ants is of major importance, as they present a great structural complexity being, possibly, one of the limitations to their successful control. Due to this importance, an work was carried out at Santana Farm, Botucatu - SP, with the objective to study the internal structure of *Atta bisphaerica* nests. Two adult nests were dug (A1 e A2) with 31 and 41 square meters of superficial excavated soil by ants, respectively. Before the excavation, area and volume of superficial excavated soil by ants were taken. The nests had their structure molded with cement (5kg/10 l of water) what facilitated a better visualization of the chambers and tunnels structure and shape. During the digging, all data refered to chambers and tunnels were taken, such as: dimensions, depth in relation to the soil surface and their position in the orthogonal axis (x,y). It was observed that the nests A1 e A2 presented some similarities in their internal structures, such as: shape chambers of a spherical calotte, tunnels flattened with elliptic section, total depths of 2.5 m and each entrance hole linked to the nest by an isolated tunnel. However, there were variations in the number of chambers in relation to the size of the nest: nest A1 with 58 chambers and A2 with 234 chambers. This species presented less chamber number of bigger dimensions than *A. laevigata* e *A. sexdens* and larger chamber numbers than *A. capiguara*. The tunnel high were 2.5 cm long and the width varied from 3.5 to 20.0 cm.
Index terms: *Atta bisphaerica*, architecture, leaf-cutting ant, nest

[3525] RESPONSE OF *ATTA BISPHAERICA* (HYMENOPTERA, FORMICIDAE) TO METHANOLIC EXTRACTS OF SUGAR CANE AND *ANDROPOGON* GRASS

A. A. Moreira[1], M. A. C. Boaretto[2] & L. C. Forti[1], [1]Dept. Produção Vegetal, FCA-UNESP, P. O. Box 237, Botucatu, SP, 18603-970, Brazil. E-mail: luizforti@fca.unesp.br; [2]Dept. Fitotec. Zootec., UESB, P. O. Box 95, Vitoria da Conquista , BA, 45100-000, Brazil.

The chemical control of the grass-cutting ants *Atta capiguara* and *Atta bisphaerica* with toxic baits, does not always result in satisfactory efficiency. Among the several hypotheses to explain such a fact, the low citric pulp attraction to these ants deserve attention. The impregnation of the baits with attractive scents can result in improvement in the transport rates by facilitating the workers to find them. The objective of this work was to verify the attractiveness of sugar cane (*Saccharum officcinarum*) and *Andropogon* grass (*Andropogon gayanus c.v.* Planaltina) methanolic extracts to *A. bisphaerica*, trying to incorporate it into toxic baits. The extracts were obtained from new and dried grass leaves from that two species at the Laboratory of Social Insects of the Department of Produção Vegetal (FCA/UNESP/Botucatu). To the vegetable material, methanol solvent was added, following the filtering and drying stages in rotative evaporator. The dry methanolic extracts were diluted in soybean oil at 0.5% (p/v) for the tests in adult nests of *A. bisphaerica* located in grass land. Cellulose fragments (3 x 3 mm), previously marked with plastic ink of different colors, were immerged in the extracts for 2 minutes and offered to the ants. The experiment consisted in 4 treatments and 10 repetitions (nests). The experimental unit constituted of 10 sequential presentations with 10 cellulose fragments group on the side of the trail, next to the entrance hole. In addition to the extracts treatments, were included one oil treatment and one with just cellulose (check). A limit time of 10 minutes between the beginning and the end of each presentation was established, after which the remaining fragments were removed and counted. The obtained results were submitted to variance analysis the mean values were compared to Tukey test at 5% of significance. The highest mean transportation rates were obtained with the treatments with sugar cane extracts (85.2%) and *Andropogon* grass (78.5%), not differing between them, but were higher than the treatments with soybean oil (48.2%) and just cellulose (3.2%). These results indicate that the studied extracts present potential for future experiments with their incorporation in toxic baits.
Index terms: *Atta bisphaerica*, grass-cutting ant, methanolic extracts

[3526] ATTRACTION OF *ARNITICUS* SP (COLEOPTERA: CURCULIONIDAE) IN THREE MULBERRY CULTIVARS (*MORUS ALBA*) IN PIRACICABA - SP

O. Murari[1,4], N. C. Bellizzi[2,4] & L. C. Marchini[3], [1]Dept. of Animal Science, UEM, Av. Colombo 5790, Maringá, PR 87020-900, BRA, e-mail: omurari@carpa.ciagri.usp.br; [2] Unid. of Jardim, UEMS, Av. 11 de dezembro s/n, Jardim, MS, 79240-000, BRA, e-mail: ncbellizzi@bol.com.br; [3] Dept. of Entomology, ESALQ/USP, Av. Pádua Dias 11, Piracicaba, SP, 13418-900, BRA. [4] Doctor students of the Dept. of Entomology, ESALQ/USP, Av. Pádua Dias 11, Piracicaba, SP, 13418-900, BRA.

Arniticus sp. (Coleoptera) is an important pest of mulberry (*Morus alba* L.) and may affect the productive development of this plant. Damages of this insect were observed in ESALQ/USP, in 1997 and 1999 (October and November) on an experimental field. The adult of this insect hinds under leaves or in dark places, and during the night comes out to eat mulberry leaves. To control this insect one should pick it up manualy, because the use of chemicals, would affect the silkworm *Bombix mori* L. Preference tests were done with leaves of three mulberry cultivars: Miura, and the hybrids FM- Shima Miúra and IZ-56/4. Leaf discs of each cultivar were mesured and placed in petri dishes each one containing 5 couples of *Arniticus* sp. After 24 hours the foliar areas were measured again and the consumed areas were evaluated. The consumed foliar areas of the cultivar Miura, FM- Shima Miura, and IZ 56/4 were 2.769 cm^2, 1.965 and 1.470 cm^2 respectively, showing the preference for the Miura cultivar when compared with the other cultivars. However no resistance was observed for any cultivar. An increase in the *Arniticus* sp. population in the field was observed during highly humid days.
Index terms: mulberry, resistance, preference.

[3527] PRESENCE OF THE *ARNITICUS* SP (COLEOPTERA: CURCULIONIDAE) IN MULBERRY (*MORUS ALBA*) IN PIRACICABA-SP

O. Murari[1,4], N. C. Bellizzi[2,4] & L. C. Marchini[3], [1]Dept. of Animal Science, UEM, Av. Colombo 5790, Maringá, PR 87020-900, BRA, e-mail: omurari@carpa.ciagri.usp.br; [2] Unid. of Jardim, UEMS, Av. 11 de dezembro s/n, Jardim, MS, 79240-000, BRA, e-mail: ncbellizzi@bol.com.br; [3] Dept. of Entomology, ESALQ/USP, Av. Pádua Dias 11, Piracicaba, SP, 13418-900, BRA. [4] Doctor students of the Dept. of Entomology, ESALQ/USP, Av. Pádua Dias 11, Piracicaba, SP, 13418-900, BRA.

Some insects that attacks the mulberry (*Morus alba* L.) although not very important, are always a problem, because the insecticides to control them, may kill the silkworm (*Bombix mori* L.). During the months of September to November of 1997 and 1999, we detected *Arniticus* sp.(Coleoptera: Curculionidae, Curculioninae)attacking the plant. During daytime the adults remain under the leaves and in shadding places of the mulberry plantation.During the night the insect attacks the upper leaves of the mulberry plants. If the insects are touched they fall down to the floor and remain motionless for some minutes We observed that some males were larger than the females (size between 8 and 12 mm). The sexual dimorfism presented by this species is the presence of two pairs of red hairy clusters in the ventral part of the abdomen of the males and absent in females. Female mates with several males during 2 to 4 minutes. The females use the mandibles to open holes in the mulberry trunk, where the yellow eggs are laid. Upon hatching the scarabaeid larvae are yellow. Considering the mulberry cultivar Miura, the mean consumption of leaves per night was 22.5 mg for the males and 30.5 mg for the females.
Index terms: sexual dimorfism, occurrence, mulberry, *Arniticus* sp.

[3528] A NOVEL FUNCTION OF THE PARALYTIC PEPTIDE OF THE WILD SILKMOTH *ANTHERAEA YAMAMAI* (*ANY*-PARP) FOR DIAPAUSE INDUCTION OF THE SILKWORM *BOMBYX MORI*

Y. An, H. S. Song, K. Suzuki, Dept. of Bioscience and Technology, Faculty of Agriculture, Iwate Univ. Ueda3-18-8, Morioka 020-8550, Japan, E-mail anying@iwate-u.ac.jp.

The paralytic factor, which is identified from the 5th-instar larval hemolymph of the wild silkmoth *Antheraea yamamai*, named *Any*-ParP, induces paralysis of several body segments of *A. yamamai* and *Bombyx mori* and the primary structure of the *Any*-ParP is determined to be 23 amino acid peptide [Seino et al., (1998) J. Seric. Sci. Jpn. 67:473-478]. In the present study, we isolated a cDNA encoding the precursor for the peptide from cDNA library representing whole bodies of post-diapause pharate first-instar larvae of *A. yamamai*. Northern hybridization analysis showed that the gene expressed in the fat body and hemocytes in the final instar larvae of *A. yamamai*. In order to find new functions of *Any*-ParP, we examined effects of synthetic *Any* -ParP on induction of embryonic diapause of the silkworm *B. mori*. *Any*-ParP was injected into the pupae of *B. mori*. Diapause eggs were significantly induced not only in the producers destined to lay non-diapause eggs, but in the producers extirpated the suboesophageal ganglion (SG) from diapause egg producer. This diapause induction showed dose- and developmental-dependent response. The embryonic diapause of *B. mori*, is well known to be induced by diapause hormone (DH), which is secreted from neurosecretory cells of SG. DH has been determined to be a 24-amino acid peptide amide. However, it is unclear how DH arrests embryonic development. Our results indicate that although the amino acid sequence of *Any*-ParP and DH is entirely different , *Any*-ParP has the same function with DH. It is an important clue to analyze the control mechanism of embryonic diapause of *B. mori*.
Index terms: diapause hormone, suboesophageal ganglion, non-diapause egg producer, diapause egg producer

[3529] MORPHOLOGICAL CASTE DIFFERENCES IN *SYNOECA CYANEA* (HYMENOPTERA, VESPIDAE, EPIPONINI), ACCORDING TO ONTOGENETIC DEVELOPMENT OF THE COLONIES WITH SPECIAL REFERENCES ON MULTIVARIATE ANALYSIS

S. C. M. Noda[1] & S. N. Shima[2], [1] bolsista Fapesp, [1, 2] Dept. of Zoology, UNESP, Rio Claro-SP- Brazil, E-mail scmnoda@ms.rc.unesp.br.

Intraespecific variability in social wasps has been reported according to the stages of colony development. The aim of this work was to verify if caste variation occurs among six colonies in different stages of development. A sample of 200 individuals was taken randomly to take measurements of the head, mesosoma, metasoma and wing in a total of 23 characters. Analyses of ovarian development, insemination and some aspects of internal and external morphology were also made. The morphometric data was treated by canonical multivariate analysis. The remainder of the colonies' population was dissected and only the queens and intermediates (if present) were measured. The following ovarian patterns were found: 11-day colony, patterns A(n=18), B1(n=1), B2(n=1), B3(n=1), B4(n=1) and D1(n=1); 20-day colony, A(n=77), B1(n=61), B2(n=58), C1(n=1), C2(n=2) and D1(n=1); 45-day colony, A (n=316), B1(n=27), D1(n=14) and D2(n=2), 150-day colony, A(n=320), B1(n=221), C2(n=4) and D1 (n=84); 360-day colony, A(n=401), B1(n=80), B2(n=137) and D1(n=43) and "winter agregation" colony A(n=88), B1(n=140) and D1(n=42). Females with type A (filamentous) ovaries and type B1 to B4, (oocytes in the beginning of development) were not inseminated and were called workers. Wasps with type C1 and C2 (moderately developed ovaries) were not inseminated either and were called intermediates. Females with type D1 and D2 (developed ovaries) were inseminated and were called queens. An interesting result was obtained on intermediates. In the 20-day colony the intermediates differed from queens and were similar to workers, while in the 150-day colony they differed from the queens and workers suggesting that they could be a special kind of female. Statistically, there was variation according to the degree of diferentiation of castes which tended to decrease as the colonies matured. About the external morphology there was not distinction among females. There was a tendency of queens and intermediates to present a larger and clearer venom gland. Regarding gut content, the queens had a clearer color.
Index terms: Intraespecific variability, ovary, wasps

[3530] CHANGE OF GENE EXPRESSION PATTERN CAUSEDBY COMPOUND EYE METAMORPHOSIS OF *BOMBYX MORI*

J. Nohata[1,2], K. Mita[1], Y. Koike[1,2], M. Ote[2], T. Shimada[2], H. Kawasaki[3], T. Kanda[4] & T. Tamura[4], [1]Genome Research Group, Natl. Inst. Radiol. Sci., Chiba 263-8555, JAPAN, E-mail j_nohata@uexs72.nirs.go.jp [2]Dept. of Agri. Envir. Biol., Univ. of Tokyo, Tokyo 113-8657, JAPAN; [3]Utsunomiya Univ., Utsunomiya, Tochigi 321-8505, JAPAN; [4]Dept. of Insect Genet. Biol., Natl. Inst. Seri. Entomol. Sci., Tsukuba, Ibaraki 305-8346, JAPAN.

We investigate the change of gene expression patterns caused by tissue differentiation during metamorphosis by cDNA catalog. Previously, we analyzed the cDNA libraries of wing discs before and after metamorphosis. In this presentation, we focus on the development of compound eyes, one of imaginal discs. Since the size of the compound eyes is too small to collect enough amount of tissues for the construction of cDNA library at 5th larval instar, we took the following strategy: A cDNA library was prepared from the mixture of RNAs isolated from compound eyes at S0 toP3 stages, from which about 5,000 ESTs were determined. DNA chip for independent ESTs (about 8,000 ESTs cover 40% of total genes of *B.* mori) will be prepared and hybridized with the probe prepared by mRNAs isolated from compound eyes at each stage during S2 and P3 stages to produce the gene expression profiles in compound eye development during metamorphosis and tissue differentiation. EST analysis of compound eyes presented 14 genes specifically expressed in eyes, among which the genes encoding neuropeptide, neurohormone, cuticle peptide and Notch-like gene were identified though most of them are unknown genes. But, no cDNA clone for angiotensin converting enzyme homolog (ACE) was found which was highly and specifically transcribed at the S2 stage (ecdysone titire reaches maximum at S2 stage) in wing disc and identified as the early effector gene family. This fact suggests that a different type of early effector gene should work in compound eye development from ACE homolog in wing development.

Index terms: cDNA catalog, EST, DNA chip, differentiation, imaginal disc development.

[3531] BEHAVIOURAL RESPONSES OF THE HONEYBEE TO ALARM-SCENTS AT THE FOOD SOURCE.

J. A. Núñez1, N. Balderrama2, W. M. Farina1, R. Guerra2 & A. Padilla2, 1Depto. de Biología, Ftad. de Cs. Exactas y Naturales, UBA, Cdad. Univ., (1428) Buenos Aires, Argentina,.2Instituto de Zoología Agrícola, Ftad. de Agronomía, Univ. Ctral de Venezuela, (AP 4579), Maracay 2101, Aragua, Venezuela. This work was supported by funds from the University of Buenos Aires (TW 43) to J. A. Núñez.

Free-flying foragers of two honeybee strains, *Apis mellifera ligustica* (European) and *Apis mellifera scutellata* (Africanized bee) were tested at a food source for their reaction to substances produced in the head region and in the sting chamber The break off of the foraging activity at the food source and the approaching flights to a swinging visual target were recorded as behavioural response parameters to the presence of volatiles. The intensity of responsiveness depended on: (1) the bee strain, (2) the time of the year and (3) the body part used as source of the substances. A maximum break off responsiveness for volatiles of the sting chamber was recorded during the main flowering time of the year. However, only deterred africanized bees were prone to approach the close swinging visual target. Similar fluctuating patterns of responsiveness were elicited when constant amounts of the pure chemicals, 2-heptanone (2-Hep, component of the mandibular gland pheromone) and Isopentyl acetate (IPA, component of the sting-chamber pheromone) were used as scent source. The increase in responsiveness to "alarm scents" at the food source during the flowering periods suggests a functional relationship between both. That is, with increasing foraging activity, bees make more frequent use of "alarm scents" and, concomitantly increase their responsiveness to the presentation of the scents. A difference in population strength between strains at each time would explain the shift of one month observed in africanized compared with european strains. in relation to particularities of their original biotop.

Index terms: *Apis mellifera ligustica, Apis mellifera scutellata,* volatiles, responsiveness

[3532] DIGESTIBILITY OF POLLEN GRAINS COLLECTED BY HONEYBEE, *APIS MELLIFERA* (HYMENOPTERA, APINI), IN THE MICROREGION OF VIÇOSA, MG, BRAZIL

G.V.OLiveira[1] & J. E. Serrão[1], [1]Dept of General Biology, Fed. Univ. of Viçosa, Viçosa, MG. 36571-000, Brazil, E-mail jeserrao@mail.ufv.br. Supported by Brazilian Research Agencies CNPq and FAPEMIG.

The purpose of this study was to verify the pollen grains digestibility consumed by *Apis mellifera* workers during august/98 to july/99, because previous studies have pointed out that in the microregion of Viçosa, there is low nectar flows during the month of September to December. In three hives of *A. mellifera* were, bi-monthly, sampled five young workers/hive. After digestive tract dissection, the rectum was isolated and transferred to 4% paraformaldelyde at phosplate buffer. After rectum wall disruption, its content was stained with 1% methylene blue, following observation under light microscope. For each content were sampled three observation fields and the pollen grains identify and quantify according to their digestibility conditions. Some rectum contents were submitted to acetolyses method for pollen grains identification. The pollen grains in the rectum were classified as undigested (filled), digested (empty or with their content retract in the center of the grain) and broken. Along the year studied were found 80,03% of digested pollen, 4,99% of undigested pollen and 14,98% of broken pollen. Therefore the useful rate by bees was high and there was not statistical differences (Kruskal-Wallis $p<0,05$) among the hives sampled which was also observed among the years periods. Therefore there is not relationship between the low honey flows period with the use of protein resources at Viçosa microregion. The predominant pollen species during the year were those of families Asteraceae, Euphorbiaceae, Leguminoseae, Myrtaceae and Poaceae. Sometimes the pollen consumed by bees workers were different from those found in the flowers on a determined year period, e.g., pollen grains of *Mabea fistulifera* were found inside the rectum of bees sampled on September, while the plant flowering occurs from March to June. This is an expected result because young bees feed on pollen grains, which one stored in the hive.

Index terms: pollen grains, digestion, honeybee

[3533] NFESTATION OF TERMITES IN *EUCALYPTUS* SP. AT THE "UNIVERSIDADE FEDERAL RURAL DO RIO DE JANEIRO"

R.C.G. Peralta[1]; G.T. Araújo[1]; E.B. Menezes[1]; A.G. Carvalho[2] & A.M. Lunz[2] . 1CIMP "CRG"/ UFRRJ, BR 465, km 7, Seropédica, RJ 23890-000, Brazil, E-mail ebmen@zaz.com.br; [2]Instituto de Floresta/UFRRJ, BR 465 km 7, Seropédica, R.J., Brazil, Email: acacio@ufrrj.br.

The termites are considered pests in the forests throughout the tropical region of the planet, and they are a limit factor for reforesting. They attack seedlings of forest species, principally eucalyptus. The species of termites that destroy the core of the trees are a serious problem in many countries, such as Brazil and Australia. The problem with termites in reforest using eucalyptus in tropical countries has been reported since the beginning of this century. There are many factors affecting the feeding activity of termites on woods. In general, two main factors prevail: extrinsic releasing stimuli (wood characteristics) and intrinsic response threshold levels. There is evidence supporting the hypothesis that the woods' characteristics influence the feeding activity of termites. Depending on the characteristics of the wood species, initiation, maintenance or cessation of feeding by termites may follow their exposure to a wood species. Physical, mechanical and chemical properties of the wood are probably interdependent and results in variability in wood characteristics. This will ultimately cause variability in wood resistance to termite. Rio de Janeiro city is famous to have part of the Atlantic Forest. In the "Universidade Federal Rural do Rio de Janeiro", exactly in front of the building of the Department of Forest Products, there is a secondary forest. The soil is sandy, but is protected by a litter where we may find many species of arthropods (e.g., *Nasutitermes* spp.). Six wooden of 1.20 m in length of five vegetal species (*Clitoria* spp.; *Mimosa* spp.; *Albizia* spp.; *Acacia* spp.; *Pinus* spp. and *Eucalyptus* spp.) were placed in the surface of the soil to study the behavior of xylophage insects for six months. Only the *Eucalyptus* spp., from all the tested varieties of vegetal species, was infested by *Nasutitermes* sp.. However, its infestation occurred after the attack of Scolytidae and Fungi.

Index terms: *Nasutitermes* sp., reforest, wood infestation, xylophage insects

[3534] NECTAR COLLECTING IN HONEY BEES: HOW DO CHANGES IN THE RELATIVE FOOD SOURCE PROFITABILITY EXPLOITED BY INDIVIDUAL BEES AFFECT THE SOCIAL FORAGING ACTIVITY?

N. Pírez, R. J. De Marco & W. M. Farina, Depto. de Biología, Ftad. de Cs. Exactas y Naturales, UBA, Cdad. Univ., (1428) Buenos Aires, Argentina. E-mail walter@bg.fcen.uba.ar. This study was supported by funds from ANPCYT (PICT 98-03103) and from the University of Buenos Aires (JX 53) to WMF.

When a foraging group of honeybees (*Apis mellifera ligustica*) exploits a floral patch, the recruitment mechanisms displayed inside the hive as well as the number of bees arriving at the feeding place change according to the *actual* food source profitability. However, bees returning from a constant profitable food source could modify their recruiting behaviors according to changes in the social context of the hive, a fact that could incidentally affect recruitment levels in hive mates exploiting other feeding places. With the aim of studying this problem, interactions between an individual forager returning from a constant profitable rate-feeder and a group of bees exploiting an alternative feeder that fluctuated in terms of sugar solution flow were analysed in a flight enclosure. We used two rate-feeders offering an unscented sugar solution of 1.8 M. The first one was located at the end of a one-meter corridor that measured 100 x 15 x 1.5 cm. (1) while the other was inside a flight enclosure of 6 x 3 x 2.5 m. (2). Only one (individually) trained bee was allowed to forage at the rate-feeder that delivered 5 µl/min of sugar solution. At the rate-feeder (2) we used a decreasing profitability program presenting a sugar solution flow rate of 90 µl/min. at first and 3 µl/min. after four foraging cycles performed by the trained bee collecting sugar solution from the feeder (1). At the same time the number of bees foraging per min. in the flight enclosure was quantified, we also recorded the dancing and trophallactic behavior performed in the hive by the individual bee returning from rate-feeder 1.When the sugar solution flow rate offered at the flight enclosure was decreased, the number of foraging bees showed an oscillatory response. In such cases, some of these increasing fluctuations were positively correlated with a previous permanence in the hive by the individual bee that foraged at the constant profitable feeder 1. On the other hand, when the sugar solution intake rate of the colony was artificially reduced, we also observed an increase either in the number of dancing events performed or in the trophallactic giving contacts by the same trained bee. Thus, the size of a group of foragers exploiting a fluctuating profitable food source can *instantaneously* increase in response to changes in the recruiting behavior of individual foragers which actually exploit *other* sources in the surrounding environment.
Index terms: *Apis mellifera*, foraging, communication.

[3535] USE OF ABOVE GROUND 0.5% HEXAFLUMURON BAITS (RECRUIT* AG) IN THE CONTROL OF *COPTOTERMES HAVILANDI* (ISOPTERA: RHINOTERMITIDAE) IN CONSTRUCTIONS LOCATED IN SÃO PAULO, SP, BRAZIL

M.R. Potenza[1], F.J. Zorzenon[1], J. Justi Junior[1] & S.L. de Almeida[2], [1] Instituto Biológico, SP. Av. Cons. Rodrigues Alves, 1252, CEP 04014-002 - São Paulo, SP, BR. E-mail: potenza@biologico.gov.br; [2] Dow AgroSciences, R. Alexandre Dumas, 1671, CEP 04717-903 - S. Paulo, SP, BR. E-mail: salmeida@dow.com.

Subterranean termites are one of the main wood-destroying pests in the urban environment, consuming structural wood and other cellulose materials in buildings. The most common species in Brazil is *Coptotermes havilandi*. The chemical control of *Coptotermes havilandi* infestation in structures is a difficult task. The use of baits impregnated with 0.5% hexaflumuron (60 g net weight), an IGR (chitin synthesis inhibitor) molecule, can be an efficient method for termite control in buildings. This experiment consisted of the application of an above ground hexaflumuron bait over active aerial infestations of *C.havilandi* in 7 different structures and the observation of its effects. Following the detection of termite infestation, baits containing the chitin synthesis inhibitor, hexaflumuron, were applied in 16 strategic places with termite activity. Evaluations on bait consumption and termite activity were performed at intervals of 3 weeks. Termite activity in the baits was detected in 13 above ground stations (81.25% of hits), at an average of 21 days after the installation. Termite activity ceased in the treated bait stations after 86 days with a total of ca. 59 g of bait consumed. The seven structures were monitored for 120 days after baiting and with no more termite activity being found.
Index terms: *Coptotermes havilandi*, termite, baits, hexaflumuron, structures

[3536] CONTACT POISONS IN THE ANT GENUS CREMATOGASTER: CHEMICAL DIVERSITY AND BIOLOGICAL FUNCTIONS

Y. Quinet[1], J.C. de Biseau[2], V. de Marneffe[2], J.F. Marlier[2] & J.M. Pasteels[2], [1] Dept. of Biology, Cear· Sta. Univ., Av. Paranjana, 1700, Fortaleza, 60740-000 CE, Brasil, E-mail:yves@ivia.com.Br, yves@ivia.com.br; [2] Dept. of Animal and Cellular Biology, Av. F.D. Roosevelt, 50, 1050 Brussels, Belgium, E-mail:jcbiseau@ulb.ac.be jcbiseau@ulb.ac.be

With more than 400 species, Crematogaster ants form one of the four largest ant genus. They are very abundant insects, especially in tropical arboricolous ecosystems where numerous Crematogaster species possess a dominant status in the ants comunities. Their ecological success could be partly due to their peculiar defense strategy. Instead of injecting their venom as most primitive ant species do, they use their spatulate sting to apply their venom topically to the integument of enemies. The chemical analysis of the venom of European, New-Guinean and, more recently, Brazilian species showed that the defensive compounds are highly variable. Up to date, two major groups of defensive compounds were identified from the Dufourís gland: mixtures of long chain derivatives linked to a primary acetate function, and furanocembrenoid diterpenes. The formers are enzymatically transformed into toxic aldehydes during venom emission, at least in the European species. The use of the venom in the defensive behaviour of one European species (C. scutellaris) and two Brazilian species (C. sp1 and C. brevispinosa rochai) was analysed during encounters with competitive ant species, as well as during intraspecific contests. Significant differences were found between the European and Brazilian species with regard to the frequency of the venom use. The type of enemy, in particular its aggressiveness, also influenced markedly the frequency of venom emission in both European and Brazilian species. The assessment of the venomís toxicity in C. scutellaris and 6 Brazilian species (C. brevispinosa rochai, C. b. ampla, C. sp1, C. sp2, C. sp3, C. sp4), using ant and termite target species, showed that the venom toxicity is related both to its chemical composition and to the ant or termite target species used. Nevertheless, despite the clear toxicity observed in all the cases, the venom action was very slow, significant lethal toxicity occurring between several hours or days following topical application. This observation, together with analysis of the behaviours during agonistic encounters between Crematogaster workers and other ant species, suggest a more direct repulsive effect of the defensive compounds.
Index terms: Formicidae, Crematogaster, venom, toxicity, defensive, behaviour

[3537] UTILIZATION OF WILD SILKWORMS AS A TOOL FOR RURAL DEVELOPMENT

S.Raje, Urs, Joint Director, Central Silk Board, Bangalore, India. E.Mail : rajeurs@yahoo.com

The wild silk has been the integral part of the long and adventurous journey of the silk through diverse cultures of human civilization. The wild silk conservation helps the basic means of livelihood of millions of rural people in many ways. There are about 400-500 species of sericigenous insects distributed around the world, abundantly in Asia and African regions. The food plants of these species are also available in plenty with scope for their commercial exploitation. Wild silk moths are commercially exploited in China and India giving employment opportunities to thousands of rural people. Wild silk culture is an integral part of their civilization and culture. For the production of one kilogram of non-mulberry fabric one man-year (250 days) of employment is generated which is three times higher than the mulberry and much greater than other rural avocations. Of late, many of these species are facing depletion and a possible extinction due to the unscientific and improper utilization of the forest wealth. This may result in massive reduction in income and employment opportunities of the rural folks. Hence proper strategies are required to be devised to limit the utilization to sub-optimal level and with out disturbing the natural ecosystem. Such a sustained development would create stable employment opportunities for the rural people. Many wild silk moth flora and fauna are available in the African and Latin American countries where the rural people are desperately looking for some alternate avocation for their livelihood. If support systems are created for orderly planning and development of this natural resource, the wild moth culture can be used as an effective tool for rural development among many developing countries. At present there is a high demand for these green textiles materials in the World textile industry due to its Eco-friendly characteristics and comfort. Due to lack of co-ordinated efforts, internationally, the wild silk is undervalued in the world textile market. There is an urgent need to create awareness about the advantage of these materials and diversification of products that will result in better marketing and pricing. These efforts should benefit the primary producers, the rural population. The efforts of the government and other agencies should be concentrated to conserve these species in their natural habitats and to create a system of support for better and optimum use of the products to the benefit of the rural people and the ecosystem

[3538] CRITERIA AND EVIDENCE FOR DOMESTICATION OF THE FUNGAL CULTIVARS OF LEAFCUTTER ANTS (TRIBE ATTINI)

S. A. Rehner, Dept. of Biology, University of Puerto Rico, Rio Piedras, Puerto Rico 00931-3360

All Neotropical fungus-gardening attine ants (tribe Attini) are obligately dependent on fungiculture for their survival. Within ant-fungus mutualisms, there are five distinct variants of fungiculture, each of which appears to have arisen through independent recruitment of fungal cultivars from different ancestral fungal taxa. Although all evidence suggests that each form of attine fungiculture represents a highly sophisticated coevolutionary interaction, definitive evidence supporting or rejecting the hypothesis that any of the attine fungal cultivar groups are in fact domesticated is presently lacking. In this talk I will discuss several criteria by which it may be determined whether the fungal crops of attine ants are truly domesticated or simply intimately associated populations of interacting mutualists. Using the leafcutter symbiosis as an example, I will review historical information concerning leafcutter fungiculture and present new population genetic and phylogenetic evidence indicating that these fungi exist exclusively in association with their ant hosts and can thus be considered true domesticates.

[3539] AN AUTOMATIC DEVICE FOR DETECTING LOCOMOTOR ACTIVITY OF SINGLE ANT IN A SOCIAL CONTEXT

P. Renzi[1] & V. Pasquali[1], [1]Dept. of Psychology, Univ. of Rome "La Sapienza", Via Dei Marsi 78, 00185 Rome, Italy, E-mail renzi@uniroma1.it.

In automatic monitoring of animal's activity in its home cage it is very important the individual labelling in social contexts. Current technics for individual labelling social contexts are mainly based on observation of morphological or chromatic (natural or artificial) characteristics of the subjects. This type of labelling is not suitable for automation. Some automated systems put devices on the subject. In all case the animal dimension is critical both for visual and automatic identification. Subjects of very small dimensions shows individual characteristics that often the human can't discriminate. Automatic detectors connected with a computer and the computerised control of the experimental setting offer more control over the error sources. This project have been developed to obtain data on the locomotor activity of single individuals of *Formicidae:Formica* living in a group. The prototype is consisting of a detector and of a miniaturised resonant passive circuit glued to the back of the subject. The dimension of this last circuit are 1.5x0.5x0.5 mm. The detector use radio waves at ultra high frequencies (GHz) and can check 20/30 animals at the same time. The subject is now identified only in a short range from the detector, but a larger rang is in project. The detector is connected with the digital input/output board of a computer and the data are saved in files.
Index terms: *Formicidae*, labelling, identification

[3540] CIRCADIAN AND ULTRADIAN RHYTHMS OF LOCOMOTOR ACTIVITY IN WORKERS OF ANT *FORMICA PRATENSIS*

P. Renzi[1] & V. Pasquali[1], [1]Dept. of Psychology, Univ. of Rome "La Sapienza", Via Dei Marsi 78, 00185 Rome, Italy, E-mail renzi@uniroma1.it

Endogenous rhythmicity has been largely studied in many species of vertebrates; studies on invertebrates in many species don't give sharp results. Some authors (McClusky 1963, 1965; North 1987, 1993) investigated circadian rhythmicity in locomotor activity of different species of ants. We focused on the analyses of rhythmicity in locomotor activity of *Formica Pratensis* a species close to *Formica Rufa*. The experimental apparatus for measuring the locomotor activity was represented by two small rooms made in plaster of Paris and plastic material: the nest and the outer world. The two rooms are connected by a small glass tube. An infrared photocell check the crossings. A computer equipped with an I/O board pickup the photocell output and save data in files. Data smoothed (3 point smoothing) and de-trended have been analysed by a Discrete Fourier Transform (Conte, Ferlazzo & Renzi 1995). The Fourier transform describe the time series in the frequencies domain. Results for grouped ants shows a clear circadian rhythmicity in 12:12h Light:Dark (LD) cycle. Similar but not so clear results have been found in *Formica Rufa* by North. To obtain more information's about endogenous rhythmicity we studied single subjects with the same technique and apparatus. In continuos darkness (DD) *Formica Pratensis* don't show circadian rhythmicity but a strong ultradian rhythmicity.
Index terms: *Formica Rufa*, Fourier transform, darkness.

[3541] DEFINING THE NATURE OF COOPERATION IN THE BARELY EUSOCIAL SWEAT BEE, *HALICTUS SEXCINCTUS*, IN SOUTHERN GREECE

M. H. Richards, E. Wilhelm, & L. M. Wyman, Department of Biological Sciences, Brock University, St. Catharines, Ontario L2S 3A1, Canada, E-mail mrichard@spartan.ac.brocku.ca.

Socially polymorphic sweat bees (Hymenoptera: Halictidae), those in which both solitary and social behaviour is expressed, are particularly fascinating because they help us to elucidate the ecological and evolutionary factors that favour the evolution and devolution of social colony organization. *Halictus sexcinctus* is a large, socially polymorphic halictine, with solitary populations in northern Europe and social populations in the south. Since 1997, we have studied a population containing 400-500 nests at Daimonia, near Molai, in south-eastern Greece as part of our effort to determine which behavioural traits are most critical in determining the strength of eusocial colony organization and the expression of altruism by workers. In early May, large foundresses establish nests alone, solitarily raising a brood of males and small daughters. After emergence, most first-brood daughters remain as workers in their natal nests, foraging and provisioning a second brood that consists of more males and large gynes. In southern Greece, very few *H. sexcinctus* workers fit the classical definition of a sterile worker whose reproductive options are limited to helping to raise related brood. In fact, the majority of workers are actually reproductive: dissections from 1998 (n=82 workers) indicate that only 30% had not mated and only 25% had little or no ovarian development. Most of the non-reproductive females had unworn wings and mandibles, indicating that they were newly emerged. Moreover, 69/72 older workers (with worn wings and mandibles) had developing ovaries, while only 3/72 did not. All three had been rendered sterile by abdominal dipteran parasites. Thus, in *H. sexcinctus*, extreme altruism is exhibited only by severely parasitized workers. Non-parasitized workers are much less helpful than parasitized ones. Observations and dissections of marked foragers indicate that probably, most workers provision and lay their own eggs. But many mid-summer nests contain viable foundresses that have ceased foraging, or 'selfish' workers that never forage but exhibit a high degree of ovarian development. These must lay eggs on provisions provided by foraging workers. Altogether, these observations suggest that in *H. sexcinctus*, altruism is a conditional strategy employed by disadvantaged worker-brood females, because the inclusive fitness benefits of raising related brood are greater than not reproducing at all, although not as great as the fitness benefits of selfish reproduction. The most disadvantaged and most altruistic females are those with parasites that render them sterile.
Index terms: Halictidae, social evolution, eusociality.

[3542] A PILOT TEST FOR AREA WIDE MANAGEMENT OF THE FORMOSAN SUBTERRANEAN TERMITE IN THE FRENCH QUARTER, NEW ORLEANS, LOUISIANA

D. R. Ring[1], A. L. Morgan[1], W. D. Woodson[2], A. R. Lax[2], X. P. Hu[1], E. D. Freytag[3] & L. Mao[1], [1]LSU Agricultural Center, Louisiana State Univ., P. O. Box 25100, Baton Rouge, LA 70894-5100, USA; [2]Southern Regional Research Center, USDA-ARS, 1100 Robert E. Lee Blvd., P. O. Box 19687, New Orleans, LA 70179-0687, USA; [3]New Orleans Mosquito & Termite Control Board, 6601 S. Shore Harbor Blvd., New Orleans, LA 79126, USA.

The Formosan subterranean termite, *Coptotermes formosanus*, is a serious pest in several parts of the world and is the most destructive insect in Louisiana. The density of the Formosan subterranean termite in the French Quarter, New Orleans, Louisiana, USA is very high. A large area pilot test for area wide management of this insect was begun in 1998 in the French Quarter to reduce densities of termites and demonstrate the effectiveness of the approach of treating all properties in a large area using area wide management. The pilot test is a cooperative effort between the LSU Agricultural Center, USDA-Agricultural Research Service and New Orleans Mosquito and Termite Control Board. All but four of 323 properties in a contiguous 15 block area in the French Quarter have been treated using commercially available baits or non repellent termiticides selected by property owners and applied by professional pest control operators. Properties were inspected for conducive conditions and proper treatment after treatments were made. Data on termite activity are being collected using glue boards for alates and in-ground monitors for foraging activity. Alates were sampled two to three times weekly during the flight season (May through July 15) in both 1998 and 1999 using glue boards hung near lamps on street lights. Monthly monitoring of foraging activity began in January, 1999 to determine the number of stations with termites, amount of wood consumed, and densities of termites. Reductions in densities of alates inside the 15 blocks were not found; probably as a result of the limited time treatments had been in place. The percentage of in-ground stations with termites was lower in the treated zone than outside the treated zone in December, 1999 and January, 2000. A reduction in the densities of alates is expected in the 2000 flight season. The program should continue over subsequent years.
Index terms: *Coptotermes formosanus*, glue boards, in-ground stations, non repellent termiticides, baits

[3543] CONTROL OF UNDERGROUND TERMITES *AMITERMES* SP. (ISOPTERA: TERMITIDAE, TERMITINAE) ON PINEAPPLE CROP IN SEMIARID ZONE OF NORTHEAST BRAZIL

N. F. Sanches[1], A. de A. Alves[2], I. Bonfim[3], R. C. Caldas[1], A. Cerilza[3], C. C. de Santana[3] & E. S. Silva [4], [1]Embrapa Cassava and Fruit Crops, C.P. 007, Cruz das Almas, Bahia, 44.380-000, Brazil, E-mail: sanches@cnpmf.embrapa.br; [2]Bahia Corporation for Agriculture Development (EBDA), Itaberaba, Bahia, 46.480-000, Brazil; [3]State of University of Feira de Santana, Bahia, 44.000-000, Brazil; [4]College of Agriculture – Federal University State of Bahia , Cruz das Almas, Bahia, 44.380-000, Brazil.

Among the secondary pests of pineapple, the underground termite causes great losses in commercial plantations in the semiarid areas of the Northeast Brazil. The losses in the pineapple production under no irrigation condition are significant due to the attack of underground termites which destroy the basal portion of the stem where the roots are formed. The objective of the experiment was to evaluate the efficiency of five insecticides in the control of underground termites *Amitermes* sp. . The experiment was carried out in field conditions in a district of Itaberaba - BA, from May to December/99, being used the cultivar Perola. The experimental design was random blocks, with 6 treatments and 4 replications. Each plot had 2 double rows spaced 1,40 x 0,40 x 0,30 m with 11 m length and total of 140 plants/plot. The treatments were: 1 – Control (only water); 2 – Relative control - Vamidothion - 330 ml of the comercial product /100 l of water; 3 - Imidacloprid - 60g c.p. /100 l of water; 4 - Thiametoxan - 60g c.p. /100 l of water; 5 - Fipronil - 30ml c.p. /100 l of water; 6 - Acephate - 100g c.p. /100 l of water. The treatments were applied two months after the planting, with application of 30 ml of the solution/plant. Thiametoxan and Imidacloprid were sprayed directly at the base of the plant. Evaluations were performed at 15, 45, 75 and 105 days after application of the treatments, when five plants were sampled per plot. For each sampled plant, one sample of soil with 20 x 10 x 15 cm was collected. To evaluate the presence of the termite, both the base of the plants and the soil samples, after been sifted, were carefully observed. At 105 days after the application, the most efficient treatments were Thiametoxan and Imidacloprid with up to 100% of control.
Index terms: *Ananas comosus*, termites, chemical control, Insecta.

[3544] PARASITE-HOST RELATIONSHIPS IN ANTS: IMPLICATIONS FOR SYMPATRIC SPECIATION

R. Savolainen, Department of Ecology and Systematics, P.O. BOX 17, FIN-00014 University of Helsinki, Finland, E-mail riitta.savolainen@helsinki.fi

Increasing evidence suggests that new species arise sympatrically: for example, in some insect species resource-based speciation via host fidelity has lead to host-race formation, with minimal gene flow between the two races, and possibly to new species. Obligate social parasites depend on their hosts for all resources during their entire life-cycle and, thus, are potential test cases for sympatric mode of speciation. To study the phylogenetic relationships between the parasites and their hosts, I sequenced parts of mitochondrial genes of four Myrmica (Myrmicinae) parasite-host pairs: karavajevi-scabrinodis, hirsuta-lonae, hirsuta-sabuleti, and microrubra-rubra to test the following hypotheses: (1) parasites form a monophyletic group and, thus, are not the closest relatives to their own host; (2) parasites and hosts are sister taxa. The sister-taxon relationship may result either from allopatric speciation followed by post-speciation dispersal, or sympatric speciation. The most parsimonious tree shows that the parasites do not form a monophyletic group, but cluster either close (karavajevi) or closest (hirsuta and microrubra) to their host, supporting the sister-taxon hypothesis. The differing relationships may be attributable to the differences in divergence times among the parasites, accompanied with flexibility in host use. The sequence divergence of karavajevi indicates a long history that has enabled the use of at least two substantially different host species, whereas the two host species of hirsuta are very closely related sister species, or ecomorphs of a single species. Microrubra is a recent taxon, presumably still undergoing speciation, and uses as a host only rubra. I will argue with the available information that the sister-taxon relationships of Myrmica social parasites and their hosts arise in sympatry. Polygynous colony structure of Myrmica species results in variable queen size and, particularly, miniaturization of the queens. In comparison to macrogynes, these microgynes may produce more queens per capita owing to less energy required per queen. If small size becomes coupled with assortative mating by size and place (in or close to the nest instead of traditional mating swarms), separate breeding groups of parasites and their hosts and, eventually new species, may evolve.
Index terms: Myrmica, phylogeny, mtDNA, polygyny, microgynes

[3545] COLONY SURVIVAL AND FAILURE IN THE SOCIAL WASP *POLISTES SNELLENI* (HYMENOPTERA: VESPIDAE)

K. Sayama, Insect Management Lab., Forestry and Forest Products Research Inst., Matsunosato, Kukizaki, Ibaraki, 305-8687 Japan, E-mail sayama@ffpri.affrc.go.jp.

In temperate regions, overwintered female social wasps (foundresses) initiate colonies in the spring on their own. All tasks concerning colony maintenance are carried out by the foundress before the emergence of her first workers if the colony is founded by a single female (haplometrosis). Thus, the pre-emergence stage is thought to be the most critical period for independent-single-female founding colonies. Even after worker emergence, not all colonies can succeed in producing reproductives. Regarding the present study, I report colony survival or failure and related factors in a northern population of *Polistes snelleni*, and discuss their effects on the wasp population. This study was conducted in Sapporo, Japan under natural conditions over eight years. Each year I made life tables for the colonies and individuals living on/in nests. Over the course of this research I have confirmed the mortality factors as thoroughly as possible. A total of 821 colonies were followed over eight years. The survival rate of colonies was 31% in the pre-emergence stage. Colony failure in this stage was mainly due to three causes, 1) loss of foundresses (31%), 2) predation on the brood in the nest including nest destruction (21%) and 3) usurpation by conspecifics (9%). Even in the post-emergence stage, the colonies continued to decrease in number. Nineteen percent of the colonies produced at least one reproductive and eight percent survived through the nesting season. Fifty eight percent of the worker-producing colonies failed because of predation on the immatures in the nest. Half of these were due to hornets (*Vespa* spp.). In spite of such colony failure, foundresses had only a few options for survival and reproduction. Renesting after nest destruction was limited early in the pre- and post-emergence stages. A part of the brood-lost foundresses usurped other colonies by worker emergence. However, foundress association as an effective option has hardly been observed so far in this population. This may be because of the relatively minor advantage of associative foundation and/or shorter nesting season in this population compared with other populations or species.
Index terms: social insect, paper wasp, population demography, colony mortality

[3546] USE OF CHEMICAL COMMUNICATION TO CONTROL AFRICANIZED HONEY BEES IN URBAN ENVIRONMENTS

J. O. Schmidt, Carl Hayden Bee Res. Ctr., 2000 E. Allen Rd., Tucson, AZ 85719, USA, E-mail joschmid@u.arizona.edu

The population of honey bees called Africanized bees has shared a long history with people. The population was derived from *Apis mellifera scutellata* from southern Africa, which, for millennia had been hunted and destroyed by humans as well as lured into boxes for exploitation. When transported to the New World, *A. m. scutellata* interbred with the European *A. mellifera* previously brought over by European settlers to produce a highly successful and adapted population of honey bees. In the USA, Africanized bees are most abundant in urban areas: indeed, they might rightly be called "urban honey bees" in this part of their range. They thrive in many urban areas because all of the major necessities of life – food, water, warmth, and nest sites – are in abundance throughout the year. In rural areas, they often encounter long periods of reduced food, water, and good nest sites. Africanized bees are considered pests because people are afraid of them and because their nests in walls of buildings can cause unwanted sounds and odors, and create structural damage and attract other organisms. Africanized bee colonies generate reproductive and migratory swarms whose behavior is strongly controlled by the Nasonov pheromone. This pheromone simultaneously strongly attracts scout bees and guides swarms in the flight to their new nest sites. Swarm traps are man-made nest cavities that attract swarms of bees, thereby acting like a large trap crop to divert swarms away from sensitive areas and into cavities where they can be destroyed. The key to the success of swarm traps is their slow-release Nasonov pheromone lures that dominate the natural pheromonal communication system of the bees, thereby redirecting the nest site selection process to favor the choice of artificial cavities. Crossover design and choice test experiments showed: 1) Nasonov pheromone is the chemical communication system for nest seeking behavior; 2) omissions of some pheromonal components reduces activity; 3) addition of non pheromonal components neither enhances nor reduces the attractiveness of the pheromone; and 4) queen pheromone and worker alarm pheromone do not enhance or reduce attractiveness of Nasonov pheromone. Swarm traps have been extensively used in the USA and Mexico for surveying for Africanized bees. In the western part of the USA they are successfully used to control bee populations around sensitive areas such as parks, schools, airports, resorts, and hospitals. A variety of pest control companies now use this pheromonally-based system to control Africanized bee problems in urban areas. The bee problem is less in rural areas, and no agricultural operators have felt the need to deploy traps to control bee problems.

Index terms: *Apis mellifera*, pheromone, stings, swarm traps, urban bees

[3547] OBSERVATIONS ON BROOD CARE BEHAVIOR OF THE LEAF-CUTTING ANT *Atta sexdens* L. (HYMENOPTERA: FORMICIDAE)

M. O. Schneider, O. C. Bueno, M. J. A. Hebling & F. C. Pagnocca, Centro de Estudos de Insetos Sociais, UNESP, Av. 24-A, 1515, 13506-900, Rio Claro, SP, Brazil. E-mail: odaircb@rc.unesp.br.

Using a system of microcameras attached to a personal computer, we have been monitoring the brood care behavior of the leaf-cutting ant *Atta sexdens*. The observations are made on laboratory colonies where the fungus garden is grown in special glass containers enabling us to follow the ants' behaviors. Our observations indicate that with the exception of soldiers, adult workers of all sizes and ages are involved in brood care. Frequently, this task is carried out by young, media and minima workers. The eggs, larvae and pupae of *A. sexdens* rest on the fungus (they are never embedded into it) and are constantly attended to by adult workers. The most common brood care behaviors are cleaning, feeding and moving the brood around on the fungus garden. Adult workers constantly clean the brood by licking it with their glossae removing any fungal hypha or contaminant from its surface. In cleaning larvae, adult workers spend most of the time on the head and anal regions. Even though the larvae are in direct contact with the fungus, they depend exclusively on the workers to be fed and this can be done in two ways: (1) rarely, a worker collects a small piece of fungus from an older and more developed part of the sponge and feeds it to the larva exactly as it was collected; (2) usually, the worker handles this piece of fungus before offering it to the larva. In order to do this, the worker uses its mouthparts (apart from the mandibles), its first pair of legs and the tips of its antennae. In this handling process the workers seem to take up part of the fungus's juices making a fluffy white tuft into a small semi-transparent ball of fungus. In either case, the adult worker deposits the fungus mass directly on the larva's mandibles while touching the larval head region with its antennae. The larva then proceeds to chew the fungus mass, ingesting it entirely. We were also able to observe larvae of all sizes engaging in proctodeal trophallaxis with adult workers of varied size and age groups. First the larva secretes a droplet of clear liquid from its anal opening. The first worker to notice the presence of this droplet by touching it with its antennae promptly proceeds to ingest it. As a rule, the larva exposes an extremely small quantity of this proctodeal fluid at first, and as the worker takes this liquid up using its glossa, the larva excretes a greater quantity of it. This behavior demonstrates a proctodeal trophallaxis from larvae to adult workers not yet described for Attini. This form of trophallaxis is much more common than the oral trophallaxis from larvae to adult workers and the rare occurrences of oral trophallaxis between adult workers.

Index terms: Attini, larval feeding, proctodeal trophallaxis, oral trophallaxis

[3548] COMPLEXITY, NOT GROUP SIZE: A VERTEBRATE ANALOGUE IN THE LONG TERM SOCIAL EVOLUTION OF AUSTRALIAN ALLODAPINE BEES

Michael P. Schwarz & Nicholas J. Bull, School of Biological Sciences, Flinders University of South Australia, GPO Box 2100, Adelaide, 5001, Australia.

The allodapine bees are largely restricted to southern Africa and southern Australia. Only a single genus, *Braunsapis*, occurs in the Oriental region, and this group is phylogenetically distal. All the most basal cladistic groups in the tribe Allodapini comprise lineages restricted to southern Africa or southern Australia, suggesting an origin during the breakup of Gondwanaland. The existence of small, family-based colonies in all non-parasitic allodapine species, combined with at least moderate levels of reproductive differentiation in all studied species, indicates that the basic elements of matrifilial sociality had already been assembled in the ancestor to this tribe. Yet, despite this ancient origin of sociality, colony sizes have remained small in all lineages, and changes to adult morphology and ecological niches have also been small, suggesting evolutionary conservatism in these traits. Small colony sizes and lack of morphological correlates of castes give the appearance of primitive sociality in this group. However, recent studies of several Australian species, and *Exoneura robusta* in particular, indicate a surprising level of social complexity. Social traits in *E. robusta* and its congeners include the following: (i) group living is largely mandatory; (ii) brood are reared communally; (iii) subordinate ovarian development is influenced pheromonally; (iv) nestmate recognition allows discrimination among large numbers of kin groups in novel environments; (v) 'queens' can discriminate between subordinates who have been in brief physical contact with either foreign males or females, even though mating has not occurred; (vi) reproductive opportunities are spread out over a period of at least 18 months, so that most subordinates at any one time have the potential for reproduction during later episodes. Totipotency, complex tactile and pheromonal communication, multiple opportunities for direct reproduction during an individual's lifetime and small colony size in these bees suggests parallels with social vertebrates. We argue that in insects, as with vertebrates, complex sociality should not be mistaken as being equivalent to group size. Constraints to large group size in allodapines have not precluded the evolution of complex sociality, rather complexity has involved decision making regarding direct reproduction in small groups where reproductive opportunities are spread out over a long life-span.

Index terms: *Exoneura*, sociality, phylogenetics, group size.

[3549] ANT-TENDING INFLUENCES SOLDIER PRODUCTION IN A SOCIAL APHID

A.W.Shingleton[1] & W.A.Foster[1], Dept. of Zoology, Univ. of Cambridge, Downing Street, Cambridge, CB2 3EJ, UK, E-mail waf1@cam.ac.uk.

The aphid *Pseudoregma sundanica* (Van der Goot) (Homoptera: Hormaphididae) has two defence strategies: it is obligatorily tended by various species of ant and it produces sterile soldiers. We investigated how the aphids optimize their investment in these two strategies. We measured the size, number of soldiers, number and species of tending ant, and number and species of predators in *P.sundanica* populations. We found that the level of ant-tending significantly correlated with soldier-investment in *P.sundanica*. Different species of ant tend at different levels, and this influences the extent to which their trophobionts invest in soldiers. We excluded ants from aphid populations and recorded changes in population size and structure over 4 weeks. Ant-exclusion led to population decline and extinction. At the same time surviving populations showed a significant increase in soldier investment. This is the first experimental demonstration that social aphids can adjust their investment in soldiers in response to an environmental change.

Index terms: *Pseudoregma sundanica*, ants, polymorphism, myrmecophily, defence investment.

[3550] ANTIBIOTIC OLAQUINDOX AS ADDICTIVE IN THE FEEDING OF *BOMBYX MORI* (LEPIDOPTERA: BOMBYCIDAE)

A. F. da Silva[1], J.E. Miranda[1], S. A. De Bortoli[1] & Takahashi[2], [1]Depto. de Fitossanidade, Fac. Ciências Agrárias e Vet., Univ. Est. Paulista, Via de Acesso Prof. Paulo Donato Castellane, s/n, 14884-900, Jaboticabal, SP, Brasil; E-mail alessan@fcav.unesp.br, [2] Depto. de Zootecnia, Fac. Ciências Agrárias e Vet., Univ. Est. Paulista, Via de Acesso Prof. Paulo Donato Castellane, s/n, 14884-900, Jaboticabal, SP, Brasil.

The incorporation of addictive to the leaves in order to improve the nutritional quality has been showing a alternative for the increase of the cocoon production. The antibiotic olaquindox acts on the midgut gram-negatives and anaerobic bacteria, improving the absorption of nutrients of the ingested food. The effect of different concentrations and methods of application of olaquindox as addictive to feeding of *Bombyx mori* was evaluated, by using the concentrations from 0 to 40 ppm, with intervals of 10ppm among each treatment. The results showed that weight of cocoons and the silk rate were increased by the addition of 20 ppm olaquindox to the mulberry leaves. The application method didn't influence the efficiency of the product.
Index terms:addictive, nutrition, silkworm.

[3551] FEEDING OF *BOMBYX MORI* WITH ARTIFICIAL DIET AND ITS EFFECT ON THE LARVAL DEVELOPMENT AND THE SILK PRODUCTION

A. F. da Silva[1], J.E. Miranda[1], S. A. De Bortoli[1] & Takahashi[2], [1]Depto. de Fitossanidade, Fac. Ciências Agrárias e Vet., Univ. Est. Paulista, Via de Acesso Prof. Paulo Donato Castellane, s/n, 14884-900, Jaboticabal, SP, Brasil; E-mail alessan@fcav.unesp.br, [2] Depto. de Zootecnia, Fac. Ciências Agrárias e Vet., Univ. Est. Paulista, Via de Acesso Prof. Paulo Donato Castellane, s/n, 14884-900, Jaboticabal, SP, Brasil.

The present work was developed out the Section of Sericulture of the Faculdade de Ciências Agrárias e Veterinárias - UNESP, Campus of Jaboticabal, SP, with the objective to evaluating the biological performance of larvae and adults of the hybrid C105x N116 of *Bombyx mori* L. fed with artificial diets added with mulberry powder comparatively to leaves *in natura*. The used treatments were: DN (natural diet with leaves *in natura* of the variety Miura), DM (artificial diet made with leaf powder of the variety Miura), DIZ (artificial diet made with leaf powder of hybrid IZ 56/4) and DSM (artificial diet made with leaf powder of hybrid FM Shima-Miura). The total and parcial weight gain of larvae, larval mortality, cocconing ratio, medium cocoon weight and liquid silk ratio was evaluated. The larvae that received as feeding the artificial diets didn't demonstrate satisfactory results, indicating the need of adequation of the diets to the nutritional requirements of the silkworm strain used.
Index terms: silkworm, mulberry,performance biological.

[3552] TERMITICIDAL SUBSTANCES FROM THE HEARTWOOD OF *CRYPTOMERIA JAPONICA* D. DON

A. Sogabe[1], K. Kinjo[1], F. Abe[2] , T. Yamauchi[2] & S. Yaga[1], [1]Dept. of Bioscience and Biotechnology, Univ. of the Ryukyus, Nishihara-cho, OK 903-0213, JAP, E-mail ykimjo@agr.u-ryukyu.ac.jp ; [2]Dept. of Pharmaceutical Sciences, Fukuoka University, Nanakuma, FU 814-0133, JAP.

Termites are found to be distributed from the tropical zone to the temperate zone. Sixteen species of termite inhabit in Japan. Among these species, *Coptotermes formosanus* Shiraki, *Reticulitermes speratus* Kolbe, *Glyptotermes domesticus* Haviland attack building and cause enormous damage. Generally, termites feed on woody materials, but in some cases, termites do not feed on certain woody materials because they contain repellent, antifeedant and/or termiticidal substances. These substances have an effect on termite either independently or in a complex form. In this study, termiticidal substances from *Cryptomeria japonica* D. Don, which is used as material for construction and furniture making for a long time, was investigated. The resistance of *C. japonica* against termites was examined by termite tests. In termite tests on small blocks and wood meal, the heartwood of *C. japonica* exhibited the highest antitermite activity. Antitermite substances were found to be present in the ethanol extractives from the heartwood of *C. japonica*. The ether soluble portion of ethanol extractives was fractionated into acidic, phenolic and neutral fractions. The neutral fraction exhibited the highest termiticidal activity. The neutral fraction was separated by column chromatography on silica gel and high-performance liquid chromatography (HPLC). The antitermite substances present in the **neutral fraction were identified as β-eudesmol, sandaracopimarinol and 16-**phyllocladanol. 16-Phyllocladanol exhibited the highest termiticidal activity among the three substances extracted from the heartwood of *C. japonica* D. Don.
Index terms: *Cryptomeria japonica, Coptotermes formosanus,* Phyllocladanol.

[3553] WHY ARE THERE NO PESTICIDE-RESISTANT SOCIAL INSECTS? IN MEMORY OF U. EUGENE BRADY (1933-1989)

C.K. Starr, Univ. of the West Indies, St Augustine, Trinidad & Tobago, E-mail ckstarr99@hotmail.com

Recorded resistance to second-generation pesticides has increased steadily for almost 50 years. However, pest-control operators report the impression that social insects remain susceptible to pesticides even after long-term exposure. Statistical comparison of the taxonomic distribution of a) arthropod pests, and b) pesticide-resistant arthropods corroborates this impression in two ways. Resistance is less prevalent in a) social insects, and in b) all hymenoptera, than in other arthropods. Three hypotheses are reviewed with respect to lower evolved pesticide resistance in social insects. These have to do with a) longer generation time, b) low effective population size, and c) the separation of replicators and interactors among colony members.
Keywords: directional selection, Hymenoptera, Isoptera

[3554] NUTRIENT DISTRIBUTION IN *SOLENOPSIS INVICTA*

H.M. Story & L.M. Hooper-Bui, Department of Entomology, 402 Life Sciences Building, Louisiana State Univ. Baton Rouge, LA, USA 70803. E-mail: heather_story@yahoo.com.

Several radio-labeled sugars and proteins were fed to both monogyne and polygyne forms of *Solenopsis invicta*. The amount of each nutrient in each individual was recorded and compared between the monogyne and the polygyne form. Differences in food flow between the two forms of red imported fire ant were found in the larvae and the queens while no difference was found between monogyne or polygyne workers. In monogyne forms queens did not begin receiving sucrose meals before 24h while polygyne queens began receiving meals before 4h. There were also distinct differences in the time required for the larvae of the two forms to be fed. Monogyne workers fed larvae high percentages of sugar solution by 4hrs. while most polygyne larvae did not receive a meal until around 24 h. It is possible that this difference is due to the high nutritional requirements of the large monogyne workers.
Index terms: Fire ants, food flow, trophallaxis, monogyne, polygyne

[3555] EFFICIENT FORAGING BY BUMBLEBEES: THE ROLE OF REPELLENT SCENT MARKS

J. C. Stout & D. Goulson, Division of Biodiversity and Ecology, School of Biological Sciences, University of Southampton, Bassett Crescent East, Southampton, SO16 7PX, UK, E-mail jcs3@soton.ac.uk

Although it has long been recognised that honeybees use complicated phenomenal signals to communicate with one another, it was thought that the more primitively eusocial bumblebee did not. We have discovered, however, that the use of scent marks is an important aspect of bumblebee foraging behaviour. In the field, we have shown that foraging bumblebees use repellent scent marks to avoid flowers which have been recently visited and depleted of nectar and/or pollen. Flowers which had recently been visited were avoided by both conspecific individuals and heterospecifics. Tarsal washes applied to flowers in the field induced similar repellent effects and we conclude that tarsal secretions are probably responsible for repelling subsequent bees. We analysed the tarsal hydrocarbons of three species of bumblebee (*Bombus lapidarius*, *B. pascuorum* and *B. terrestris*) using combined chromatography-mass spectrometry techniques. Complex mixtures of long, straight-chain alkenes and alkanes were identified and very tiny amounts of synthetic versions of these compounds induced repellency in the field. We propose that scent marks are not actively secreted but simply consist of compounds present on the bumblebee cuticle which are accidentally deposited on flowers. Flowers vary greatly in the rate at which they secrete nectar, however, and so scent marks which repelled foragers for a fixed amount of time would be inefficient. Optimally, bees should cease to be repelled from flowers at the time when nectar levels have replenished to a profitable level. We found that foraging bumblebees were repelled from *Symhytum officinale* flowers for 20-60 minutes after a previous bumblebee visit. This corresponded to the time taken for nectar to accumulate to profitable levels. We then studied the use of scent marks on a further four plant species with differing rates of nectar secretion, and found that repellency also related to flower profitability in these plant species. Since bees tend to remain constant to one flower type during a foraging bout, we propose that they learn to recognise the concentration of repellent scent which corresponds to profitable nectar levels in that plant species.
Index terms: *Bombus* species, foraging behaviour, pheromones, nectar secretion

[3556] AN INVITATION: MORE FRESH COCOONS FOR A COMPLETELY NEW USE OF SERICIN AND FIBROIN AND SILKWORM PUPAE, AN URGENT NEED FOR A NEW INDUSTRIAL SYSTEM OF SERICULTURE IN THE 21ST CENTURY

M. Sumida[1], F. Matsubara[2], T. Yamazaki[2] & D. Yasunaga[3], [1] Dept. of Appl. Biol., Kyoto Inst. of Technol., Matsugasaki, Kyoto 606-8585, Japan, E-mail sumida@ipc.kit.ac.jp; [2] Kinugasa-kai Textile Res. Inst., Kyoto, Japan; [3]SAN Ltd., Kyoto, Japan.

Sericin and fibroin from the fresh cocoons of the silkworm, *Bombyx mori* and the pupae are utilizable for a variety of purposes and they are actually more than that. The indispensable, precious resources like a gem for a new bio-industry for making cosmetics and medicine, which contributes to promote the beauty and the good health of the human being. The products are safe for the human being as well as friendly for the earth environment. We have established a product supply network, which connects the consumer industries and the supply industry of raw materials. The present question remains is how to satisfy the big needs of fresh cocoons and silkworm pupae as a raw material for the supply industry. The solution we came to the conclusion is to start a business to produce fresh cocoons by utilizing an industrial system of all the year round, aseptic sericulture system which had been developed and proposed as a new industrial system of sericulture in the 1980's but not used until present. The reason was that the system was too ahead of the times. Now is the time to use it and produce needed fresh cocoons and silkworm pupae. The development of the system originated from a question by Professor Y. Hamamura in 1935 "Why do silkworm larvae eat mulberry leaves only?" Three factors were discovered by 1957 from the fresh mulberry leaves, namely, an attractant, a biting factor and a swallowing factor. "The artificial diet" which contained the three factors, agar for the formulation of a diet, and the five nutrients including carbohydrates, proteins, lipids, minerals, and vitamins successfully supported the growth and development of the silkworm larvae which helped to produce cocoons in the laboratory scale. A subsequent larger scale rearing of the silkworm larvae on an artificial diet resulted in a complete failure, i.e., all the larvae were dead from the disease by the pathogenic fungi which grew on the artificial diet. This implicated that the adoption of an aseptic rearing method is essential in using an artificial diet, which was a start of a new study. Lowering the cost of the diet was another question, which produced a new diet, which then helped to make completely new cocoons with precious characteristics. We welcome inquiries by the people who are interested in establishing a new industry in your own country for the promotion of the beauty and the good health of the human being in the 21st century.
Index terms: *Bombyx mori*, sericin, fibroin, silkworm pupae, industrial system of sericulture.

[3557] PHOTOPERIODIC CLOCK-ENDOCRINE SWITCH AXIS IN DIAPAUSE REGULATION IN SILKMOTH

M. Takeda, M. Matsumoto, Y. Tohno, J. Bembenek, E. P. Markova & N. Ichihara, (Grad. Sch. Sci. Technol., Kobe Univ. 657-8501 JAPAN: E-mail: mtakeda@kobe-u.ac.jp,)

Neuroendocrine mechanism of diapause has been intensively studied in *Antheraea pernyi* and *Bombyx mori*. However, the whole system constitutes a black box. Physiological reality of photoperiodic clock and upstream regulatory processes of release of hormones that directly function as endocrine switch still remain unclear. Recent advance in molecular biology of circadian clocks and molecular cloning of neurotransmitter receptors provides impetus to study photoperiodic clocks and input pathways to the endocrine switches, respectively. We raised antisera against PER, DBT, CRY and aaNAT. The brains of *A.pernyi* and *B.mori* were mapped for immunohistochemical reactivity to these antisera. PER-, DBT- and NAT-like antigens existed in the same cells, indicating these cells are the clock and the messenger of clock output is melatonin, since antisera against HIOMT and melatonin all gave positive results in the same cells.Changes in neurotransmitter contents along diapause development were followed after activation by long days and low temperatures HPLC. Both photoperiod and low temperature affected enzymatic activity in NAT, MAO and others. Monoamine pathways are affected by photoperiod and temperature. Cellular architecture constituting the clock-endocrine axis is studied also using antisera against neurotransmitter receptors. The results show that indolamine pathway is critically involved in the regulation of this axis.
Index words: melatonin, *NAT*, PER, DBT, CRY

[3558] IDENTIFICATION AND CHARACTERIZATION OF A NOVEL GENE (*Kl-1*), WHICH IS EXPRESSED PREFERENTIALLY IN LARGE TYPE KENYON CELLS OF THE HONEYBEE BRAIN

H. Takeuchi[1], M. Sawata[1], A. Kamikouchi[1], S. Natori[2], K. Sekimizu[1] & T. Kubo[1], [1]Grad. Sch. Pharmaceu. Sci., Uni. of Tokyo, Bunkyo-ku, Tokyo, 113-0033, Japan; and [2]Natori Special Lab., RIKEN, Wako-shi, Saitama, 351-0198, Japan.

To analyze the molecular basis the social behaviors of the honeybee *Apis Mellifera* L., we have searched for genes that are expressed selectively in the mushroom bodies, putative sensory integration centers of the honeybee brain, by the differential display method. As results, we first identified a gene (*Kl-1*) which was expressed preferentially in the large type-Kenyon cells of the mushroom bodies. No significant expression was observed in any other parts of the honeybee body, suggesting that the function of the *Kl-1* gene product is closely related to cellular function of the large type-Kenyon cells.To determined the nucleotide sequence of the full length *Kl-1* cDNA, we performed cDNA walking and identified a consensus cDNA sequences of 10.3kbp length. We also isolated a genomic clone and restricted the regions corresponding to the exon(s) of the *Kl-1* gene by the RT-PCR method. Unexpectedly, many termination codons appeared all over the nucleotide sequences of the *Kl-1* cDNA so far determined, suggesting that the *Kl-1* transcripts encodes no proteins and function as a non-translated RNA, like the Ks-1 transcripts (See the preceding Report by Yoshino *et al.*). Our results suggest that multiple non-translated RNAs are involved in the division of the function of the Kenyon cell subtypes in the honeybee brain. The analysis of the biological function of these non-translated transcripts would be an important cue to understand the molecular basis of the highly advanced types of honeybee behavior.
Index terms: Social insect, gene expression , Differential Display.

[3559] KIN RECOGNITION ANALYSIS OF *CAMPONOTUS JAPONICUS* (HYMENOPTERA: FORMICIDAE) COMBINED WITH AGGRESSIVE BEHAVOUR TEST AND RAPD-PCR METHOD

S. J. Tan[1], X. F. Chen[1], Z. B. Liu[2] & D. M. Li, [1] The State Key Lab of Integrated Management of Insect Pests & Rodents, Inst. Of Zoology, Chinese Academy of Sciences, Box 55,Beijing, 100080, P. R. China, E-mail Lidm@panda.ioz.ac.cn, [2]Inst. Of zoology, Shaanxi Normal Univ., Xi'an, 710062, P. R. China.

Kin recognition plays a key role in social life of social insect. Analysis to the relationship between individuals or colonies is becoming one of the most active and fruitful fields in ethology. Sixty-eight random amplified polymorphic DNA (RAPD) loci in six nests of *Camponotus japonicus* Mayr from Xi'an were firstly analyzed combined with aggressive behavior test in this paper. Kin recognition was measured by the levels of aggression, and the result showed that the level of aggression differed as the distance between the nest's varied, which suggests that there is correlation between the geographic distance and the aggression level. RAPD data shows that there is not distinct correlation between the genetic and geographic distance, however, there is some correlation between the genetic distance and the level of aggression. It suggests that the kin recognition in the ant, *Camponotus japonicus* Mayr, is effected by both genetic and environmental factors, but the genetic factor is more important. RAPD method can detect the genetic diversity among individuals of different populations or colonies, so it could be widely applied in ethology.
Index terms: *Camponotus japonicus* Mayr, Kin Recognition, Aggressive Behavior, RAPD.

[3560] ECDYSONE BUT NOT 20-HYDROXYECDYSONE INDUCES THE REGENERATION OF MIDGUT EPITHELIAL CELLS IN THE SILKWORM, *BOMBYX MORI*

Y. TANAKA & F. YUKUHIRO, Natl. inst. seric. entomol. sci., Tukuba, Ibaraki, 305-8634, Japan, e-mail yoshiaki@nises.affrc.go.jp.

We already reported that ecdysone (E) has a specific effect on the morphological change of midgut epithelial cells that is distinct from 20-hydroxyecdysone (20E) in precocious fifth-instar larvae induced by 20E. Silkworm larvae, *Bombyx mori*, were fed an artificial diet supplemented with 20E during the fourth-instar to promote premature molting. At the onset of the fifth instar, these precocious fifth-instar larvae were fed diets supplemented with either E or 20E to determine the effects of the two ecdysteroids on the morphology of midgut epithelial cells.□**In the larvae that ingested 20E, the epithelial cells disrupted** without regeneration because of the degeneration of the regenerative cells, and the failure of the larvae to renew midgut epithelial cells may lead to premature death during the fifth instar. On the other hand, in the larvae that ingested E, the regenerative cells began to proliferate and differentiate very rapidly and the epithelial cells were replaced to new ones 24 hours before the larvae entered apolysis, then most of the larvae molted to the sixth-instar. However, regeneration of midgut epithelial cells normally occurs only during the molting period. Such a rapid regeneration was also induced by an oral or a hemolymph injection of E. The regenerative cells began to differentiate within 2 hrs after the injection of E. These results results suggest that E has a specific effect on the regenerative cells that differ from that of 20E in the precocious fifth-instar larvae obtained with 20E.
Index terms:Bombyx mori, midgut, regeneration, ecdysone, 20hydroxyecdysone.

[3561] RIGHT-WING BEES? PHYLOGENETIC CONSERVATISM IN AUSTRALIAN ALLODAPINES AND IMPLICATIONS FOR SOCIAL EVOLUTION

S. M. Tierney[1] & M. P. Schwarz[1], [1]School of Biological Sciences, Flinders University of South Australia, GPO Box 2100, Adelaide, S.A. 5001, Australia, E-mail: Simon.Tierney@flinders.edu.au.

Recent research in Australian allodapine bees provides a comprehensive knowledge of life history and social organisation for all four genera in the *Exoneura* group. These studies reveal a substantial degree of phylogenetic conservatism within, but not between genera, in terms of voltinism, egg-production, and brood phenology. These broad differences between genera cannot be explained by variation in climate, ecology or nesting biology. In many cases, species from different genera occur sympatrically and utilize the same nesting substrates, yet exhibit markedly different voltinism and brood phenology. This phylogenetic conservatism has important implications for social evolution in allodapine bees. Voltinism and brood phenology strongly influence opportunities for sib-rearing and therefore the kinds of sociality that can evolve. Univoltinism and synchronous brood development largely preclude eusociality in the genus *Exoneura*, whereas in sympatric species of *Brevineura*, year-round egg production and staggered brood development lead to protracted opportunities for older daughters to rear their younger siblings. Despite this, sociality involves larger colony sizes and more complex social interactions in *Exoneura* than *Brevineura*. Comparative studies of Australian allodapine bees suggest that the evolution of complex sociality need not involve elaboration of matrifilial associations. Rather, the evolution of large, complex societies appears linked to the need for group defence against enemies at the nest, despite life history constraints that may preclude caste behaviour based on matrifilial relationships. Current work investigating sociality in the African allodapine group will uncover whether phylogenetic conservatism is a widespread characteristic of evolution in allodapines, or an isolated quirk confined to the Australian fauna.
Index terms: *Exoneura*, Allodapini, comparative sociality, phylogeny.

[3562] TERMITES AS STRUCTURAL PESTS IN ARGENTINA

G.J.Torales, Fac. de Cs. Exactas y Naturales y Agrim. Univ. Nacional del Nordeste. 9 de Julio 1449. 3400. Corrientes. Argentina. E-mail: gtorales@exa.unne.edu.ar.

Termite species damaging buildings in Argentina are included in the families Rhinotermitidae and Termitidae. Among the Rhinotermitidae, *Heterotermes longiceps* is responsible for serious infestations to the historical and cultural patrimony of the city of Corrientes (province of Corrientes). This species attacked the Historical Colonial Museum, the Workshop and Museum of Artisans and some educational institutions. *H.longiceps* appears sporadically in houses, as the only infesting species or associated to *Nasutitermes corniger*. Among the Termitidae, the most important species is *N.corniger*. The damage produced by this termite reach a wide range of materials: wood used in different forms, expanded polystyrene, glass, cork, cardboard and various qualities and applications of paper. The construction of long runways on different supports is a constant characteristic of this species. Its non-arboreal nests are located mainly on roofs, walls and perimetral fences; and the arboreal ones are commonly found on woody plants of the infested buildings. This species is restricted to the city limits of Corrientes, causing severe damage to houses and to cultural, educational and sporting institutions. Other species occasionally responsible for the infestation in houses of the provinces of Corrientes and Chaco are *Microcerotermes strunckii, Cortaritermes fulviceps* and *Amitermes amifer*. The nests of *M.strunckii* and *C.fulviceps* were located on roofs. *M.strunckii* affected not only structural timbers, but also, in one occasion, some manuscripts with original descriptions of many species of the flora of Chaco were damage. The most important attack of *C.fulviceps* was to the pasteboard ceiling of the Natural History Museum, in the city of Resistencia (Chaco). The activities of *A.amifer* were detected on hard wood of an historic building from 1860, nominated as Historical National Monument in Corrientes. The infestations were mostly favored by the old constructions, the quality of building materials and the high humidity content of the walls. *M.strunckii* and *Nasutitermes aquilinus* are frequently found in several species of the genus *Eucalyptus*. *N.aquilinus* was not observed in dwelling houses, but its tendency to attack *Eucalyptus* trees might constitute a factor risk to the culture of this Mirtaceae. Chemical control is the only method applied, it is carried out individually by the house owners, which afford the costs of the treatments.

Index terms: Isoptera, buildings, damage

[3563] THE DISTRIBUTION AND CONTROL OF ANTS (HYMENOPTERA: FORMICIDAE) IN VINEYARDS IN THE MAJOR GRAPE-GROWING REGIONS OF SOUTH AFRICA

P. Ueckermann, ARC Infruitec-Nietvoorbij, Private Bag X5026, Stellenbosch, 7599, Republic of South Africa, E-mail piau@nietvoor.agric.za.

Biological control of mealybug *Planococcus ficus* on vines by coccinellid predators and parasitic Hymenoptera is only effective if honeydew-feeding ants are controlled. At present, there is no registered and effective treatment available against epigaeic ants, which are believed to be the most serious ant pests in vineyards. This study had two aims: the first was to conduct a survey to establish which species of ants are associated with mealybug and which species dominate in each of the major vine-growing regions. Twenty-two vineyards were surveyed for two weeks in six major vine-growing areas using pitfall traps and fish-bait traps. Ants were identified, counted and dominance indices were calculated. The second aim was to find a cost-effective method for ant control that is practical to carry out and acceptable for an IPM program. Two field trials were carried out over two seasons to test the efficacy of various stem treatments for preventing the Argentine ant *Linepithema humile* and the pugnacious ant *Anoplolepis custodiens* from gaining access to grapevines. Two synthetic pyrethroids, alphacypermethrin and betacyfluthrin, and two organophosphates, chlorpyrifos and terbuphos, were tested. Botanical and animal extracts including parts of tomato, garlic and the syringa tree *Melia azaderach* and crushed ants (of the same species as the pest ant) were also tested as stem sprays, intended for use by small-scale or organic farmers. From the survey, a total of 44 ant species from 18 genera were recorded. The most widely distributed ant species, which were dominant and associated with mealybug outbreaks, are *Anoplolepis custodiens, A. steingroeveri* and *Linepithema humile*. *Crematogaster peringueyi, Crematogaster* sp. 2 and *C. melanogaster* are three arboreal species potentially dominant in vines only. There were strong indications that certain abiotic factors such as soil type, irrigation type and rainfall as well as interspecific competition could influence the distribution of ants. Edge effects were noticed in four vineyards infested with *A. steingroeveri*. Treatments that were most effective in controlling *L. humile* and *A. custodiens* were a chlorpyrifos impregnated slow-release band, a slow-release band containing terbuphos, and alphacypermethrin at a dose rate of 20 mℓ/ℓ. Efficacy was measured in days after application of treatments until ants infest 25% or more of the vines. These treatments were effective for between 100 and 140 days. There are indications that the bands could last for another season. Plant and animal extracts were generally effective for approximately 40 days.

Index terms: *Linepithema humile, Anoplolepis* spp., survey, stem barriers

[3564] HONEYBEES ARE ABLE TO REPRESENT DURING TROPHALLAXIS INSTANTANEOUS CHANGES IN FLOW OF SOLUTION

A. J. Wainselboim[1], W. M. Farina[1] & F. Roces[2], [1]Depto. de Biología, Ftad. de Cs. Exactas y Naturales, UBA, Cdad. Univ., (1428) Buenos Aires, Argentina. E-mail: walter@bg.fcen.uba.ar; [2]Zoologie II, Biozentrum der Universität Würzburg, Am Hubland, D-97074 Würzburg, FRG.

The coordination of tasks in honeybee colonies requires the exchange of information between members of the hive through different communication channels such as pheromones, dancing behavior and trophallaxis. Trophallaxis is the mouth to mouth exchange of liquid food from a donor to a recipient bee and is most important when foragers return to the hive after a successful food-gathering trip. These foragers completely unload their nectar crop content to one or more simultaneous recipient bees before leaving the hive for a new foraging bout. Experiments with donor foragers gathering sucrose solution at a regulated-flow feeder showed that the rate at which the liquid food is unloaded (transfer rate) depends on the flow of solution encountered by the donor at the feeder. Thus, foragers finding a higher flow of solution at the food source will deliver the collected solution at a higher rate once in the hive. What remained to be seen was whether foragers monitored the flow of solution offered by the feeder, or the time they remained at the food source (feeding time), since with increasing flow of solution feeding time decreases. To address this question donor foragers were trained to a regulated-flow feeder offering a 50% w/w sucrose solution. After the fifth visit was complete the bee was captured and placed inside an acrylic box together with an empty recipient from the same hive. Transfer rate during the subsequent trophallactic encounter was recorded. The experimental series performed were: (a) donors were trained to a flow of 10, 20 or 60 µl/min. (feeding time=6, 3 or 1 min. respectively); (b) donors were trained to a flow of 20 µl/min in the first 4 visits and were offered 60 µl/min. in the initial 30 seconds and 10 µl/min. in the final 2.5 minutes of the fifth visit; (c) foragers were trained as in (b) but were offered 10 µl/min. during the *initial* 2.5 minutes of the visit and 60 µl/min in the *final* 30 seconds of the fifth visit. Transfer rate measured after the fifth visit was found to be related to the flow of solution found in that visit. In (a) transfer rate increased with increasing flow of solution, as expected from previous results. In (b) transfer rate decreased significantly compared to animals that experienced 20 µl/min. throughout the five visits. In (c) two populations of bees were found: one of them transferred solution at the same rate than those that found 60 µl/min. during all five visits, another group showed the same response as in (b). Thus, foragers detected the change of flow at the food source, regulating transfer rate in relation to the new conditions found at the feeder, despite the fact that feeding time was kept constant. This study was supported by funds from a PWA-Program (DAAD, Germany, and Fundación Antorchas, Argentina) and ANPCYT (PICT 98-03103).

Index terms: *Apis mellifera*, forager, communication.

[3565] ADHESIVE STRENGTH OF THE GLUE SUBSTANCES IN THE COLLETERIAL GLANDS OF THE JAPANESE WILD SILKMOTHS

M. Yago[1], S. Abe[2], S. Hashimoto[2] & T. Mitamura[3], [1]Dept.of Biochemistry, Sch. of Dentistry, Iwate Medical University, Uchimaru 19-1, Morioka, 020-8505 Japan, E-mail myago@iwate-med.ac.jp; [2] IWATE Agricultural Research Center, Narita 20-1, Kitakami, 024-0003 Japan; [3]Fukushima Sericultural Experiment Station, Yanagawamachi, Date-Gun, Fukushima, 960-0781 Japan

The eggs of lepidopteran insects are generally coated with a glue substance secreted from a female reproductive accessory gland, the colleterial gland or the mucosal gland. The glue substance hardens after oviposition to attach the eggs to plants or other substances, so that the eggs are fixed to the surfaces tightly enough not to come off easily even when strong winds blow and when it rains heavily. Studies on the gland and the glue substance have been done in several insects such as *Bombyx mori*, some saturniid moths, *Galleria mellonella* L., and *Spodoptera littoralis* L. In *Bombyx mori*, the colleterial gland originates from the imaginal disc located in the ninth abdominal segment, and grows rapidly after pupal ecdysis. The gland is composed of two parts, a secretory region and a storage region. The glue substance is produced in the former region, and stored in the latter region. There are some glue proteins in the homogenates of the whole glands. Their molecular weights range from 200 to 300kDa. The glue substances appear to be an interesting and suitable material for examining the mechanism of bio-adhesion, and for being utilized as a biomaterial. However, there have been no reports focusing on the physical nature of the glue substances such as adhesive strength or viscosity, except for the one by Yoshida & Nagata (1997) in which they measured the adhesive strength of the glue substance in the colleterial glands of *B. mori*. In this paper, we measured the adhesive strength of the glue substances in the colleterial glands of two species of Japanese wild silkmoth, *Antheraea yamamai* and *Rhodinia fugax* Butler, and compared these results with the results obtained in *B.mori*.

Index terms: *Antheraea yamamai, Rhodinia fugax* Butler, egg adhesion, female reproductive accessory gland.

[3566] PHOTOPERIODIC AND NEUROENDOCRINE REGULATION OF THE SEASONAL MORPH DEVELOPMENT IN A BIVOLTINE RACE (DAIZO) OF THE SILKMOTH, *BOMBYX MORI*

A. Yamanaka, J. Tsurumaki & K. Endo, Environmental Biology Laboratory, Institute of Biological Science, Faculty of Science, Yamaguchi University, Yamaguchi 753-8512, Japan, E-mail address: endo@po.cc.yamaguchi-u.ac.jp

A few species of moths, such as *Orgyia antiqua*, were demonstrated to have apparent seasonal morphs, some of which were shown to be regulated by photoperiod and temperature imposing during the embryonic and larval stages. By contrast to the case of butterflies, there are few studies about physiological mechanisms underlying the photoperiodic control of seasonal morph development in moths. A bivoltine race (Daizo) of the silkmoth, *Bombyx mori*, was found to have two types of male adults whose anterior wings were adorned with dark-brown and light-brown outer-lines. Male moths having dark-brown-striped wings were developed under long days at 27°C in the embryonic stage and under long days at 25°C in the larval stage, whereas male moths with the light-brown-striped wings were developed under short days at 17°C in the embryonic stage and short days at 25°C in the larval stages. The two types of males having dark-brown-striped and light-brown-striped wings may be seasonal (autumn and summer) morphs of Daizo. The female types (diapause-egg and nondiapause-egg producers) were shown to be regulated by a neuroendocrine factor, named diapause hormone (DH), produced by suboesophageal ganglion and secreted from corpora allata (or corpora cardiaca) in the first half of the pupal stage. When 2% NaCl extracts of pupal SGs or DH, gifted by Prof. O. Yamashita of Nagoya University, were injected into pharate pupae and day-0 pupae of males destined to develop into the light-brown-striped types (summer morphs), their wing patterns were found to be shifted toward the dark-brown-striped types (autumn morphs). It may be concluded that in the silkmoth, Daizo, male seasonal morphs as well as female types may be regulated by photoperiod and temperature imposing during the embryonic and larval stages. Autumn morph development in males may be determined by the same neuroendocrine factor, DH, determining the types of females. But, the stage at which the DH act on the male wings may be earlier than that on the female ovaries.

Index terms: male-moth, anterior-wing, confident-ellipse, diapause-hormone

[3567] Installation Guidelines for the Basaltic Termite Barrier: A Particle Barrier for Formosan Subterranean Termites (Isoptera: Rhinotermitidae)

J. R. Yates III[1], J. Kenneth Grace[1] & Jim N. Reinhardt[2], [1]Dept. of Entomology, Univ. of Hawaii, 3050 Maile Way, Honolulu, HI, 96822, USA, E-mail yates@hawaii.edu; [2]Architectural Diagnostics, Ltd., 1001 Bishop Street, Suite 1100, Honolulu, HI, 96813, USA.

The Formosan subterranean termite, *Coptotermes formosanus* is Hawaii's most economically important insect pest and for many decades the principle means for preventing infestations by this insect has been with soil termiticides. More recently, however, particle physical barriers have been developed and tested for efficacy with several species of subterranean termites. Included was the Basaltic Termite barrier that was commercialized in Hawaii during 1987, however, its popularity as a substitute for termiticides since then has been minimal for a number of reasons. Concomitantly, architects and building contractors have had little understanding of installation requirements for this barrier that has resulted in several failures. Subsequent evaluations of faulty installations identified problem areas that have led to the development of installation guidelines for several pre- and post-construction applications.

Index terms: *Coptotermes formosanus*, subterranean termite, physical barrier

[3568] CONTROL OF THE MATING FLIGHT TIME OF HONEYBEES BY PHOTOPERIODIC TREATMENT WITHIN THE HIVE

T. Yoshida[1], S. Kohara[2], M. Sekihara[2] & M. Sasaki[2], [1]Honeybee Science Research Center, Tamagawa Univ., Machida, Tokyo 194-8610, Japan, E-mail tyoshida@agr.tamagawa.ac.jp; [2]Lab. of Entomology, Fac. of Agriculture, Tamagawa Univ., Machida, Tokyo 194-8610, Japan

Mating flight time of new queen and drone is innately phase-fixed and photoperiodically regulated. Thus it should be possible to shift the timing by altering the light-dark (LD) conditions of a given colony. New queens of *Apis mellifera ligustica* were introduced into nucleus hives in a specially devised LD-controlled dark box. Light (15W white and UV fluorescent tubes) turned on at 01:30 and off at 13:30 (5h advanced) in the box. Drones of *Apis mellifera carnica* were kept in a glass observation hive placed in the dark room whose LD condition was same as queen's. The drones started flying at 09:15 peaking between 11:00 and 12:00, while natural drones fly from 12:00 normally. Nine queens out of 23 photoperiodically treated flew total 34 times for mating, 6 queens succeeded to mate with drones. One queen returned with mating sign twice. Four returned with mating sign at 10:13, 11:14, 11:50 and 11:58, and other 3 at 12:13, 12:16 and 12:42. From the analysis of offspring workers, queens returned at 10:13, 11:14, 11:50 and 11:58 were thought to have mated with photoperiodically-treated drones. Artificial "chronological reproductive isolation" seems to be possible if the queen flight is also controlled as in drones, which is to be confirmed. It may be applicable to keep pure strain or cross between the two-desired strains by natural mating in the same place.

Index terms: *Apis mellifera*, mating behavior, photoperiodic control, reproductive isolation.

[3569] ECOLOGICAL PHYLOGENETICS AS APPLIED TO SEMIAQUATIC BUGS (HEMIPTERA, GERROMORPHA)

N. M. Andersen, Zoological Museum, Univ. of Copenhagen, Universitetsparken 15, DK-2100 Copenhagen, Denmark, E-mail: nmandersen@zmuc.ku.dk

Most modern explanations of ecological phenomena connect observable processes in a framework of adaptationist assumptions and arguments. A valuable historical perspective, however, can be obtained by incorporating phylogenetic reconstructions into analyses of ecological problems. With advances in cladistic methods applied to both structural and molecular characters, phylogenies are now available for many taxa. By integrating phylogenetic and ecological information, we can infer the evolutionary history of ecological traits through a research program called *ecological phylogenetics*. Examples of this approach are given for semiaquatic bugs (Hemiptera, Gerromorpha), in particular with respect to the evolution of habitat use, locomotory structure and function, dispersal polymorphism and life history, mouthpart structure and feeding biology, and sexual dimorphism and mating systems.
Index terms: dispersal polymorphism, life history, sexual dimorphism, mating systems

[3570] MITOCHONDRIAL DNA SEQUENCE VARIATION OF THE WATER STRIDER *AQUARIUS REMIGIS* (HETEROPTERA, GERRIDAE)

J. Damgaard [1], B. V. Pedersen[1] & F. A. H. Sperling[2], [1] Zoological Institute, Univ. of Copenhagen, Universitetsparken 15, DK-2100 Copenhagen, Denmark; [2] Dept. of Biol. Sci., Univ. of Alberta, Edmonton, Alberta, T6G 2E9, Canada

The common north American water strider *Aquarius remigis* is one of the best studied species of water striders in terms of morphology, genetic variation, behaviour and ecology. Taxonomically, however, the species is relatively unknown, and considering its extensive distribution from the southern provinces of Canada to Mexico and Guatemala, it is expected that this species shows geographical variation that might justify subspecific or even specific segregation. The present study comprises DNA sequence data from the mitochondrial gene encoding *cytochrome oxidase subunit* 1 from populations all over North America assigned to *A. remigis* or its sibling species *A. amplus*, *A. nyctalis* and *A. remigoides*. Preliminary analyses record great regional differentiation between populations, but further molecular and morphologically based surveys are needed to establish the taxonomic status of populations and their phylogeographic relationships.
Index terms: mtDNA variation, North America.

[3571] LIFE HISTORY AND EGG DIAPAUSE OF A WATER STRIDER, *METROCORIS HISTORIO* B.WHITE

T. Harada & H. Wada, Lab. of Environmental Physiology, Fac. of Science, Kochi Univ., Kochi 780-8520, JAPAN, E-mail haratets@cc.kochi-u.ac.jp

Ban *et al.* (1988) reported that a water strider, *Metrocoris historio* which inhabits on streams of the mountains shows divoltinism and overwinters in egg stage, and that was based on field-samplings in Aichi Prefecture (35°N). Timed-catch samplings were held in a water-way in the campus of agricultural faculty in Kochi University (33°N) located in the critical area between subtropical and temperate zones. Adults, the fourth and fifth instars could be caught even in January, 1999 and February, 1998. Many first instars have been found in April, 1999. Adults collected at the end of December, 1998 were reared under natural conditions. They laid eggs during overwintering and 34.5% of them survived till the end of February, 1999 when females have kept 9.3 mature oocytes on average. Adults of *M. historio* were collected from the water way in June and reared under 15.5L-8.5D and at 20±2□. Eggs laid by them were kept there and newly hatched first instars were kept under 15.5L-8.5D or 12L-12D till adult emergence. Adults were reared under the long or short days. All the adults laid eggs regardless of photoperiodic conditions. Embryos in eggs laid by the adults which had been kept under the long days during nymphal stage and/or after emergence have developed without diapasue and showed the egg period of 18 to 23 days on average. However, eggs laid by the adults which had been reared under the short days during nymphal and adult stages could be divided into 'diapause eggs (87.1 %): 78 or 88 developmental days on average' and 'non-diapause eggs (12.9 %): 18 or 23 days on average'. Photoperiodic conditions during embrionic development had no effects on the developmental periods. On 50 or 53 days from oviposition, chilling at 7□ for 1 week could not advance the diapause development. In the critical area between subtropical and temperate area like Kochi, the physiological system of egg diapause may be on the way of establishment. This study was supported by Government Fundation by Ministry of Education, Project No. 1179001 (1999-2002).
Index terms: Semi-aquatic bug, diapause development, maternal effects.

[3572] PACIFIC HYDROMETRIDAE - INSULAR EVOLUTION IN GEOGRAPHIC AND PHYLOGENETIC ISOLATION

D. A. Polhemus[1] & J. T. Polhemus[2], [1]Dept. of Entomology, Smithsonian Institution, Washington, DC, 20560, USA, E-mail bugman@mail.bishopmuseum.org; [2]Colorado Entomological Museum, 3115 S. York, Englewood, CO 80110, USA, E-mail polhemus@stripe.colorado.edu.

Our recent discovery of a new genus of Hydrometridae on the island of Hiva Oa in the Marquesas has necessitated a revision of the phylogeny and higher classification of the family. Our revised cladistic analysis of extant hydrometrid genera indicates that the new genus falls in the proposed new tribe Marquesametrini, along with two other Marquesan endemic genera, *Chaetometra* and *Dolichocephalometra*. Our character analysis also indicates that the type species of the South American genus *Bacillometra* is not congeneric with the other species now included in the genus, and deserves tribal rank as Bacillometrini. The other species presently included in *Bacillometra* are removed to a new genus in the Hydrometrini. The placement of fossil genera within our revised phylogeny is also discussed. Our cladistic studies indicate that the basal lineages of Hydrometridae were established prior to the Mesozoic opening of the Atlantic Ocean separating Africa from South America. Subsequent diversification of hydrometrid clades apparently occurred primarily in the Western Hemisphere, with offshoots subsequently colonizing the Pacific islands of eastern Polynesia. Although the endemic Marquesan genera are relatively primitive in comparison to the cosmopolitan genus *Hydrometra*, their presence in this isolated Pacific archipelago does not indicate that to us that these islands were a site of early hydrometrid diversification, since the maximum geologic age of the archipelago is only about 8 Ma, whereas fossil hydrometrids are known from much earlier in the Baltic region and elsewhere. Instead, the Marquesan radiation appears to be a case of relictual survival in isolation.
Index terms: Heteroptera, Hydrometridae, Pacific, phylogeny, biogeography

[3573] SEASONAL ASPECTS OF FLIGHT IN WATER STRIDERS (HEMIPTERA: GERRIDAE)

J. R. Spence[1], [1] Dept. of Biological Sciences, Univ. of Alberta, CW405A Biological Sciences Bldg., Edmonton, Alberta, Canada T6G 2E9, E-mail john.spence@ualberta.ca.

Seasonal patterns of flight activity were studied in five waterstrider species over 16 years (1984-99) by marking and weekly census, flight trapping, flight muscle dissection and experiments on small ponds in central Alberta, Canada. Two pondskater species, *Gerris buenoi* and *L. dissortis*, reproduced at near replacement levels on the focal pond; two others *G. comatus* and *G. pingreensis* were generally less successful, despite consistent spring colonization. A few individuals of *Aquarius remigis*, a stream-dwelling species, colonized but never reproduced on the focal pond. Flights were observed in four seasonally distributed categories: 1) flights to and from terrestrial diapause sites in association with overwintering; 2) inter-pond flights of post-diapause breeders; 3) inter-pond flights of summer generation (direct) breeders; and 4) inter-pond flights of pre-diapause bugs. Category 1 flights were observed in all species. Most individuals of the three most common species, *G. buenoi*, *G. comatus* and *L. dissortis*, overwintered at terrestrial sites somewhat distant from natal ponds and immigrated to breeding sites in the Spring; an apparently small proportion of *G. buenoi* overwintered close to the focal pond and walked to and from these sites. Long-winged (LW) individuals of *G. pingreensis*, emerged as adults elsewhere during the previous summer, colonized during the first few weeks after ice-off and generally left only a few progeny, *c.* 68% of which were also LW. A few *A. remigis* adults flew to the focal pond in spring, but apparently bred elsewhere. After mid-May, many reproductively active, overwintered individuals of *G. buenoi*, *G. comatus* and *L. dissortis* regularly made category 2 flights. Individuals of *G. buenoi* and *L. dissortis* were still colonizing the focal pond in mid-July; adult bugs also actively emigrated from the focal pond. Such flights were truncated by flight muscle histolysis during May for *G. pingreensis* and a little later for *G. comatus*. Category 3 flights were made by LW direct breeders of *G. buenoi*, *G. comatus* and *L. dissortis* that colonized temporary ponds re-filled by summer thunderstorms in June and July. If the pond did not dry out, per capita reproductive success of these direct breeders was 2-10 times that of the average observed for overwintered breeders 1984-1999. Pre-diapause adults of *A. remigis*, *G. buenoi* and *L. dissortis* arrived at the focal pond after mid-summer through category 4 flights; some adults of *A. remigis* overwintered near the pond. Females of all four pondskater species flew carrying mature eggs, showing that flight and reproduction occur contemporaneously in these gerrids; however, early in the season females of *G. buenoi* and *G. pingreensis* that histolysed flight muscles carried, respectively, 25.7 and 33.6% more eggs. In addition to the classical ideas that flight is retained to permit escape from high density situations and to allow adults to leave and re-colonize temporary habitats, selective advantages for retention of flight in northern pondskater populations may include use of the best foraging opportunities by pre-reproductive adults, escape from natural enemies, and bet-hedging reproductive strategies, especially in relation to natural enemy impacts.

Index terms: dispersal, oögensis-flight syndrome, flight muscle histolysis, natural enemies, life-history strategies, *Aquarius*, *Gerris*, *Limnoporus*

[3574] MATING SUCCESS IN INTRA- AND INTERSPECIFIC MATINGS OF TWO WATERSTRIDER SPECIES (GERRIDAE)

Kari Vepsäläinen, Dept of Ecology and Systematics, P. O. Box 17, FIN-00014 University of Helsinki, Finland, E-mail kari.vepsalainen@helsinki.fi

Gerris odontogaster (*Go*) is Palearctic. The male has a pair of tooth-like appendages ('pegs') ventrally on the abdomen, in front of the genital segments. The pegs are thought to increase male's mating success in a species where courtship is exceptional, and blatant, forceful attacks are the mode of mating trials. The function of pegs would be that of a morphological attachment apparatus, helping the male to resist female's cast-off attempts while mounted. Males of *G. buenoi* (*Gb*), a Nearctic species very close to *Go*, have no pegs. The species interbreed in the laboratory, allowing assessment of male success in mating trials with con- and heterospecific females. Because the on average smaller *Gb* males lack morphological special features to boost success, *Go* males are expected to be more successful in their mating attempts than are *Gb* males. Before the laboratory experiments, males and females were kept in separate groups to maximise the suggested selective advantage of pegs. The 251 intra- and interspecific tests with one male and one female in each were controlled for female status (virgin *vs* mated, post-diapause *vs* direct breeder) to yield 16 treatments. In seven pairwise comparisons of eight (while controlling over female status), the proportion of successful *Gb* males was 1,4-8,4 times that of *Go*. In all statistically significant comparisons between both con- and heterospecific matings (after pooling the female statuses), the percentage of successful *Gb* was higher. The better success of *Gb* is at least partially due to their higher mating-attack rates. If the length of pegs is stabilised by higher losses of long-pegged males during the final moult (as has been suggested), then there is place for discussion why the pegless alternative tactic based on more persistent mating attempts has not evolved and outcompeted the costly peg tactic of *Go*.

Index terms: *Gerris odontogaster*, *Gerris buenoi*, male grasping apparatus, female resistance

[3575] LIVING AT THE EDGE OF ICE: CARABID BEETLES IN AN ALPINE GLACIER FORELAND

B.-A. Gereben-Krenn[1] & H.W. Krenn[1], [1]Institute of Zoology, Univ. of Vienna, Althanstr. 14, A-1090 Vienna, Austria, E-mail Barbara-Amina.Gereben@univie.ac.at.

Based on the alternating periods of climatic cooling and warming over geological time, the attendant changes of glacial advances and retreats can be determined. Most glaciers in the European Alps have been retreating since the maximum postglacial extension in the middle of the 19th century, although occasionally interrupted by short advances. The dramatic retreat of glaciers in the last ten years has opened up new area for the colonization of animals and plants. Glacier forelands are suitable for the study of colonization in expanding high-altitude habitats, their primary succession and the underlying factors and mechanisms. In the Hornkees glacier foreland (Zillertal Alps/Austria) the first investigation of the succession of the arthropod fauna dates back to the middle of the 20th century. These studies showed that carabid beetles are one of the major epigean arthropods. In a second phase of investigation, between 1986 and 1988, distribution patterns of carabid beetles were assessed in more detail for this particular glacier foreland. Among the Carabidae, species of the genus *Nebria* are found to be the first colonizers of new alpine area after glacier retreat. The six *Nebria*-species, which were dominant within the ground beetle assemblage of the Hornkees glacier foreland in both the number of species, as well as in the number of trapped individuals, provided an excellent opportunity to investigate the co-existence of taxonomically closely related carabid beetles in the high-mountain region. The study focused on aspects of habitat and microhabitat use of the adults and larvae, phenology and diel activity. Each of the *Nebria*-species was most active, both as adults and larvae, in different areas within the glacier foreland characterized by distinct geomorphological and ecological conditions. The most recent investigation in the Hornkees glacier foreland were carried out in the year 1999. The glacier has retreated more than 100 m in the last ten years. The youngest ice-free area is limited by a characteristic end moraine. Five *Nebria*-species co-exist in an area immediately below this end moraine but only two *Nebria*-species were found in the newly exposed area above the end moraine. Comparative investigation of the distribution patterns and environmental factors in the various areas within the Hornkess glacier foreland allow us to conclude that habitat selection seems to be a major mechanism for the colonization and co-existence of carabid beetles of new alpine areas.

Index terms: *Nebria*, Carabidae, co-existence, colonization

[3576] STUDYING HOST AND MICROHABITAT USE BY ARTHROPODS IN TROPICAL RAIN FOREST CANOPIES: ISSUES & PERSPECTIVES

Y. Basset[1], V. Novotny[2] & S. E. Miller[3], [1]Smithsonian Tropical Research Institute, Apartado 2072, Balboa, Ancon, Panama E-mail: bassety@tivoli.si.edu; [2] Institute of Entomology, Czech Academy of Sciences, Branisovska 31, 370 05 Ceske Budejovice, Czech Republic Email: novotny@entu.cas.cz; [3] Dept of Entomology, National Museum of Natural History, Smithsonian Institution, Washington DC 20560-0105, USA Email: miller.scott@nmnh.si.edu

Interest for canopy arthropods in tropical rain forests is a lively component of a wider scientific agenda intended to explore and understand one of the most significant, exciting and endangered habitats on Earth. In less than 20 years, this topic has emerged as a vigorous field of entomological investigations, as the ever-increasing number of publications focusing on this habitat attests. Tropical forest canopies represent fascinating environments for entomologists because (1) the species-richness of their arthropod communities is exceptional and, arguably, tropical rain forest canopies may support much of the Earth's biodiversity; (2) their entomological faunas are still largely unknown and have been the subject of much controversy among entomologists and ecologists; (3) they represent a suitable arena where biologists can study multiple species interactions within communities and test the latest hypotheses in evolution and co-evolution; and (4) rapid logging of tropical forests makes their canopy inhabitants particularly vulnerable to extinction; therefore, dissemination of scientific information to foster scientific interest on those arthropod communities is crucial before they vanish. Many of the earlier studies of canopy arthropods focused on the taxonomic distribution and species diversity of the material collected, and have relied upon indirect sampling methods, such as light trapping or canopy fogging. Often, observers were limited to ground level, with few opportunities to study canopy organisms directly. Recent methodological developments (such as construction cranes, canopy towers, canopy rafts, aerial sledges, aerial walkways or single rope techniques) have broadened our ability to access the canopy and allow the observation and collection of canopy arthropods *in situ*. Collecting methods are accordingly much more diverse and reflect the increasing complexity of the questions that are pursued by canopy entomologists. The study of canopy arthropods has matured considerably in recent years and investigations now target specific questions, instead of comprising rather descriptive accounts. Many of the research groups are now in a position to explain how arthropods are distributed within and among tree-crowns, and how they use their food resources. A better understanding of how arthropods are distributed and use their resource in tropical canopies is crucial to refine global estimates of species richness and to facilitate management and conservation of these species-rich communities. Index terms: Food resources, Host specificity, Spatial distribution

[3577] WHAT CAN WE SAY ABOUT THE PROPORTION OF SPECIALIST AND GENERALIST SPECIES OF COLEOPTERA IN TREES OF SE-ASIAN LOWLAND RAIN FORESTS?

A. Floren, Univ. of Wuerzburg. Department of Animal Ecology and Tropical Biology. Biozentrum Am Hubland, 97074 Wuerzburg, Germany. E-mail floren@biozentrum.uni-wuerzburg.de

The tree crowns of tropical lowland rain forests are inhabited by the most species rich terrestrial arthropod communities known on earth. Although the investigation of this habitat has been intensified during the last years both the extent as well as the pattern of this diversity is still being controversially discussed. A questions of general interest is, how many species are adapted to an individual tree species. We investigated this for arboreal phytophagous Coleoptera communities of the tree species (*Aporusa lagenocarpa*, Euphorbiaceae) of the lower canopy of a lowland rain forest in Borneo, for which we would rather expect to find tree species adaptations. If one wants to investigate this for the complete community of Coleoptera, one is dependent on tree fogging which alone can document the high species diversity. Tree specific arthropod communities were collected by excluding arthropods from the higher canopy with a large cotton roof, which is stretched out over the top of the crown of the fogged tree. Although we carried out 36 foggings on 19 *A. lagenocarpa* trees, each sample consisted of an almost complete set of new species, most of which were singletons, while no species was found with more than 100 individuals. This distribution makes it impossible to discover a tree specific community and to distinguish specialists from generalists. One gets a different impression, however, in disturbed secondary forests (forests which had been left for regeneration after agricultural use). Considerably fewer species were found here, few species reached high numerical dominance and were found on most trees. Communities as a whole became more predictable. Such changes in the distribution of species and in the structure of whole communities, which are caused by human disturbance, can lead to a wrong assessment of such basic questions like the degree of species adaptation to a host plant, which can give important information about the mechanisms structuring communities.

Index terms: anthropogenic disturbance, community structure.

[3578] HOST PHYLOGENETIC TRAITS AS DETERMINANTS OF TEMPORAL VARIATION IN CANOPY ARTHROPOD ASSEMBLAGES

N.D. Springate[1] & R.K. Didham[2], [1]Dept of Entomology, The Natural History Museum, Cromwell Road, London SW7 5BD, UK; [2]Dept of Zoology, Univ. of Canterbury, Private Bag 4800, Christchurch, New Zealand, E-mail r.didham@zool.canterbury.ac.nz

Temporal variation in the abundance and diversity of canopy arthropods can be quite marked, even in supposedly 'aseasonal' tropical forests. Various combinations of abiotic (e.g., temperature, rainfall, relative humidity and light intensity) and biotic (e.g., bud-burst and leaf flush phenology) factors have been put forward to explain these trends, but no framework exists within which to interpret patterns. Temporal variation in community dynamics is still largely thought of as a climatic phenomenon. However, host plant traits may have as important a bearing on temporal dynamics as they are recognized to have on spatial dynamics of insects. Although poorly investigated, phylogenetic traits of host trees may be some of the most important proximate determinants of temporal variation in canopy arthropod community structure. We ask the question, 'Does the phylogenetic and/or successional status of host trees mediate the expression of temporal trends in arthropod community structure?' Tree phylogeny and successional status are expressed in traits such as tree phenology, growth rate and senescence pattern. It is well recognized that tree phenology may mediate short-term seasonality of canopy arthropods in the tropics (e.g., diel activity), while tree growth and senescence patterns may have a direct effect on long-term arthropod seasonality (e.g., annual activity). We extensively review the published literature on temporal variation in arthropod community structure in an attempt to place these trends firmly in a phylogenetic context. The implications of these findings could be very interesting given that anthropogenic disturbance causes significant changes in plant species composition, tree phenology, growth rates and senescence patterns. Changes in host tree dynamics may not only lead to pronounced changes in the spatial structuring of arthropod communities, but also to previously unsuspected changes in short-term and long-term temporal variation in community structure

Index terms: temporal dynamics, phenology, seasonality, tropical forest canopy, fragmentation

[3579] HOW WELL DOES FOGGING SAMPLE A HIGH CANOPY EPIPHYTE?

M.D.F. Ellwood[1] & W.A. Foster[1], [1]Dept. of Zoology, Univ. of Cambridge, Downing Street, Cambridge, CB2 3EJ, United Kingdom, E-mail: mdfe2@cam.ac.uk

It is widely postulated that rainforest canopies accommodate unusually high numbers of arthropod species. however, the canopy of most rainforests is incredibly difficult to access. not surprisingly, this makes ground-based collection techniques seem more attractive. since erwin's landmark fog in 1981, many workers have opted to collect data by fogging canopies with insecticide. as a result, estimates of arthropod diversity in tropical rainforests, and even global biodiversity, have largely been based on data derived from fogged samples. understanding the limitations of fogging is therefore important and widely relevant. new ascension techniques have allowed us to work within tree-crowns of the emergent dipterocarp species, *Parashorea tomentella*. one of the most common epiphytic plants in emergent trees is the bird's nest fern, *Asplenium nidus*. this epiphytic fern, which commonly reaches dimensions of 2m x 3m, and weights of approximately 200 kg, may support a greater diversity of arthropods than the tree-crown of its host. however, fogging only sampled a fraction of the animals associated with this fern; essentially those on its extremities. moreover, as the stunned arthropods fell to earth, those from the fern became inextricably mixed with the tree-crown fauna. a new fogging protocol has enabled us to make a precise distinction between fern samples and tree-crown samples. thus, we can assess how well fogging samples the arthropod inhabitants of this epiphytic fern, and to what extent true canopy diversity could potentially have been underestimated in this study.

Index terms: *Asplenium nidus*, *Parashorea tomentella*, arthropods, diversity, tropical rainforest

[3580] ESTIMATING THE ARBOREAL COMPONENT OF THE ANT COMMUNITY (HYMENOPTERA: FORMICIDAE) IN A COSTA RICAN RAINFOREST

J. T. Longino[1], [1]Lab I, The Evergreen State College, Olympia, WA, 98505, USA, E-mail longinoj@evergreen.edu.

Partitioning arthropod diversity into canopy and ground components is important for estimates of global species richness, and for understanding niche partitioning in tropical arthropod communities. I attempt to estimate the proportions of the ant community found on the ground, in the canopy, and in both compartments, for a lowland tropical rainforest at La Selva Biological Station, Costa Rica. The data are from Project ALAS (Arthropods of La Selva). Ground ants were sampled with 3 methods (bait, Berlese, Winkler); canopy ants with 2 (fogging, Malaise); additional non-quantitative hand sampling supplemented the inventory. Partitioning arthropod diversity is inherently difficult. Species accumulation curves do not plateau, and estimates of species richness do not stabilize with increasing sample size. Also different methods are used to sample arthropods on the ground and in the canopy, so comparing rates of species accumulation in the two compartments conflates actual community differences and differences due to sampling efficiency. I used two different approaches to estimate ground vs. canopy richness. The first approach used abundance distributions. Abundance distributions appeared bimodal and composed of two distributions: a lognormal that was increasingly revealed as sampling intensity increased, and a logseries with a permanent peak in the lowest abundance class. I presumed that the former was caused by the community that was "visible" to the sampling methods; the latter by "edge" species or tourists. I selected the modal abundance class for the lognormal by visual inspection. I estimated species richness of the "visible" community as the number of species in the modal class plus two times the number of species above the modal class. For species common to both compartments, I calculated the fraction of species that were in or above the modal abundance class in both compartments, and assumed the fraction was the same for species in the lower abundance classes. Following this method, I estimated 107.25 (52%) species restricted to the ground; 89.25 (43%) species restricted to the canopy; and 9.75 (5%) species common to both. This method estimated a total of 206.25 species, less than half the known fauna. A large number of rare species was ignored. An alternative method relied on knowledge of the biology of individual species, and used the entire set of all known ants from the site. First, known "edge" species were separated: specialized plant-ants (8 species), army ants (11 species), and synanthropic species (12 species). The remaining 399 known species were divided into canopy, ground, and shared, based on biology or collecting sites. This yielded 154 (39%) canopy, 207 (52%) ground, and 38 (10%) shared species. The two methods produced similar proportions. These results are compared with Brühl's study of canopy ants in Borneo.

[3581] SPECIES RICHNESS AND COMPOSITION OF WEEVILS (CURCULIONIDAE) IN THE CANOPY OF A LOWLAND TROPICAL RAIN FOREST IN PAPUA NEW GUINEA

O. Missa[1,2], [1]Royal Belgian Inst. of Natural Sciences, Dept. of Entomology, 29 Vautier street, B-1000 Brussels, BELGIUM; [2]Free Univ. of Brussels, Lab. of Animal and Cell Biology, 50 Ave. F.D. Roosevelt, B-1050 Brussels, BELGIUM.

Weevils are the most speciose family of herbivorous insects, with about 48,000 species described world-wide, and belong to many different feeding guilds: xylophages, leaf-chewers, flower-, stem-, and leaf-miners, seed eaters, ... This group should thus be very useful to study the organisation of herbivore communities in the canopy of tropical forests, which remains poorly studied due to its difficulty of access. Basic questions are still insufficiently addressed. What is the average level of host-plant specificity for herbivorous insects? To what extent are their communities organised and predictable ? What is the most prevalent influence on their dynamics: bottom-up (resources) or top-down (predators). I will present data on the organisation of the weevil fauna collected by insecticidal fogging from the canopy of a tropical rain forest in Papua New Guinea. Thirty seven trees were sampled: 10 from *Dracontomelum dao*, 11 from *Pometia pinnata* and 16 from 15 other tree species. A total of 3,418 weevils from 353 species of 23 subfamilies were collected. Almost half the species (48.7%) were singletons and only 20 weevil species (6%) were collected in more than seven trees. Tree and vines (but not epiphytes) identity had a significant influence on the weevil species composition. However, few weevil species -sufficiently frequent to be analysed- seemed to be narrowly host-specific. These data do not support the hypothesis that the canopy is a favourable environment for host-specific weevils. As for community structure, *D. dao* trees were significantly more speciose than the other trees sampled. Weevil species richness was significantly and positively correlated with both the number of vine species and ant biomass in a tree (among all trees sampled), but was significantly correlated with the number of epiphytes species only among *D. dao* trees. Differences in terms of weevil subfamily composition were apparent between *D. dao* and *P. pinnata* trees but failed to explain the differential influence of epiphytes on weevil species richness. Distribution among the trees sampled tended to be correlated between the major weevil subfamilies, but the pattern differed extensively between *D.dao* and *P. pinnata* trees, and was much weaker among the various array of trees. Overall, this suggests that weevils, even if they did not seem highly host-specific, still responded to broad characteristics of the tree species. The weaker pattern of correlation among the various array of trees suggests further that the different feeding guilds of weevils (e.g. xylophages, flower feeder) tend to prefer different sets of tree species.

Index terms: Weevils, Curculionidae, community structure, host-plant, specificity

[3582] SPECIES COMPOSITION AND HOST SPECIFICITY OF PHYTOPHAGOUS BEETLES IN THE CANOPY OF A TROPICAL DRY FOREST IN PANAMA

F. Ødegaard, Norwegian Institute for Nature Research, Tungasletta 2, N-7485 Trondheim, Norway

Species composition and host specificity of adult phytophagous beetles (buprestidae, chrysomeloidea and curculionoidea) in the canopy of a tropical dry forest in panama were studied. beetle species associated with 24 tree species and 26 liana species were collected regularly throughout a year cycle. a canopy crane system was utilised to access the canopy. host observations were revealed by feeding observations and probability based methods. a total of 35,479 individuals belonging to 1,167 species of phytophagous beetles were collected. a species list of the beetles is given, 1022 species were identified to genus and 380 species were identified to species level. probably 35-40% of the species belongs to described species. chrysomelidae and curculionidae were the dominant beetle families both with regard to species and individuals. the forest, which consists of 300-500 species of trees and lianas, is estimated to contain 1,600-2,000 species of phytophagous beetles. a total of 2,561 host associations for 697 species of beetles were determined for the 50 plant species. on average 51.2 ± 32.0 (sd) beetle species were found to be associated with each plant species. the effective number of species associated with each plant species, which takes into consideration the fauna which is shared between plant species, was 13.9 ± 10.0 (sd). host specificity for phytophagous beetles in the canopies of a tropical dry forest in panama is estimated to range from 7-10% if the forest consists of between 300 and 550 species of trees and lianas. estimation of the magnitude of species richness and host specificity was performed through applying a beta binomial abundance model.

[3583] SEASONALITY OF CANOPY ARTHROPODS IN BUDONGO FOREST, UGANDA

T. Wagner, Zoologisches Forschungsinstitut und Museum Alexander Koenig, Adenauerallee 160, D-53113 Bonn, Germany.

In Budongo Forest, a seasonal rain forest in Western Uganda, the canopy arthropod fauna on trees of *Cynometra alexandri* (Caesalpiniaceae) and *Rinorea beniensis* (Violaceae) was collected using insecticidal fogging technique. Field study was carried out in plots of different local forest types during the wet season in June/July 1995, and during the dry season in January 1997. A total number of 80 trees were fogged. Seasonal change in arthropod composition was highest in the secondary forest and lowest in the swamp forest. Especially Collembola, Psocoptera and Cicadina reached higher abundances during the dry season, while numbers of Ensifera, Heteroptera and Coleoptera was higher during the wet season. Overlap of the beetle fauna between both seasons show also strong differences in the secondary forest, and was most similar in the swamp forest. Abundance of mycetophagous beetles like Latridiidae and Alleculinae strongly decrease from wet to dry season, but faunal overlap was comparatively low because of low species richness in these groups. Change in faunal composition was much higher in Chrysomelidae and Curculionidae. Especially the Alticinae were much more abundant and species rich during the dry season. Data show a high influence of abiotic factors, forest structure, and seasonality on the canopy beetle fauna, while tree species has no significant influence even on the fauna of phytophagous beetles, and number of specialised species is very low.

Index items: Rain forest, Coleoptera, Africa.

[3584] INSECTS ON CROWNS OF *TABEBUIA OCHRACEA* AND *TABEBUIA AUREA* IN NEOTROPICAL SAVANNAS: HOST SPECIFICITY AND HABITAT EFFECTS ON INSECT SPECIES RICHNESS AND ABUNDANCE

S. P. Ribeiro[1,2] & V. K. Brown[1],[1] CABI Bioscience: Environment, Buckhurst Road, Silwood Park, Ascot, Berks. SL5 7TA, UK; [2] Dept Ciências Biológicas, Univ. Fed. Ouro Preto, Morro do Cruzeiro, Ouro Preto, MG, CEP 35400-000, Brazil.

Neotropical savannas are poorly researched into patterns of insect distribution on tree crowns. This work compares species composition and distribution of herbivore feeding guilds and ant assemblage on *Tabebuia ochracea* (Bignoniaceae) and *T. aurea*. These species co-occur in the 'cerrado', the savanna of Brazil. *Tabebuia aurea* also occurs in floodplains of the wetland 'Pantanal matogrossense', Brazil, as large monodominant stands. This pattern contrasts with its sparse occurrence in the cerrado, where *T. ochracea* is more abundant. Species richness and ß diversity (Jaccard's similarity index) between pairs of populations, (*T. ochracea, T. aurea*/cerrado, and *T. aurea*/Pantanal), were used to compare insect communities. During the wet seasons of 1996 and 1997 insects were sampled from 15 marked trees per population. They were collected manually from 120 to 200 leaves, randomly chosen among the main branches, encompassing the whole crown. Half of the crown of each tree was fogged with pyrethroid, and in 1996 one branch per tree was beat. Insects were identified to family or subfamily level, separated into morphospecies, and identified when possible. Galls were collected and each different leaf tumour was counted as a morphospecies. A preliminary data survey (1996) showed a total of 112 insect morphospecies for the three plant populations (58 herbivores, 10 scavengers, and 44 ants). Herbivorous insect species were more diverse on *T. ochracea* than *T. aurea*, and also more diverse in the cerrado than in the Pantanal. No ant species in the Pantanal was found in the cerrado, but both assemblages were equally rich. Great ß diversity was found for both *T. ochracea* vs. *T. aurea*/cerrado, and *T. aurea*/cerrado vs. Pantanal. Only 9.7 % (Cj = 0.10) of insect species were common to both tree species in the cerrado, and 13.8 % (Cj = 0.16) were common to the two habitats, showing that insect communities can be as different between two sympatric tree species as between two distant and contrasting habitats, for the same tree species. The most diverse herbivore guilds were chewing insects on *T. aurea* and sap-sucking insects on *T. ochracea*. *Oedionychus* (Alticinae, Chrysomelidae) was the commonest genus, with 5 different species. Plant characters related to insect deterrence and predictability of habitat conditions are likely to be the main force driving the patterns above described .

Index terms: Brazilian ecosystems, canopy, cerrado, herbivory, Pantanal

[3585] SEASONAL AND DISTURBANCE-INDUCED VARIATION IN CANOPY INVERTEBRATE COMMUNITIES IN NEOTROPICAL RAIN FORESTS

T. D. Schowalter[1] & L. M. Ganio[2], [1]Dept. of Entomology, Oregon State Univ., Corvallis, OR 97331-2907, USA, E-mail schowalt@bcc.orst.edu; [2]Dept. of Forest Science, Oregon State Univ., Corvallis, OR 97331-2907, USA.

Canopy invertebrates can greatly affect canopy structure, hence canopy-atmosphere interaction, including photosynthesis, evapotranspiration, and interception of light, precipitation and atmospheric nutrients. However, few studies have addressed canopy invertebrate communities or their responses to environmental variation. Canopy invertebrate communities were sampled on representative early and late successional tree species during wet and dry seasons, in plots representing light and severe hurricane disturbance, at the Luquillo Experimental Forest Long Term Ecological Research (LTER) Site in Puerto Rico, and during wet and dry seasons at the Ft. Sherman Canopy Crane in Panama. Canopy communities were more diverse (higher species richness and evenness) in Panama than in Puerto Rico, on congeneric tree species, but functional organization was similar between the two sites. Invertebrate abundances and functional group organization differed significantly among tree species, but not between early and late successional tree species. Hurricane disturbance in Puerto Rico affected invertebrate community structure for at least 6 years. In particular, folivores and detritivores were more abundant in lightly disturbed canopies, whereas sap-suckers and molluscs were more abundant in severely disturbed canopies. In addition, seasonal changes in species abundances, community structure, and herbivory were apparent. Data on canopy invertebrate community responses to environmental variation are necessary for designing studies to predict effects of environmental changes on biodiversity, or consequent effects on ecosystem processes.
Index terms: insect, mollusc, community, succession, hurricane

[3586] AFRICAM CAVES, TROGLOPHILES, CLIMATE AND ENVIRONMENT

E. Marais

ABSTRACT NOT RECEIVED

[3587] CLIMATIC RELICT VERSUS ADAPTIVE SHIFT: NO MATTER, THE DIE IS CAST AFTER CAVE COLONIZATION

L. Desutter-Grandcolas, ESA8043 CNRS, Lab. Entomologie, Muséum National d'Histoire Naturelle, 45 rue Buffon, F - 75005 Paris, FRANCE. E-mail: desutter@mnhn.fr

Two main hypotheses are classically put forward to explain cave life evolution: the climatic relict hypothesis (crh) and the local habitat shift hypothesis (lhsh), as renamed by peck & finston (1993). they are based on the combination of 3 criteria : speciation mode and present-day distribution (allo- vs. parapatric) of epigean and hypogean sister taxa, and past environmental conditions (favorable vs. unfavorable). in a phylogenetic perspective, the combination of these criteria allow the definition of 8 equally probable hypotheses, but their use in historical studies present severe difficulties (desutter-grandcolas & grandcolas 1996). The formulation and/or justification of crh and lhsh, 2 among the 8 possible hypotheses, should then be revisited. it is argued that a new theoretical frame should be defined, which would recognize cave colonization as the only key step in cave life evolution. in this context, preadaptation and shifts in resource use would be central proposals to explain cave life occurrence, the availability and adequacy of subterranean resources for the taxa being the ultimate factors. speciation modes and distributional patterns bear no significance in this process, as they are by-products of some post-colonization evolution of epigean and hypogean taxa, and that reference to any phenotypic modification is unnecessary and inopportune. in addition, no difference between temperate and tropical areas can a priori be hypothesized. in this frame, taxa should be classified according to the resources they usually need (desutter-grandcolas 1997), and connections between phenotypic modifications and environmental conditions should be closely analyzed to explain the similarities and differences observed in the varied troglobitic organisms. all these theoretical proposals could be tested in a phylogenetic perspective and by the comparison of as many case studies as possible (desutter-grandcolas 1997). many authors have criticized classical theories for cave life evolution and insisted on their inefficiency to explain available data. it is time now to take the plunge and to study cave organisms in a renewed perspective.
References: Desutter-Grandcolas, L. 1997. J. Zool. Syst. Evol. Research 33: 23-31. Desutter-Grandcolas, L. & Grandcolas, P. 1996. Mém. Biospéol. 23: 57-63. Peck, S.B. & Finston, T.L. 1993. Mém. Biospéol. 20: 19-37.
Index terms: Evolution, Adaptation, Troglobitic environment, Phylogeny

[3588] SYSTEMATICS OF CAVE ANIMALS AND THE USE OF TROGLOMORPHISMS IN PHYLOGENETIC RECONSTRUCTION

P. Gnaspini[1] & A. C. Marques[2], [1]Depto Zoologia, I. Biociências Univ. S. Paulo, Cx.P. 11461, 05422-970 São Paulo - SP, Brazil. E-mail: gnaspini@ib.usp.br; [2]Depto Biologia, FFCL Ribeirão Preto, Univ. S. Paulo, Av. Bandeirantes 3900, 14040-901 Ribeirão Preto - SP, Brazil. E-mail: marques@ffclrp.usp.br.

Animals inhabiting the subterranean environment are subjected to peculiar abiotic and biotic characteristics, such as constant temperature, high relative humidity, lack of light, low food availability, among others. Because of that, animals restricted to the cave environment (the troglobites), may show typical characteristics (morphological, physiological, etc.), the so-called troglomorphisms, such as reduction or absence of eyes, pigmentation and/or wings, longer antennae and legs, lower metabolism, among others. Troglomorphisms may arise due to either natural selection or accumulation of neutral mutations. Anyway, they evolve due to the peculiar ecological features of the cave environment, being potentially sensible to parallel evolution. We propose herein a procedure to deal with characters which are sensible to parallel evolution (in our case, troglomorphisms) in substitution to the two procedures used so far, which are to completely consider and to completely disregard these characters. These procedures lead to two opposite errors: respectively, (1) to consider them as true synapomorphies when they are not, and (2) to disregard them as true synapomorphies when they are. We suggest herein to recode the characters by splitting each troglomorphic character into as many as the number of taxa which show the given troglomoprhic state, and for each split character, each taxon will have the derived state, while the others will be coded as missing data. After testing our procedure with real examples, we believe that the procedure filters the possible biases, resulting in trees where the troglomorphisms do have phylogenetic signals. Our procedure would deal with other characters sensible to parallel evolution, such as ecological and behavioral traits, as well.
Index terms: cladistics, methods, parallel evolution, troglobites

[3589] SUBTERRANEAN SPECIATION – WHAT CAN WE LEARN FROM HAWAIIAN, AUSTRALIAN AND CANARY ISLAND CAVE PLANTHOPPERS (HEMIPTERA: FULGOROMORPHA)?

H. Hoch, Museum für Naturkunde, Humboldt-Univ., Invalidenstr. 43, D-10115 Berlin, Germany, E-mail hannelore.hoch@rz.hu-berlin.de.

Adaptation to subterranean environments has traditionally been viewed as an evolutionary dead-end. This is due to the fact that cave adaptation was believed to have occured in troglophilic populations only subsequent to the extinction of closely related surface populations by adverse ecological conditions on the surface such as glaciation. Much of the research supporting this view stemmed from taxa occuring in temperate regions (relict hypothesis). The discovery of highly specialized, obligately cavernicolous arthropod taxa on young oceanic tropical islands, however, challenged this view, and alternatively explained the evolution of troglobitic taxa by parapatric speciation due to the colonization of novel habitats (adaptive shift hypothesis). Own research on the systematics and behavioral ecology of troglobitic planthoppers (Cixiidae) from Hawaii, the Canary Islands and Australia not only support the adaptive shift hypothesis but revealed that a) in each region, cave invasion occured in several independent evolutionary lineages, and b) within the same evolutionary lineage, there is a high degree of differentiation between populations. This concerns morphological and behavioral traits suggesting the existence of reproductive isolation between at least some of the populations. From our findings we concluded that a) in the past, speciation occured in taxa which were already highly adapted to the subterranean biome, b) subterranean speciation is ongoing, especially in regions where active volcanism keeps creating new habitat, and c) the observed diversity is likely to be independent of adaptive processes. As closely related populations colonize similar habitats, diversification may instead rely on other factors, such as e.g., local geomorphology resulting in the isolation of populations, and genetic drift. Apart from the fact that cavernicolous planthoppers constitute an excellent model for the study of speciation, they play an important role within the cave ecosystem. As phytophagous insects feeding on roots of native trees, they are primary consumers and thus a central element of the food web within the subterranean biome. As species composition especially of the lava tubes of Hawaii and the Canary Islands is comparatively well known and – compared to surface ecosystems – much less complex, future research will focus on the comparative analysis of food webs within the caves of these regions with the aim to develop a semantic and ultimately a quantitative model to better understand ecosystem functioning and to predict possible impacts of species extinctions as well as invasions by non-native species.
Index terms: Cixiidae, cavernicolous species, lava tubes, evolution, conservation

[3590] SPECIATION PROCESSES IN TWO SYMPATRIC CAVE-DWELLING TRECHUS FROM PICO ISLAND, AZORES

I. A. Rosario, R. Wayne, P. A. V. Borges do Heroismo

ABSTRACT NOT RECEIVED

[3591] PROTECTING DARKNESS: CONSERVATION BIOLOGY OF CAVE-DWELLING ARTHROPODS

F. G. Howarth, Hawaii Biological Survey, Bishop Museum, 1525 Bernice St., Honolulu, HI 96817, USA. E-mail <fhowarth@mail.bishopmuseum.org>.

The fantastic adaptations displayed by obligate cave animals have long intrigued biologists. Their often narrow environmental tolerances, coupled with their island-like habitats, have reinforced the view that these animals are fragile and lead an endangered existence. However, development of conservation programs is hampered by severe lack of data. Discoveries in the past few decades of cave ecosystems in a wide variety of cavernous rocks in diverse regions have revolutionized our understanding of cave life. We now believe that cave colonization and adaptation are general phenomena and will occur wherever there are suitable underground voids available for evolutionary time. Unfortunately, most cave species remain undiscovered, and many cave systems are being destroyed before their faunas become known. Biological surveys are urgently needed. Also, recent systematic studies reveal that cave arthropod faunas are far more diverse than previously thought, indicating that priority should be focussed on recognizing and protecting each distinct population rather than a single population of each conventional species. The major anthropogenic threats to cave faunas include 1) mining the surrounding rock, 2) changes in land use over subterranean habitats such as deforestation and urbanization, 3) alteration of ground water flow patterns, 4) waste disposal and pollution, 5) invasion by non-native species, 6) disruption of food inputs, and 7) direct human disturbance during visitation. Conservation efforts must consider how the impending threats affect the system rather than take an anthropocentric view. Generally, species extinctions result from novel perturbations; e.g., new stresses with which a species has had little experience during its evolution. Ecological studies are needed that improve our understanding of the functioning ecosystem as well as understanding natural successional processes. However, experimental ecological studies in caves are problematic because in few other habitats are humans so dramatically intruders as in caves. Not only do researchers affect the environment of the passages they study, but also they cannot sample the medium-sized voids where the major activity usually occurs. Caves are a fragile window through which we can see and study the fauna living within cavernous rock. Protected areas must include a sustainable portion of the ecosystem as well as suitable source areas for food and water resources. This usually represents an area larger than the footprint of the known cave.
Index terms: Biological survey, subterranean ecosystems, environmental threats, endangered species

[3592] IMPORTANCE OF SOME PLANTS OF THE MEDITERRANEAN FLORA IN THE BIOLOGY OF *FRANKLINIELLA OCCIDENTALIS* (THYSANOPTERA THRIPIDAE)

R. Addante, S. Di Gioia & T. Moleas, Dipartimento di Biologia e Chimica Agro-Forestale ed Ambientale. Università degli Studi di Bari (Italy). E-mail: rocco.addante@agr.uniba.it and moleas@agr.uniba.it.

Considering the primary role of *Frankliniella occidentalis* as pest of several crops in Southern Italy (grapevine, tomatoes, etc.), a study was carried out to verify some aspects of this thrips bio-ethology in Apulian agro-ecosystems. Samples of 200 flowers or inflorescences of different cultivated and self-sown plants were weekly collected from 02/01/98 to 01/31/99 in three important agricultural areas of Apulia. In the laboratory immature and adult stages of *F. occidentalis* and other Thysanoptera were separated and counted for each sample. Then the population density during the year and the thrips moving among the different blooming plants were described. 37 out of 50 collected plant species belonging to different families (*Diplotaxis* ssp., European Blackberry, Crimson Clover, Tomato, Grapevine, *Sonchus* sp., etc.) were infested by *F. occidentalis*. This thrips represented about the 22% of the adult Thysanoptera collected on the different host plants, while others were represented mainly by the genus *Melanthrips*, followed by *Thrips*, *Aeolothrips*, etc. Particular importance showed *Diplotaxis erucoides* as host plant of *F. occidentalis* either because widespread in all considered agro-ecosystems or because blooming plants of this species were collected all year round. The wild European Blackberry was the host plant with the highest infestation of *F. occidentalis* (with about one thrips per flower), followed, in decreasing order, by *Diplotaxis tenuifolia*, Tomato, Olive tree, *Phacelia tanacetifolia*, *Sonchus*, etc. Some of these and other wild plants are very important in the biology of *F. occidentalis* allowing it to feed and reproduce all year round and to reach high density levels before infesting valuable crops such as vine, Tomato, Pepper, ecc. The adult population density in the three considered areas ranged from 0.4 to 0.8 *F. occidentalis* per flower. Adults of *F. occidentalis* were found since January on some of the considered host plants, their number increased slowly month by month to reach a peak in August (with about two thrips per flower) and then gradually decreased up to December. Therefore, *F. occidentalis* was able to overwinter as adult in our climatic conditions. It is important to underline that *F. occidentalis* reached the highest density levels in summer, according to this insect thermophilia, while *Melanthrips* and other thrips were more abundant at the end of winter-biginning of spring. *F. occidentalis* sex ratio varied during the year with a prevalence of females in winter and annual mean ratio of 1:5.
Index terms: *Melanthrips*, *Diplotaxis*, host plants.

[3593] USE OF *STACHYTARPHETA GLABRA* (VERBENACEAE) BY HERBIVOROUS AND NECTARIVOROUS INSECTS IN A METALIFEROUS ALTITUDINAL REGION, MINAS GERAIS, BRAZIL

Y. Antonini & C. M. Jacobi, Laboratório De Ecologia E Comportamento De Insetos, Departamento De Biologia Geral, Icb,Ufmg, Cx Postal 486 Cep: 31140-390 Belo Horizonte, Mg, Brazil E-Mail: Antonini@Mono.Icb.Ufmg.Br

The diversity of plant species in metaliferous regions (locally known as "canga") is low on account of their poor soils and high metal contents. hence, populations of plants resistant to these anomalous edaphic conditions frequently constitute important food sources for several groups of animals. we evaluated the importance of *stachytarpheta glabra* cham. as a source of food for herbivorous and nectarivorous insects, in a canga platform at rola-moça state park (20º 03' 60" s, 44º 02' 00" w, 1200m a.s.l.), minas gerais. the individuals of *s. glabra* are shrubby, densely branched, seldom reaching 100cm in height. inflorescences are conspicuous, with several bright-blue tubular flowers opening at the same time, and producing abundant nectar. the flowering season lasts several months, starting in november. our study took place in december 1998 through april 1999. the density of plants is high in the area (3,05 ± 1,27 individuals/m^2). the vegetative parts were attacked by larvae of *automeris* sp (noctuidae) and scale insects (homoptera). no florivores were found, but the flowers are visited by several nectarivores that act as either pollinators or thieves, according to their behaviour. pollinators were long-tongued species such as *eulaema nigrita* lepeletier and *euglossa* sp (euglossini), sfingidae, *anteos menippe* huebner (pieridae), *papilio* sp (papilionidae). short-tongued bees perforated the base of the corolla to steal nectar: *bombus (fervidobombus) morio* (swederus), *xylocopa* spp. (apidae) and *oxaea flavescens* klug (andrenidae). visits were frequently interrupted by the attack of competing territorial hummingbirds. *s. glabra* represents an important source of food for the insect community in the rola-moça state park.

[3594] HOST PLANTS OF ARGENTINEAN GALERUCINAE (COLEOPTERA, CHRYSOMELIDAE)

N. C. Cabrera, Depto. Entomología. Facultad de Ciencias Naturales y Museo. Paseo del Bosque s/n. 1900 La Plata. E-mail ncabrera @museo.fcnym.unlp.edu.ar

The subfamily Galerucinae is one of the largest group of neotropical chrysomelids with 58 species belong to 20 genera described for Argentinean fauna. Species are almost exclusively herbivorous and are associated with a great number of plants, mainly dicotyledons (Jolivet & Petitpierre, 1976). Adults and larvae of some genera feed on leaves, flowers and fruits, in others (*Diabrotica, Acalymma, Paranapiacaba)* larvae feed on roots, most of which are important pests of crops. Though the importance of this subfamily that represent 14% of all Argentinean chrysomelids, the host plants of the majority of species are poorly know. Bosq (1943), Hayward (1941) and Rosillo (1944) were the first authors that listed host plants for eight species of Galerucinae and more recently (Cabrera, in press) listed new insect/host plants associations. The objetive of this contribution is to provide a synopsis of host plants of Galerucinae with diagnoses of insect species, habits and a detail of geographical distribution and host plants. As a result of this study, 113 host association are citated for 22 species. The majority of species were collected on Solanaceae, Cucurbitaceae, Graminae and Compositae. Whilst *Diabrotica* shows a widespread spectrum of host plants, only *D. speciosa* is associated with 70 host plants, most of the records for *Acalymma* are almost restricted to Cucurbitaceae, association that appears to be a co-evolutionary relationship between Diabroticini and these plants.

Index terms: Argentina, leaf beetles, crops, *Diabrotica*

[3595] THE INTRODUCED INSECT PROBLEM IN THE GALÁPAGOS ISLANDS

C.E. Causton[1] & L. Roque Albelo[1], [1] Invertebrate Program, Charles Darwin Research Station, A.P. 17-01-3891, Quito, Ecuador, causton@fcdarwin.org.ec

The growth of tourism and associated migrations to the galápagos islands over the last 20 years has brought about a dramatic rise in the number of alien species introductions. aliens species are a threat to the survival of 120 native terrestrial vertebrates, 560 native plants and an estimated 2,000 native terrestrial invertebrates. at least 300 species of invertebrates have been accidentally introduced by humans in imported plant material, stored products, and in packing and construction material. programs have been initiated to control six alien insect species thought to have the most significant impact on galápagos biodiversity. the eradication of the two fire ant species, *Wasmannia auropunctata* roger and *Solenopsis geminata* (fabricius), probably the most aggressive species that have been introduced, has commenced by means of poisoned baits on the smaller islands where the distribution of these species is still limited. both species are voracious feeders of native invertebrates and may have an impact on the nesting behaviour of land iguanas, tortoises and birds. the paper wasp species, *polistes versicolor* olivier and *brachygastra lecheguana* fabricius are also predators of native invertebrates. a resident oecophorid moth is being studied as a potential biocontrol agent of *P. versicolor*, while the attractiveness of different baits is being tested on both species. the biology of a biting black fly, *Simulium bipunctatum* malloch, thought to displace native, freshwater invertebrates and which is a potential vector of avian diseases is currently being investigated preliminary to researching possible control methods. the greatest threat to galápagos flora is *icerya purchasi* maskell. known to attack at least 45 native and endemic plant species in galápagos, its control using *Rodolia cardinalis* (mulsant) is currently being investigated. new species arrive on a daily basis and recent introductions include a *bemisia* spp. and tephritids. to reduce the rate of new introductions, a quarantine and inspection system for the islands (sicgal) is being implemented. the system will control the introduction of food products and animals from mainland ecuador and between islands. with complementary projects to decrease the dependence on imported products by increasing local agricultural production, an ecological monitoring system to detect new incursions, and an intensive educational campaign aimed at the islanders, the charles darwin research station and the galapagos national park service hope to halt the influx of new species and conserve the biodiversity of galápagos.

Index terms: *Wasmannia auropunctata, Solenopsis geminata, Polistes versicolor, Brachygastra lecheguana, Simulium bipunctatum, Icerya purchasi.*

[3596] COMMUNITIES OF POD-INHABITING INSECTS IN MADAGASCAR: PATTERNS OF SPECIES RICHNESS, SPATIAL RESOURCE FRAGMENTATION, AND TROPICAL-TEMPERATE COMPARISONS

R. Dolch & T. Tscharntke, Agroecology, Univ. of Göttingen, Waldweg 26, 37073 Göttingen, Germany, E-mail rdolch@gwdg.de.

Pod-inhabiting insect communities of wild legumes (Fabaceae) have been investigated in Western Madagascar. Insects of 20 species of Fabaceae were obtained by sampling at least 160 pods of each species. Legume characteristics differed, such as life-cycle, abundance, size, and architecture. Patterns of species richness found support the idea of spatial resource fragmentation as crucial force in structuring tropical insect communities. Species richness (measured as number of species per pod) of both herbivores and parasitoids significantly decreased with increasing hostplant rarity and species richness (measured as number of species per plant) decreased with decreasing plant height. However, structure of tropical communities on legumes appears to be different from temperate communities. We found the number of herbivore species per plant to be higher in tropical Madagascar compared to temperate Germany, whereas this was not the case for parasitoids. The high specifity of malagasy herbivores may mean smaller niches, which would lead to more species per plant. But in this species-rich array of potential hosts, single host species might be too rare to be found by parasitoids, again supporting the idea of spatial resource fragmentation. Implications for biogeography and macroecology are discussed.

Index terms: Fabaceae, biodiversity, macroecology, latitudinal patterns.

[3597] INVESTIGATIONS OF THE BUTTERFLY FAUNA (LEPIDOPTERA, RHOPALOCERA, ZYGAENOIDAE) AROUND A DISUSED BROWN COAL MINE NEAR GRÄFENHAINICHEN (GERMANY, SACHSEN-ANHALT)

K. Epperlein & C. Weinhold, Inst. of plant breeding and plant protection, Martin-Luther-Univ. Halle-Witten-berg, E.-Abderhalden-Str. 27, Germany

The landscape around Gräfenhainichen is characterised by brown coal open-cast mining. In consequence of the mining of the coal new typical landscapes with different stages of succession and recultivation were created. The investigations into the butterfly fauna were carried out in 1999. 14 trial plots (50mx100m) near Golpa Nord and 11 plots near Gröbern were laid out. The trial plots were subdivided in bottom of the mine, slopes and slagheaps. The butterflies and Zyganidae were recorded at 5 dates from May until September. Within the investigation period 36 species of butterflies and 2 Zyganidea species were registered. 10 of the observed species are recorded in the Red Data List of Sachsen-Anhalt. Five of them count as endangered species in Germany. The species *Mellicta athalia, Plebejus argus, Lysandra bellargus, Issoria lathonia and Melitea cinxia* were especially remarkable. One slagheap near Golpa turned out as an interesting habitat. According to the ecological demands 12 ubiquists and 11 species of the mesophile open country were registered. Furthermore 9 species of the mesophile undergrowth rich habitats, 4 species of the xerothermophile open country, 1 species of the xerothermophile undergrowth and 1 species of the mesophile forest habitat were observed. It can be summarised that it needs only a relatively short period of time after the exhaustion of brown coal that plants and butterflies re-established in this area. In comparison to the surrounding area „Dübener Heide" where about 70 species can be found the investigation area is habitat for over 50% of the potential species. In further investigations an increasing number is expected.

[3598] HOST-PLANT SELECTION BY INSECTS – A THEORY BASED ON "APPROPRIATE/INAPPROPRIATE LANDINGS" BY PEST INSECTS OF CRUCIFEROUS PLANTS

S. Finch & R.H. Collier, Department of Entomological Sciences, Horticulture Research International, Wellesbourne, Warwick CV35 9EF, United Kingdom

Seven hypotheses, including the "Resource Concentration Hypothesis" and the "Enemies Hypothesis", have been put forward to explain why fewer specialist insects are found on host plants growing in diverse backgrounds than on similar plants growing in bare soil. All seven hypotheses are discussed and discounted, primarily because no one has used any of them to produce a general theory of host-plant selection, they still remain as hypotheses. However, we have developed a general theory based on detailed observations of insect behaviour. Our theory is based on the fact that during host-plant finding the searching insects land indiscriminately on green objects such as the leaves of host plants (appropriate landings) and non-host plants (inappropriate landings), but avoid landing on brown surfaces, such as soil. The complete system of host-plant selection involves a three-link chain of events in which the first link is governed by cues from volatile plant chemicals, the central link by visual stimuli, and the final link by cues from non-volatile plant chemicals. The previously "missing" central link, which is based on what we have described as "appropriate/inappropriate landings", is governed by visual stimuli. Our theory explains why attempts to show that olfaction is the crucial component in the central link of host-plant selection proved intractable. The "appropriate/inappropriate landings" theory is discussed to indicate the type of work needed in future studies to improve our understanding of how intercropping, undersowing and companion planting can be used to optimum effect in crop protection. The new theory is used also to suggest how insect biotypes could develop and to describe why pest insects do not decimate wild host-plants growing in "natural" situations.
Index terms: Brassica pests, intercropping, undersowing, Resource Concentration Hypothesis

[3599] AREAS OF HIGH ENDEMICITY IN THE IBERIAN PENINSULA (SOUTH-WEST EUROPE): ESTIMATION OF POPULATIONS OF *OTIORHYNCHUS* IN THE PYRENEES (SPAIN)

P. Gurrea[1] & J. Martín[1], [1]Dept. de Biología, Fac. Ciencias, Univ. Autónoma de Madrid, Cantoblanco, 28049 Madrid, Spain, E-mail pilar.gurrea@uam.es.

Endemic fauna represents a measure of the richness/diversity of geographical areas, for which reason it is one of the criteria employed in conservation and territorial management programmes. The values obtained for these populations are indicators of the state of conservation of the habitat. The Iberian Peninsula occupies a privileged position in the south-west of Europe as is reflected by the numerous references regarding its faunistic and floral composition. Of this endemic fauna, the curculionids of the genus *Otiorhynchus* stand out. One of the most significant characteristics of this group of Curculionoidea (Entiminae) is the highly restricted area of distribution of many of its representatives, in such a way that there is also an increased number of endemic species. The objective of this study is to investigate the distribution of these species in the Iberian Peninsula and to establish the state of the populations in areas of high endemicity. It has been shown that to date the Iberian Peninsula is home to 67 endemic species of this genus, although this may be higher still since according to the bibliography consulted, knowledge of this group is quite fragmentary. The majority of these species are restricted to the mountainous systems, in particular the Picos de Europa, Pyrenees, the Sistema Central and the Sierra Nevada. Furthermore, the analysis of the data obtained from sampling over three years in various localities of the Central Pyrenees have demonstrated that the localization of the individuals of the populations of the genus *Otiorhynchus* fit a contagious distribution with no clear tendency with respect to size in the occupation of stones used as refuges. Factors determining the distribution of these coleoptera and the importance of endemisms as bioindicators of the conservational state of the environment are discussed.
Index trems: bioindicators, conservation, endemic

[3600] OVERWINTERING STRATEGY OF *APHIDIUS ERVI* (HYMENOPTERA: APHIDIIDAE)

T. Hance, F. Van Stappen & A. Langer, Unité d'écologie et de biogéographie, Univ. Catholique de Louvain, Place Croix du Sud, 5, Louvain-le-Neuve, b-1348. Belgium, E-mail: Hance@ecol.ucl.ac.be

Aphidius ervi is one of the main cereal aphid parasitoids in Northern Europe but may also parasitize other aphid hosts such as *Acyrtosiphum pisum*. Little data are presently available on its capacity to enter in diapause within its potential hosts in relationship with its cold resistance. Our aim was to compare the capacity of *Aphidius ervi* to enter in diapause within two of its current hosts, *Sitobion avenae* (mainly anholocyclic) and *A. pisum* (mainly holocyclic), during two consecutive generations. In a second step, we have analysed the supercooling point (SCP) of diapausing or non-diapausing mummies of the second generation, the mortality rate and the sex ratio of the offspring. Finally, survival rates after 30 days exposure to 0°C and -10°C were compared for diapausing and non-diapausing mummies of *A. ervi* on *S. avenae*. The results show that *A. ervi* enter more rapidly and at a higher level in diapause on *A. pisum* than on S. *avenae*. This observation is probably linked to the kind of cycle of the aphid hosts and thus to their availability in last autumn. The sex ratio of *A. ervi* offspring does not differ according to the aphid species. However concerning the mortality of the diapausing forms it was higher on *A. pisum* than on *S. avenae*. Considering the SCP, a significant difference of only 1 °C was observed between diapausing mummies (mean: -27°C) and non-diapausing ones (mean: -26°C) but no difference was observed in relationship with aphid host. However, long term exposure to cold temperature gave a very better survival for diapausing mummies than for non-diapausing ones on *S. avenae*.
Index term: Supercooling, diapause, cold-hardiness, *Sitobion avenae*, *Acyrtosiphum pisum*

[3601] FIELD MARGINS ARE POTENTIALLY VALUABLE HABITATS FOR FORAGING BUMBLEBEES

A. R. Kells[1], J. M. Holland[2], & D. Goulson[1], [1]Biodiversity & Ecology Division, School of Biological Sciences, University of Southampton, Bassett Crescent East, Southampton, Hampshire, SO16 7PX, UK. E-mail: andrea.kells@soton.ac.uk, [2]The Game Conservancy Trust, Fordingbridge, Hampshire, SP6 1EF, UK.

Recent intensification of agricultural processes in western Europe have been paralleled with a decline in numbers and diversity of flora and fauna associated with such systems. One species group where a decline has been recorded across countries is the bumblebees (*Bombus* spp.). This decline has potentially serious consequences as many species of entomophilous crops grown in western Europe depend on bumblebees for their pollination. This study investigated the potential role that field margins sown with wildflower mixes may have in providing a nectar resource for bumblebees on farmland. Sampling was carried out across field margins and controls for the duration of the flowering period in summer 1999. The main findings were that field margins planted with wild flowers provide a much more valuable resource for bees than standard field boundaries; and that different species of bumblebee forage preferentially on different flower species. The potential role that such field margins could have in bumblebee conservation, and the likely knock-on effects on other species if action is not taken are discussed.
Index terms: *Bombus*, nectar source, floral diversity, preferential foraging

[3602] EVIDENCE FOR HANDEDNESS IN BUMBLEBEES

A. R. Kells & D. Goulson, Biodiversity & Ecology Division, School of Biological Sciences, University of Southampton, Bassett Crescent East, Southampton, Hampshire, SO16 7PX, UK. E-mail: andrea.kells@soton.ac.uk

We describe a simple study of how bumblebees (*Bombus* spp.) behave when visiting florets which are arranged in a circle around a vertical inflorescence. In four different species of bee, individuals showed a tendency for rotation in the same direction around each inflorescence on successive visits i.e. each individual tended to go either clockwise or anticlockwise. Similar behaviour has also been observed in mammals including humans. The implications of this tendency to repeat tasks in the same way are discussed, particularly in relation to our understanding of the phenomenon known as flower constancy. In humans, the tendency for individuals to turn in a particular direction is strongly related to handedness. In one of the four bee species, *B. pascuorum*, there was a significant overall tendency for the bees to rotate in an anticlockwise direction, suggesting that they too may exhibit handedness.
Index terms: Bombus, rotation, foraging, nectar, handling, flower constancy

[3603] VARIATIONS IN GROUND-DWELLING ARTHROPOD COMMUNITIES IN GRAZED AND PROTECTED AREAS IN THE DESERT OF MENDOZA (ARGENTINA)

S.J Lagos, M.C Dominguez & E.E Scheibler, IADIZA, CRICYT Av. Adrián Ruiz Leal s/n. Parque Gral. San Martin, Mendoza, Argentina cc: 507 cp: 5500 E-mail: slagos@lab.cricyt.edu.ar

Arthropods have been used as effective indicators when monitoring or planning management strategies for protected areas. The epigeic arthopods have an additional importance because of their participation in a great number of processes ocurring on the ground. In order to measure the differences between the arthropod communities belonging to a grazed *Prosopis* sp. forest (algarrobo dulce) and a protected forest *Prosopis* sp.(Ñacuñan Biosphere Reserve, Mendoza, Argentina), pit-fall traps were set during a whole year. Species richness was analized using ANOVA; and a cualitative analysis of the guild structure and the family abundance was realized. No significant differences were found in species richness during the summer between the grazed area and reserve. During the winter the number of species found in the reserve was significantly higher than in the grazed area. The guild structure followed the same pattern. The phytophages and scavengers were most numerous during the winter in the protected area, but during the summer the greatest number was found in the grazed forest. A greater number of families was found in the reserve all year round. All this leads us to the idea that the reserve may serve as a refuge for the fauna present at Ñacuñan during the winter.
Index terms: reserves, guilds, grazing.

[3604] PISTACHIO NUT CULTIVATION IN AN ATYPICAL ENVIRONMENT – PATTERN AND PROCESS IN PEST AND DISEASE PREDICTION

S. vdM. Louw[1] & W. J. Swart[2], [1]Dept of Zoology & Entomology, Univ. of the Orange Free State, P. O. Box 339, Bloemfontein 9300, South Africa. E-mail: LouwSvdM@dre.nw.uovs.ac.za; [2]Dept of Plant Pathology, Univ. of the Orange Free State, P. O. Box 339, Bloemfontein 9300, South Africa. E-mail: WJS@landbou.uovs.ac.za

A novel, unique and costly enterprise that will produce pistachio nuts (*Pistacia vera*) for the export market is currently under development on the bank of the Orange River near the town of Prieska in the Northern Cape province of South Africa. However, cultivation of a foreign new crop in a harsh, semi-arid area that receives superfluous irrigation, can be expected to accommodate an array of unknown pests and diseases. The fungal pathogen, *Botryosphaeria obtusa*, isolated from newly established pistachio trees at this site, is a world first report and a strong case in point. Insect incidence on pistachio has been surveyed in California, USA where 18 insect species and a single mite species have been recorded as harmful. Locally only peanuts and macadamia and pecan nuts have been surveyed for insects and mites, with data on insect – pistachio relationships virtually non-existent. However, preliminary surveys have exposed Lasiocampidae moth larvae and especially *Adoretus* adults (Scarabaeidae) as seasonal problems on pistachio foliage. The prediction that pests on pistachio in South Africa pose a real threat to the industry is based on the following points of reasoning. 1) A newly introduced plant species into an area is particularly susceptible to pests and diseases occurring naturally in that area. 2) Pests and diseases are often inadvertently translocated with plants introduced from another area. 3) Establishing a 'green oasis' in an environmentally harsh area will readily attract and even lead to the establishment of organisms from surrounding areas. Analyzing a system such as this will thus need to consider and incorporate five parameters, *i.e.* host, biodiversity, environment, time and the human factor. A three-phase plan towards addressing the health of pistachio orchards is offered. Sequentially implemented it comprises an intensive bio-monitoring program, followed by risk assessment and ultimately development of a sustainable IPM model. Index terms: *Pistacia vera*, biodiversity, sustainable IPM, South Africa.

[3605] ARTHROPODS OBTAINED FROM THE CANOPY OF *VOCHYSIA DIVERGENS* MARTIUS (VOCHYSIACEAE) IN THE PANTANAL OF BRAZIL

M. I. Marques[1], J. Adis[2], C. Nunes da Cunha[3] & G. B. dos Santos[1], [1]Dept.of Biology and Zoology, Univ. Federal of Mato Grosso, Ave. Fernando Correa da Costa s/n, 78060-900, Cuiabá, MT, Brazil, E-mail: m.marque@zaz.com.br; [2]Max-Planck-Institute for Limnology, Tropical Ecology Working Group, Postfach 165, D-24302 Plön, Germany, E-mail: adis@mpil-ploen.mpg.de; [3]Dept. of Botanic and Ecology, Univ. Federal of Mato Grosso, Ave. Fernando Correa da Costa s/n, 78060-900, Cuiabá, MT, Brazil, E-mail: catianc@nutecnet.com.br.

This is the very first study that investigates arthropods in the canopy of *Vochysia divergens* (Vochysiaceae; height 12m, crown diameter 12m, trunk dbh 0.4m) in the Pantanal of Mato Grosso, Brazil. Sampling was done in June 1999 in the Pirizal region near Poconé (56°18'W, 16°23'S). The canopy was sprayed once during 15 mins with an agricultural atomizer employing synthetic pyrethrum Lambidocialotrine (5%, non-residual). Two plastic covers (6x8 m each) were spread on the forest floor under one selected tree in order to collect the knockdown of arthropods. After a drop time of 2 hrs the tree crown was shaken and all arthropods were manually sampled after another 2 hrs. A total of 4,166 arthropods was obtained, representing a density of 43 ind./m^2 and 14 orders. Of the Insecta, Hymenoptera showed the greatest density, with Formicidae amounting to 19.2 ind./m^2 (44.2 % of the total catch), followed by adult Coleoptera (6.2 ind/m^2; 14.2 %) and Diptera (3.2 ind./m^2; 7.4 %). Twenty-six families of Coleoptera were obtained, with the Curculionidae (22 %), Scolytidae (19 %), Elateridae (17 %) and Dryopidae (13 %) being most frequent. Of the Arachnida, Araneae amounted to 14.1 % (6.1 ind./m^2) and Pseudoscorpiones to 4.5 % (1.9 ind./m^2) of the total catch.
Index terms: Arthropoda, pyrethrum, floodplains, fogging, Mato Grosso.

[3606] EFFECT OF INTERCROP WITH CHINESE BEET *(BRASSICA JUNCEA)* ON THE ABUNDANCE OF BREVICORYNE BRASSICAE AND THE QUALITY OF CABBAGE (*BRASSICA OLERACEA* VAR. CAPITATA)

A. Pérez[1], Ana Maria Folcia[1], Caffarini Patricia[1], Mónica Rubio[1] y Zdenka Premuzic[2] , Facultad de Agronomía-UBA: [1]Sanidad Vegetal, [2]Química Analítica.Av San Martín 4453, (1417) Buenos Aires, Argentina. Tel +54-11-4524-8046/66. E-mail: caffarin@mail.agro.uba.ar [3] INTA Pro-Huerta. Chile 460. (1098) Buenos Aires, Argentina . Tel +54-11- 4339-

In this paper was evaluated the incidence of Chinese beet intercrop on the aphids infestation, in two cabbage variety and his effect on nutritional –C vitamin content.
In experimental field in a farm school of Gaham, Buenos Aires, Argentina, betwwen winter and spring of 1999. Plots 100 m^2 each , two variety of cabbage (*Brassica oleracea* L.): red and bull heart. The transplanting was a 0,80 m between row. The experimental design was complete randomized with two treatment cabbage and cabbage intercrop with Chinese beet by each variety (eight repetitions). Monitoring on aphids. Sample unit was aphids per plant. The analysis statistic was made in 3th, 4th and 5th date. ANOVA and Tukey test (0.05). To achieve normality and homogeneity data transformed by natural logarithmic on the number of aphids per plant.. C vitamin content was determinate on random selection plants at harvest time (AOAC,1990). The red one was more susceptible to aphids in 3th and 4th observation: 33.38 y 43,75 aphids per plant average (PP/P) and show significative differences against the treatment. Sin embargo, in the step close harvest the intercrop wasn't enough effective (22,5 y 28,75 PP/P). In bull hearth no attack was registered in 3th and 4th monitorig time but the intercrop was effective: 24,38 y 3,75 PP/P. The content of vitamin didn't show significative differences between treatments (Square Chi Test). The intercrop don't affect the nutritional quality of cabbage.

[3607] EXTRAORDINARY NEST SITE OF *AUGOCHLOROPSIS CAERULANS* (HYMENOPTERA; HALICTINAE) IN A WET PASTURE HOLLOW

C. Pietsch[1,2], A. Köhler[1,2] & W. Engels[2], [1]Lab. Pesq. Biol., Pontifícia Uni. Católica, P. O. Box 1429, Porto Alegre, RS, 90619-900, Brazil, E-mail lpb@pucrs.br; [2]Zool. Inst., Uni. Tübingen, Auf der Morgenstelle 28, D-72076 Tübingen, Germany, E-mail christof.pietsch@uni-tuebingen.de.

Ground nesting hymenoptera mostly inhabit well-drained soils exposed to the sun which is thought to help prevent microbial destruction of cell content and to facilitate development of offspring. but some augochlorine bees are able to build their nests in shaded and moist locations. reports even exist of the augochlorine *Megommation insigne* nesting in very wet soils. our study site is located in southern brazil (29° s) on the escarpment of the serra geral, at an altitude of circa 900 m. in this area, soil-dwelling insects have to withstand more than 2000 mm precipitation per year. nests of *augochloropsis caerulans* were found on raised ground located in a water-filled hollow of about 80 m^2. these small mounds, about 20 cm in height, exclusively consisted of organic matter. bees excavated a vertical burrow up to 10 cm long leading to a cavity which contained a cluster of vertically orientated cells. due to the shape of the mound, nests were shallow and sometimes situated only a few centimetres above the water table. *Augochloropsis caerulans* excavates soil from around the cell cluster. this might assist aeration and drainage of cells in waterlogged soils, and microbial growth might also be restricted by acidic and anaerobic conditions. another aspect that could make the nest site suitable to *a. caerulans* is the balanced thermal and hydric conditions effected by the large water body. the finding of some nests at a heavily shaded location in close vicinity to running water supports this assumption. however, the nest architecture might require *a. caerulans* offspring to eclose in an rather amphibian habitat.
Index terms: *Augochloropsis caerulans*, nest-site, nest architecture, waterlogged habitat, fossorial bee.

[3608] SPATIAL AND TEMPORAL VARIATION OF *EFFLAGITATUS FREUDEI* (HETEROCERIDAE) POPULATIONS AT THE SUPRALITTORAL OF RONDINHA SANDY BEACH, RS, BRAZIL, BETWEEN AUTUMN AND SPRING

R. Schreiner[1], H. P. Romanowski[2] & C. P. Ozorio[3], [1,2,3] Progr. Pós-Grad. Biol. Animal, Univ. Federal do Rio Grande do Sul, Avenida Paulo Gama, s/n, Porto Alegre, RS, 90040-060, Brazil, E-mail[1] rosvita@bewnet.com.br.

The sandy shore environment is a very important area for conservation; however, a better understanding of the biology and ecology of the species that live there is still needed. This study aims to describe the distribution of the marine coleoptera *Efflagitatus freudei*, Pacheco 1973 (Heteroceridae) at the supralittoral: the population was monitored through time, the developmental stages observed and their distribution in the area recorded. A 6 m wide x 45 m long strip perpendicular to the swash line was demarcated. This strip was divided in upper, medium and lower strata and subdivided in 1 m^2 quadrats. Seven quadrats per stratum were selected at random per sampling occasion. Sediment was collected using a 25 cm diameter x 5 cm depth core and washed on a 0,3 mm mesh sieve. Individuals were counted and returned to the same site they were collected. A total of 12 fornightly sampling occasions were carried out between may and october 1999. No immature stages were found between june and august, period in which *E. freudei* concentrated in the upper stratum and the average density was 11,8 individuals/m^2. Eggs were first found in the beginning of september at the lower stratum, larvae appear by mid september and pupae by the beginning of october. A week before eggs were first registered, adult migrated to medium and lower strata, where psammic algae abound. Immature stages were found only in the medium and lower strata. The highest density for the period of this study - 34,6 adults/m^2, 4,1 egg clumps/m^2, 246,5 larvae/m^2 and 8,1 pupae/m^2 - occurred by the end of october at the lower strata.
Index terms: marine coleoptera, distribution, local dispersal, phenology.

[3609] COMPARISON OF PLANT SPECIES AS HOST FOR CABBAGE LEAF MINER *(SCAPTOMYZA FLAVA)* (DIPTERA: DROSOPHILIDAE)

A. A. Seraj, Plant Protection Department, Shahid Chamran University, Ahvaz, I. I. Iran. E-mail: aseraj@ahvazuni.neda.net.ir

Scaptomyza flava (Fallen) (Diptera: Drosophilidae) is a native and oligophagous leaf miner insect on cruciferous plants (Brassicaceae). It occurs in many parts of the world and throughout Khuzestan. The relationship between feeding and ovipositional preferences of insect and host plant suitability on seven host plant species (cauliflower *Brassica oleracea var. botrytis,* green cabbage *B. oleracea var capitata,* hedge mustard *Sisymbrium officinale,* brussels sprout *B. oleracea var germmifers,* turnip *Brassica rapa,* cucumber *Cucumis sativus,* wheat *Triticum aestivum,* and rice *Oryza sativa)* was evaluated. Ovipositional preference of *S. flava* was determined by measuring feeding punctures and egg density after adult female flies were given a simultaneous choice and non-choice of all host plants for feeding and oviposition. All studies were performed under greenhouse condition. The experimental design was a randomized complete block with 8 treatments and 5 replications of each treatment. *S. flava* showed distinct hierarchical ordering in their ovipositional preference with turnip, green cabbage and hedge mustard being preferred over all others. Approximately 1.05-fold and 5.8-fold more eggs were deposited on green cabbage than on turnip and cauliflower respectively.When the percentage of punctures with eggs was calculated for each species, cauliflower had by far the highest value at 10% and 19.7% in choice and non-choice tests respectively. For all other species on which eggs were laid it was less than half this. In non-choice tests females laid more eggs on green cabbage and turnip than other brassicas.

Index terms: Insect-plant relationship, choice and non-choice tests, Drosophillidae, feeding and ovipositional preference.

[3610] EVOLUTION AND SPECIATION OF CIXIIDAE IN THE PACIFIC: A COMPARATIVE STUDY OF HAWAII AND THE GALÁPAGOS ARCHIPELAGO (HEMIPTERA: FULGOROMORPHA)

H. Hoch, Museum für Naturkunde, Humboldt-Univ., Invalidenstr. 43, D-10115 Berlin, Germany, E-mail hannelore.hoch@rz.hu-berlin.de.

The current knowledge of the taxon *Oliarus* paints the following picture: the "genus" is distributed worldwide and rather speciose (ca. 350 species). Centers of species density are in the Afrotropical region, North America and the Pacific Islands. The Hawaiian Archipelago being the best studied island group is known to harbour at least 85 endemic *Oliarus* species, including seven evolutionary lineages that have independently invaded the subterranean biome on Molokai (1), Maui (3), and Hawaii Island (3). From other high Pacific Islands with a comparable habitat diversity, only few *Oliarus* species have been described (Cooks: 1, Societies: 3, Marquesas: 18, Galápagos: 5). A biogeograhic analysis of the colonization history of the Pacific Islands, however, is hampered by the lack of a cladistic analysis. So far, there is no morphological evidence for *Oliarus* s.l. to be a monophyletic group. The Hawaiian *Oliarus* species, however, may form a monophyletic group, i.e., they are likely to have derived from a single ancestral species colonizing the islands. Their phylogenetic relationships to the "*Oliarus*" species from any adjacent continent or other Pacific islands are largely unclear. A comparative morphological study of previously uninvestigated material from Galápagos revealed: 1) species diversity is much higher than previously assumed, 2) the species from Galápagos do not share any synapomorphic characters with the taxon occuring in Hawaii; they certainly do not belong to the same monophylum, and 3) the "*Oliarus*" species from Galápagos share a set of characters that may be interpreted as synapomorphies, thus for now we assume, that – like Hawaii – Galápagos has been colonized by a single ancestral species that subsequently underwent speciation. Observed patterns suggest that species may not only have formed by allopatric speciation, i.e., on different islands, but differentiated within a given island according to habitat diversity (host-plants, altitude). The species richness in the Galápagos Islands can thus be most likely attributed to adaptive radiation. Interestingly, parallel evolution has led to the colonization of subterranean habitats (lava tubes) also in the Galápagos by a blind, flight- and pigmentless species. Objectives of current research on these two parallel cases of colonization of island biota with subsequent adaptive radiation to similar habitat types are 1) to reconstruct the phylogenetic relationships within each group, 2) to relate speciation events to evolutionary time based on genetic information, and 3) to identify the potential source area from where colonization commenced. Especially South America deserves an in-depth investigation in regard to its cixiid fauna which so far must be regarded as extremely poorly known.

Index terms: *Oliarus*, phylogeny, zoogeography

[3611] THE ENIGMATIC NEOTROPICAL DELPHACIDAE (INSECTA, HEMIPTERA, FULGOROMORPHA) – A STATUS REPORT OF OUR KNOWLEDGE ABOUT A LONG NEGLECTED GROUP

M. Asche, Museum für Naturkunde, Humboldt-Univ., Invalidenstr. 43, D-10115 Berlin, Germany, E-mail manfred.asche@rz.hu-berlin.de.

The Delphacidae contains >2000 species worldwide, many of which are important vectors for plant diseases; others have been considered as indicator species for determining environmental quality. In contrast to many other regions, the Neotropics are very poorly investigated in regard to their delphacid fauna: ca. 260 species were reported, i.e., ca.12% of the world´s known species with 80 % endemism. Nearly 70 % of the species were described by only four taxonomists (Crawford, Muir, Caldwell, Fennah). Ca. 35 % of the species were published by Muir in 1926, mainly based on single collections from Equador and Brazil, thus, these two countries are still leading in totals of delphacid species compared with the rest of the Neotropics. 44 species are currently known from Equador, but only 2 resp. 3 from the adjacent countries Peru and Bolivia. This unsatisfactory situation applies to nearly all other countries in Central- and South America, and in the Carribbean. Moreover, almost nothing is known about biology and ecology (not even host plants). Our fragmentary knowledge of the neotropical delphacids, especially their poor systematic status, may lead to misinterpretations of taxa and misconceptions of distributional patterns. The lack of a phylogenetically based systematics does not allow sound zoogeographical analyses: almost 100 neotropical species are still generically misplaced, e.g., in the European genera *Delphacodes* and *Euides*; however, none of the New World species shares any synapomorphies with the corresponding European monophyla. A preliminary evaluation of recently collected samples from various neotropical areas has revealed a considerable increase of species, e.g., 1.) in Ugyopinae about 80 % of the species were found to be new to science; 2.) in Plesiodelphacinae the number of species in the genus *Burnilia* will rise from 5 to 15; in the Delphacinae genus *Megamelus* the total of species will increase from 3 to about 12. Similar increase may be predicted for other delphacid taxa. The Stenocraninae – previously believed to be absent from the Neotropics – appear to be well represented with several yet undescribed species. Consequently, we may expect the current total of neotropical delphacid species to be doubled or even tripled, i.e., 500- 700 species. Future research on neotropical Delphacidae should address the following fields: 1) completing the inventory, 2) description of taxa and systematic evaluation on a phylogenetic basis, 3) zoogeographical analysis of the neotropical fauna, - also in respect of potential source areas for the colonisation of Pacific islands, 4) dissemination of information via electronic media. For reaching these goals, it is absolutely essential to train and educate local students in all countries of the Neotropics.

Index terms: systematics, faunal inventory, species estimates

[3612] THE NEW WORLD ACHILIXIIDAE & RICANIIDAE (HEMIPTERA: FULGOROMORPHA)

M. R. Wilson[1] & A. Stroinski[2], [1]Department of Biodiversity & Systematic Biology, National Museum of Wales, Cardiff, CF10 3NP, Wales, UK, E-mail: mike.wilson@nmgw.ac.uk; [2]Museum and Institute of Zoology PAS, Wilcza 64, P.O. Box 1007, 00-679 Warszawa, Poland, E-mail: adam@robal.miiz.waw.pl.

The planthopper family Achilixiidae is one of the smallest of the Fulgoromorpha. There are only two genera recognised; *Achilixius* from the Oriental region with 16 species (revised by Wilson, 1989 Systematic Entomology 14, 487-506) and *Bebaiotes* with 8 species from Central and South America. The family is characterised by the possession of one or two pairs of processes arising laterally from the abdomen. Relationships to other families are somewhat unclear. Further study will be necessary to define generic relationships and also to place the family within the other Fulgoromorpha. All species are known from tropical lowland and medium altitude rain forest where the nymphs probably feed on plant tissue. Although only 8 species are described from south and central America it is now clear that achilixiids may be more common than previously thought and additional species remain to be described. The family Ricaniidae is a medium-sized family of the Fulgoromorpha and contains 52 tropical and subtropical genera with about 400 species mostly in Old World. Only four genera (8 sp.) are known in the Neotropics. Neotropical ricaniids (with two exceptions) are restricted to Central America: Mexico (Chiapas), Panama, Costa Rica, Colombia and Venezuela to Peru. As part of a cladistic analysis of the ricaniid genera, new morphological characters have been investigated, with emphasis on female genitalia. In particular, Neotropical Ricaniidae share some diagnostic characters: gonoplac without teeth, posterior margin at least partly membranous; gonophysis VIII short and wide, with numerous teeth on its posterior margin; bursa copulatrix without observable ornamentation; absence of gonospiculum. *Cotrades* and *Semestra* seems closely related and are characterized by a ring-like anal tube, the middle part of the gonoplac posterior margin membranous, by a single tooth on gonophysis VIII lower margin, by a posterior vaginal process weekly sclerotinized and by the bursa copulatrix with two pouches. *Kruegeria* differs from them by a flattened anal tube, the fully membranous posterior margin of gonoplac, the lower margin of gonophysis VIII without tooth, the posterior vaginal process well sclerotinized and the bursa copulatric formed by a single pouch. Future cladistic analysis will show if these characters are synapomorphies. Do the neotropical ricaniids form a monophyletic group and Do they represent an old gondwanian lineage or a more recent lineage which reached the neotropics via dispersion through North America?

Index terms: systematics, morphology, female genitalia.

[3613] NEOTROPICAL KINNARIDS: THE MISSING LINK? (HEMIPTERA, FULGOROMORPHA)

T. Bourgoin, Muséum national d'Histoire naturelle, Lab. Entomologie & ESA 8043 CNRS, 45, rue Buffon, F-75005 Paris, France. E-mail: bourgoin@cimrs1.mnhn.fr

Recent cladistic analysis showed that within the Fulgoromorpha, Kinnaridae and Meenoplidae form a strongly supported monophyletic group (Bourgoin, 1993). Within this clade the monophyly of the Meenoplidae also is well supported while Kinnaridae appears paraphyletic, their clade including the meenoplids. Three main clades [1+(2+3)] were observed as follow: 1. South Asian genus *Kinnara*, sister group of all other taxa; 2. Canarian kinnarids + (Mascarene genus *Nesomicrixia* + Central American Prosotropinae); 3. Central American genus *Oeclidius* + (Palaearctic kinnarids + (Neotropical genus *Southia* + all Meenoplidae genera)). In this phylogenetic perspective, these results seem unsatisfactory from the viewpoint of historical biogeography. No clear biogeographical track supports the observed distribution and two obvious gaps are seen: the near absence of kinnarids in both the Neotropical and Afrotropical areas. Recently several new meenoplid genera have been discovered (Bourgoin, 1997, Bonfils & Attié, 1998) and particularly several new Neotropical kinnarid genera (Bourgoin, *in prep.*), a family previously considered absent from South America. New cladistic phylogeny inferred with new morphological characters and including these new Neotropical kinnarid taxa allow reworking the Meenoplidae-Kinnaridae relationships, testing the kinnarid paraphyly, and the support of the three previously recognized clades. A new biogeographical scenario is proposed.

Index terms: systematics, phylogeny, historical biogeography, Meenoplidae.

[3614] A SYNOPSIS OF THE NEOTROPICAL NOGODINIDAE (HEMIPTERA: FULGOROMORPHA)

N.D. Penny[1] & L.B. O'Brien[2,1] Dept. of Entomology, California Academy of Sciences, Golden Gate Park, San Francisco, CA, 94118, USA, E-mail npenny@calacademy.org; [2]3009 Brookmont Drive, Tallahassee, FL, 32312-2406, USA.

Fennah (1987) divided the family Nogodinidae into two subfamilies (Gastriniinae and Nogodininae): Gastriniinae is based on a single genus, *Gastrinia,* currently known from two species (three specimens) found in a relatively small area of southeastern Brazil. The higher classification of the other subfamily, Nogodininae, was proposed by Fennah (1978) to include five tribes, two of which (Bladinini and Nogodinini) are found in the Neotropical Region.. The Bladinini are divided into three subtribes, two of which are found in the Neotropics: Gaetuliina and Bladinina. The subtribe Gaetulina includes only a single genus, *Gaetulia,* in the region under consideration, with eight species ranging from northern Mexico to Panama. Bladinina previously included a single genus, *Bladina,* which was revised by Kramer (1976). *Bladina* are grass-feeding species which have forewings that are relatively long and narrow, often almost parallel-sided. There are currently 19 species and two subspecies in this genus ranging from southern Mexico to Paraguay and northern Argentina. Two additional genera are here recognized, each with a single species from Mato Grosso and Rondonia States in west-central Brazil. The only other tribe of Nogodininae found in the Neotropical Region is Nogodinini. In his paper on nogodinid higher classification, Fennah (1978) divided the Nogodinini into two subtribes, Nogodinina and Vutinina, both found exclusively in the Neotropical Region. These subtribes are separated by the length of the basal stalk of the media vein in the forewing. Vutinina contains a single genus, *Vutina,* which has rather broad, dark forewings. Seven species and one subspecies were previously known, but we recognize 14 species distributed from Panama to Bolivia, with a center of diversity in southern Peru. The subtribe Nogodinina consists of five closely related genera, *Biolleyana, Neovarcia, Nogodina, Orthothyreus,* and *Varciopsis.* Biolleyana was previously known from three species and we have recognized six additional species distributed from Nicaragua to Peru. *Neovarcia* previously has consisted of two species, *N. aequata* and *N. lurida;* we are herein transferring two additional species from *Varciopsis – N. tenguelana* and *N. vitripennis.* They are distributed in a relatively small area of Venezuela, Ecuador, and northwestern Brazil. *Nogodina* consists of a single species, *N. reticulata,* found in northern Brazil, Guyana, Surinam, and French Guiana. *Orthothyreus* is known from a single poorly known species, *O. apicalis,* from Ecuador. We are herein recognizing two species in *Varciopsis, V. nigricoxis* (transferred from *Orthothyreus*) and *V. trigutta,* found from Ecuador to Bolivia and Chile.

Index terms: true bugs, taxonomy, systematics

[3615] TROPIDUCHIDAE (FULGOROMORPHA, HEMIPTERA), GREEN GEMS OF THE FOREST

L. B. O'Brien, Center for Biocontrol, Florida A & M. Univ., Tallahassee, FL 32307-4100, USA, E-mail biocontrol@nettally.com.

The Tropiduchidae, found in all tropical and warm temperate regions of the world, feed on everything from ferns and palms to grasses and dicots. At least 16 species have been reported as pests on human food plants, on cacao, coffee, guava, and grapefruit in the Neotropics, and on sugarcane, rice, breadfruit, and palms in the Old World. One species, *Ommatissus lybicus*, the Dubas (Dubas =honeydew in Arabic) bug, is considered the most serious pest of date production in the Middle East and can cause the death of trees. There are 15 tribes, 124 genera, and about 300 species in the world compared to 5 tribes, 34 genera and 90 species in the Neotropics (The two U.S. species are also reported from Cuba.) Unlike any other fulgoromorpha family but Kinnaridae, half of the species know from the Neotropics are found in the West Indies. One, Tangiini, has 10 genera and 37 species there. Two other tribes have half their species there. I have seen at least 23 new species.The most distinctive tribes are those found only on the continent. Tambiniini, with 1 genus and 3 species in the New World, all on palm, are the size and shape of delphacids, with perhaps wings held more flat. Found in Mexico, Paraguay, and Brazil, this is the only N.W. tribe found also in the Old World. It is characterized in the Neotropics by three subapical cells. The second continental tribe is the Alcestini, found in Eastern S. America from Argentina through Brazil to Trinidad and Guyana. These species are flat, nearly round, have a short costal cell and costal area, and Sc+R forked in basal third. The Cyphoceratopini, the "humped horn faces", found half in the W.I., half from Central America to Ecuador, have a single row of transverse veins after the nodal line. They often have carinae marked with black or red. The Remosini, again half from the islands, but mostly the Greater Antilles, have vertex more or less elongate, tegmen with M forked twice before nodal line, 3rd valvulae of ovipositor with more than 5 teeth on ventral margin. The last tribe, Tangiini, have two subtribes, one primarily from the Lesser Antilles and one primarily from the Greater. These have the vertex not elongate, tegmen usually without M forked twice before nodal line,or, if so, nodal line concave, nearest to base at M.

Index terms. Systematics, Neotropics

[3616] THE NEOTROPICAL LOPHOPIDAE (HEMIPTERA) AND THE ENIGMA OF *HESTICUS* AND *SILVANANA*

A. Soulier-Perkins & T. Bourgoin, Mus. nat. d'Hist. nat. Lab. d'Entomologie & ESA 8043 CNRS. 45 rue Buffon. 75005 Paris. FRANCE. E-mail: soulier@cimrs1.mnhn.fr, bourgoin@cimrs1.mnhn.fr.

A cladistic analysis based on morpholigical characters (Soulier-Perkins, in press1) showed that the Lophopidae (Hemiptera, Fulgoromorpha), sensus Metcalf, is a paraphyletic group. Two South american genera, *Hesticus* and *Silvanana* cannot be regarded as Lophopidae. This family is now divided into four clades: Carriona +, Makota +, Sarebasa + and Bisma +. The clade Carriona + contains only one genus represented by three species. Within the phylogeny of the Lophopidae, the genus *Carriona* is the more basal clade and the sister group of all the others (33 studied genera). This genus is also the only Lophopidae presents on the american continent with a distribution located in Panama, Ecuador and Peru. The Lophopidae presents a transpacific tracing. Subsequently fiew hypothesis can be made for this paradoxal tract (Soulier-Perkins, in press2). One of the hypothesis is that during paleocene and after in between the upper miocene and pliocene, a way throughout the Behring'isthmus has existed. During the pleistocene' glaciation we can imagine that the taxa disappeared from the oriental margin of Asia and North America being pushed southwards into mid and south America throughout the Panama'isthmus. A fossil described by Cockerell and found in the Rocky Mountains supports this hypothesis. Withdrawing the genera *Hesticus* and *Silvanana* from the Lophopidae was a necessity but to which fulgoromorphan family do they belong? Shall we describe a new family for them? The position of these two genera could be elucidated throughout the study of the wing venation, the male and female genitalia and some peculiar morphological structures. We should check as well if any known synapomorphies for the fulgormorphan families are present within these genera. Should their taxonomic position remain uncertain, a phylogenetical study at the family level will have to be undertaken.

Index terms: Fulgoromorpha, phylogeny, taxonomy, biogeography.

[3617] BIODIVERSITY AND BIOGEOGRAPHY OF NEOTROPICAL LEAF LITTER WEEVILS (CURCULIONIDAE)

R. S. Anderson, Canadian Museum of Nature, P.O. Box 3443, Station D, Ottawa, ON. K1P 6P4, Canadá, E-mail: randerson@mus-nature.ca

Patterns in diversity, endemism and biogeographic relationships are summarized for leaf litter Curculionidae in various habitats in North, Central and South America. These patterns are discussed from ecological and historical perspectives and the implications of these results for conservation and management of Neotropical species diversity are also presented.

Index terms: conservation, endemism, diversity

[3618] THE ROLE OF INBREEDING IN THE PHYLOBIOLOGY OF TROPICAL BARK BEETLES

L. R. Kirkendall, Univ. Bergen Dept. Zool., Allégaten 41, N-5007 Bergen, Norway. Email: lawrence.kirkendall@zoo.uib.no.

Bark beetles (Curculionidae-Scolytinae) are snoutless weevils which tunnel in their woody breeding material. About one-fourth of all Scolytinae (and one-half of all tropical species) inbreed, so understanding current day patterns of scolytine diversity requires an understanding of the impact of inbreeding and outbreeding on their genetics, ecology, dispersal behavior, and history (phylogeny). I will summarize general patterns of inbreeding and outbreeding bark beetle diversity, including latitudinal and altitudinal diversity patterns and island effects (see also Jordal, Beaver and Kirkendall, this volume). For example, tropical faunas are dominated by ambrosia beetles (species growing symbiotic fungi in tunnels in wood) and by inbreeding, and the success of outbreeding taxa is more severely affected by decreasing tropical island size than is that of inbreeders. I will also summarize preliminary data on the population genetics, ecology, and phylogeography of a pair ecologically similar species, one inbreeding and one outbreeding. On the Canary Islands, the endemic *Dactylotrypes longicollis* (outbreeding) and the cosmopolitan *Coccotrypes dactyliperda* (inbreeding) breed in palm seeds: I will present a comparative overview of their life histories and genetic variation (isozymes, mtDNA, cuticular hydrocarbon profiles) for these populations plus samples from Madeira, Morocco, mainland Europe, and the USA, and discuss worldwide patterns of distribution of the two species.

Index terms: biodiversity, biogeography, ambrosia beetles, Scolytinae, Canary Islands

[3619] SYSTEMATICS, CLADISTIC ANALYSIS, AND GEOGRAPHICAL DISTRIBUTION OF THE TRIBE STERNECHINI (COLEOPTERA, CURCULIONIDAE, MOLYTINAE)

G. H. Rosado-Neto, Dept. of Zoology, Federal University of Paraná, P. O. Box 19020, Curitiba, PR 81531-990, Brazil, E-mail ghrosado@bio.ufpr.br.

A generic reclassification of the Neotropical tribe Sternechini, employing new morphological characters, and based on cladistic analysis is presented. The 59 recognized species are assigned to 13 genera, 9 of which are new: *Heleperrinus*, (type-species: *Sternechus egenus*); *Ptilechus* (type-species: *Tylomus pollinosus*); *Merinoides* (type-species: *Liparus uncipennis*); *Achethus* (type-species: *Sternechus denticollis*); *Obrienus* (type-species: *Sternechus inconditus*); *Moureiellus* (type-species: *Sternechus russatus*); *Diacmechus* (type-species: *Sternechus irroratus*); *Chelkus* (type-species: *Curculio pinguis*); *Bondarius* (type-species: *Sternechus tuberculatus*). Four genera are redescribed, one of them revalidated: *Sternechus, Tylomus, Hypnideus* and *Plectromodes* (revalidated, type-species: *Plectromodes paludatus*). The following synonyms are established: *Chelkus denudatus*, new combination., revalidated [= *Sternechus extortus* var. *reticulatus;* = *Sternechus denudatus* var. *denudatus*; = *Sternechus denudatus*]; *Bondarius subrufus*, new combination [= *Chalcodermus subrufus*; = *Sternechus subrufus*; = *Sternechus vulgaris*]. An external general morphology of the tribe is presented and important structures are discussed and illustrated. The presence of cornified labial palpi with the articles strongly fused and a stridulatory apparatus (abdomino-elytral method) are reported for the first time for the tribe. The genera are keyed and described. The treatment of each genus included also: type-species indication, diagnosis, discussion and a list of species. For each species, a complete nomenclatorial and bibliographic information, specimens studied and biological data when known are mentioned. The geographical distribution of the species is briefly discussed and represented by symbols in the maps. A cladogram showing the tribe monophyly and the phylogenetics relationships among the genera is also presented. Two genera formerly placed in the Sternechini are removed from this tribe: the Oriental genus *Dirodes*, a Molytinae considered *incertae sedis*; and *Chalcodermus*, transferred to Cleogonini (Molytinae).

Index terms: taxonomy, weevils, sternechids

[3620] NEGLECTED ANTIPODEANS ON WEEVIL CLASSIFICATION AND PHYLOGENY (COLEOPTERA: CURCULIONOIDEA)

R. G. Oberprieler, CSIRO Entomology, GPO Box 1700, Canberra ACT 2601, AUSTRALIA. E-mail Rolf.Oberprieler@ento.csiro.au.

Weevil classification systems have mostly been devised in the northern hemisphere, whereas the majority of phylogenetically critical taxa occur on the southern continents. These groups are generally poorly represented in northern-hemisphere collections and were consequently often ignored or only superficially included in classification schemes based, in essence, on northern taxa. This situation is particularly critical in the "higher" weevils (Brentidae and Curculionidae), whose phylogeny and classification into natural subfamilies and tribes is still very much unresolved. Recent discovery of the larvae of many basal Australian and African taxa, and comparative morphological study of larval and imaginal characters, in these two families have major implications for their classification and phylogeny. Several traditionally important characters, such as the adelognathous condition of the mouthparts, are indicated to have been evolved several times, and internal structures such as terminalia (in particular the ovipositor), mouthparts and metendosternite are evidently more reliable indicators of phylogenetic relationships at this level. The classification and phylogenetic position of the following taxa are discussed: Carinae, Eurhynchini, Microcerini, Cyladini, Antliarhinini, Ithycerini, Brachycerini, Cryptolaryngini, Cyclomini (= Somatodini), Hipporhinini, Gronopini, Rhytirhinini, Amycterini, Aterpini, Listroderini, Cylydrorhinini.

Index terms: Brentidae, Curculionidae, basal taxa.

[3621] A PHYLOGENY OF THE WEEVIL MAJOR GROUPS: MORPHOLOGICAL AND MOLECULAR EVIDENCE

C.H.C. Lyal, M. Barclay, A.P. Vogler & S.L. Shute, Dept. of Entomology, The Natural History Museum, Cromwell Road, London SW7 5BD, England. E-mail chcl@nhm.ac.uk

Despite several attempts at phylogenetic analysis of the Curculionoidea over the past 12 years there are still major unresolved problems. Kuschel's groundbreaking work has been accepted by many, but other authors have used very different family and subfamily concepts and recognised many more supra-generic taxa. To resolve this three methods must be used: demonstration of monophyly of the terminal taxa; identification and application of hitherto unused morphological characters; use of sequence data. As a first step a larger number of terminal taxa than accepted by Kuschel are used, and character states employed by Kuschel and others re-assigned. The search for novel characters has not been wholly successful so far, although much more accurate distributions of sclerolepidia and stridulatory organs are employed than hitherto. Attempts to use ventral thoracic structures have not been successful, although homologies have been determined and taxonomic use may be made of them, particularly in taxa such as Cossoninae. Sequence data based on the 18S rRNA gene is used. Aspects of the gene make positioning of the Platypodidae very difficult, and relatively few informative characters can be found within the Curculionidae s.str. From separate analyses several novel relationships emerge. Belidae may be basal within the Curculionoidea; Nemonychidae are not clearly monophyletic; Microcerinae must move from the Brachyceridae to the Brentidae; Brentidae s.str and Cyladinae form a clade; Nanopyinae are not clearly close to the Apionidae; Apionidae and Nanophyinae are not grouped with Brentidae; Raymondionymidae and Erirhinidae are sister-groups. The new tree is used to examine species richness, but its implications are not clear. Within the Curculionoidea numerous separate factors may have led separately to high diversification. The shift in the trade-off balance between use of the rostrum in oviposition and in feeding towards soil oviposition and more powerful mandible action has allowed diversification in broad-nosed weevil groups. Overall, the use of wood as a larval feeding habitat has had major significance.

Index terms: Curculionoidea, Curculionidae, beetle, diversification

[3622] EVOLUTION OF "DERELOMINE FLOWER WEEVILS" (COLEOPTERA: CURCULIONIDAE) IN ASSOCIATION WITH PALMS AND CYCLANTHS

N. M. Franz[1] & C. W. O'Brien[2], [1]Dept. of Entomology, Comstock Hall, Cornell University, Ithaca, NY 14853, USA, E-mail nmf2@cornell.edu; [2]Center for Biological Control, Florida A&M University, Tallahassee, FL 32307-4100, USA, E-mail biocontrol@nettally.com

The interaction between "derelomine flower weevils" (Curculioninae: Derelomini) and their monocot hosts, including many Arecaceae and all Cyclanthaceae, offers research opportunities for various aspects of plant/insect evolution. Known Derelomini are approximately 35 genera and 200 species, but similar numbers of undescribed taxa are on hand based on field work in the Neotropics. Host specificity of many species goes beyond the generic level. Ecological studies indicate that the life habits and their effects on host reproduction are diverse, ranging from beneficial (e.g., pollination in *Bactris* by *Phyllotrox*) to detrimental (e.g., seed predation in *Carludovica* by *Systenotelus*). Such effects are mediated by oviposition in pistillate flowers, staminate flowers, or staminodes, as well as larval development inside or outside the maturing organs of the host plant; detritivorous larvae are present in many species. Phylogenetic analyses are useful to reconstruct the historical pattern of character transformation among the associated taxa, and to discuss how these factors relate to the evolution of host specificity, cospeciation, and colonization. However, they are not suitable to test for the presence of coevolutionary processes - which may or may not become evident through geographic heterogeneity of reciprocal selection among extant populations. Thus, an evolutionary interpretation of the complex interaction between "derelomine flower weevils" and their host plants, which may have originated during the Eocene, requires that a phylogenetic framework is available to address ecological questions. Two examples are presented to illustrate these aspects. (1) *Notolomus*, with two described and four new species from North America and nine new species from the West Indies. All are associated with palm flowers and three are known to develop in the staminate flowers, pupating in the soil. The adults function as pollinators of their hosts. Although the individual species visit various palm genera and species for pollen, apparently they breed in only one species. (2) A new genus and species which is associated with *Asplundia*. Behavioral studies at La Selva, Costa Rica, show that the females use a frontal horn to transport the ephemeral staminodes to the oviposition site in the leaf litter. The males are characterized by armed tibiae with which they fight each other, to remain on the moving staminodes. The sexual dimorphism is hypothesized to have evolved from monomorphic ancestors, and may represent an extraordinary case of non-reciprocal adaptation.

Index terms: host specificity, phylogeny, plant/insect interactions, pollination, sexual dimorphism.

[3623] HIGHER PHYLOGENY OF THE CURCULIONIDAE: EVIDENCE FROM A MOLECULAR AND MORPHOLOGICAL STUDY

A. E. Marvaldi [1,3], A. S. Sequeira [2, 3] & B. D. Farrell [3], [1] Inst. Arg. Invest. Zonas Aridas, C.C. 507, 5500 Mendoza, Argentina; [2] Dto. Genética, Univ. Bs. As., 1428 Buenos Aires, Argentina; [3] Museum of Comparative Zoology, Harvard University, 26 Oxford Street, Cambridge, MA 02138, USA. E-mail: marvaldi@lab.cricyt.edu.ar, amarvaldi@oeb.harvard.edu

Phylogenetic relationships among the weevils (Curculionoidea) were inferred from cladistic analysis of nucleotide sequences of 18S ribosomal DNA and morphological characters of larval and adult stages. More than 50 % of the rDNA sequences are new from this study, and current work also includes sequences (the first obtained for the weevils) of a large nuclear DNA gene. A worldwide sampling of 100 species was made maximizing the morphological and ecological diversity. All families of Curculionoidea are represented: Nemonychidae, Anthribidae, Belidae, Attelabidae, Caridae, Brentidae, and Curculionidae *sensu lato*. The Curculionidae are represented by about 80 species in 30 "subfamilies" of traditional classifications (e g. Dryophthorinae, Erirhininae, Entiminae, Curculioninae, Molytinae, Cossoninae, Scolytinae, Platypodinae, etc.). Some basal Chrysomeloidea were included as outgroups. The main goals of this study were to discover relationships and major natural groups within the "megadiverse" family Curculionidae, and to provide a robust phylogeny for the families of Curculionoidea. Phylogenetic reconstruction was done by parsimony analysis, support to tree topology was evaluated, and incongruence between molecular and morphological data sets was tested. Results of the combined analysis show that monophyly and relationships among weevils families are well supported. Within the Curculionidae clade, whose larvae have incomplete frontal lines, the basal positions are occupied by taxa with the "primitive" type of male genitalia (and mostly monocot feeders), followed by "broad-nosed weevils" (Entiminae and allied taxa) and then by the rest of the weevils (including Scolytinae and Platypodinae which appear closely related). High support values were found for the monophyly of the Dryophthorinae (several tribes represented), the Platypodinae (Tesserocerini plus Platypodini), the Baridinae, and the Ceutorhynchinae, among others. The partition homogeneity test did not find significant incongruence between molecular and morphological data sets. Sequences from one or more additional genes and a re-evaluation of the morphological characters promise to provide a better understanding of the phylogeny of the Curculionidae. Based on the results the evolution of larval habits in weevils will be discussed.

Index terms: weevils, DNA, larvae, adults.

[3624] IMMATURES AND CURCULIONOID PHYLOGENY: THE REST OF THE STORY!

P. W. Kovarik, Center for Biological Control, Florida A&M University, Tallahassee, FL 32307-4100, USA, E-mail pkovarik@famu.edu.

Weevil larvae and pupae possess an array of unique characters which compliment those of the adult stage. Prominent among these are the numerous setae and pores borne on the larval and pupal integument. The inherent stability of setae and pores make them an ideal tool for identification and phylogenetic studies. Proper setal nomenclature and homology are essential in order to maximize the information content of this data set. Accurate serial homology permits recognition of variations in setal patterns and sclerite development on segments of different tagmata. A groundplan nomenclatural system for describing the distribution of setae and pores on weevil larvae is presented and discussed. Unlike most existing nomenclatural systems, this system provides logical names for setae on the thorax and abdomen as well as the head. The utility and universality of this system was tested on exemplars from most of the major subfamilies of weevils. Curculionoids are apparently unusual among Coleoptera larvae in that there has been an anterior migration of mesothoracic pleural setae and sclerites and a corresponding reduction of prothoracic pleural setae and sclerites. The taxon selected to illustrate the groundplan chaetotaxy for the Curculionidae is *Diaprepes abbreviatus*. This weevil was chosen primarily because *Diaprepes* and several other broad-nose weevil genera exhibit a pattern of setation which approximates that of *Ithycerus noveboracensis*, a putative sister group of the Curculionidae. *Ithycerus* is clearly not a weevil in the strict sense because the larvae have segmented thoracic legs that are lacking in true weevils. However, because *Ithycerus* is apparently very closely related to curculionids, it is an ideal choice for determining the polarity of setal characters among weevil larvae. In terms of overall numbers of setae, *Ithycerus* (excluding the legs) has a few more than *Diaprepes*. These "extra" setae were taken into consideration during the numbering process. The importance of setal characters in defining supra-specific taxa will be demonstrated. In addition, general trends in relationships among the subfamilies of curculionids will be presented and discussed.

Index terms: *Diaprepes abbreviatus*, *Ithycerus noveboracensis*, chaetotaxy, larvae, pupae.

[3625] WEEVILS AS VECTORS OF PLANT PATHOGENS: A CASE STUDY ON AMARANTH IN SOUTH AFRICA

S. vdM. Louw[1], S. J. Honiball[1], W. J. Swart[2] & W. Cheng[2], [1]Dept of Zoology & Entomology, Univ. of the Orange Free State, P. O. Box 339, Bloemfontein 9300, South Africa. E-mail: LouwSvdM@dre.nw.uovs.ac.za ; [2]Dept of Plant Pathology, Univ. of the Orange Free State, P. O. Box 339, Bloemfontein 9300, South Africa. E-mail: WJS@landbou.uovs.ac.za

The larval stem galleries of *Hypolixus haerens* (pigweed weevil), the main pest of cultivated *Amaranthus hybridus* in South Africa, show extensive tissue decay from which various pathogenic fungi (*Fusarium* spp.) have been isolated. This gave rise to the hypothesis that *H. haerens*, and other stem-boring weevils of *A. hybridus*, serve as vectors of fungal diseases. *A. hybridus* is a drought tolerant vegetable crop with considerable potential for cultivation in the semi-arid regions of the world. A thorough understanding of the biotic and abiotic factors that influence successful cultivation is thus an important agronomic prerequisite. Insect - fungal relationships are especially relevant since they play important roles in the phenology and ecology of most cultivated plants. During the 1999 growing season three weevil species, *viz. H. haerens*, *Baris dodonis* and *Microlarinus angustulus*, were sampled in numbers warranting further investigation into fungal association. Individually isolated specimens of these three species were killed by exposure to 75°C and aseptically plated onto malt-extract agar (MEA). Fungi isolated in this manner included *Fusarium* spp., *Alternaria* spp. and *Phoma* spp., the pathogenicity of which on *A. hybridus* was investigated in the greenhouse. Our results provide considerable evidence for the following: 1) All three the weevil species investigated serve as fungal vectors. 2) *Fusarium* spp. are the predominant pathogens involved in the interaction. 3) Both male and female individuals of *B. dodonis* and *H. haerens* serve as vectors suggesting incidental fungal transmission. 4) Specific *Fusarium* spp. associated with adult weevils can cause extensive tissue decay in *A. hybridus*.

Index terms: Fungal disease transmission, Curculionidae, *Amaranthus hybridus*, South Africa.

[3626] PHYLOGENY AND EVOLUTION OF DRYOPHTHORIDAE (COLEOPTERA: CURCULIONOIDEA)

H. Kojima[1] & C. H. C. Lyal[2], [1] Entomological Lab., Faculty of Agriculture, Kyushu Univ., Fukuoka, 812-8581 JPN; [2] Dept. of Entomology, The Natural History Museum, London, SW7 5BD, UK.

Phylogenetic relationships among the subfamilies of Dryophthoridae (= Rhynchophoridae) are estimated using morphological characters, and the evolution of this group is discussed in relation to feeding habitat, host association and distribution. The position of this group within Curculionoidea is also discussed. As a result of our analysis, the basal clade in the family is identified as Dryophthorinae, with the sister to the remaining subfamilies being the Stromboscelinae. These two clades are associated with decaying wood, both Angiosperm and Gymnosperm. Rhynchophorinae is regarded as both the most advanced and the most successful group, including about 85% of the genera in the family. Rhynchophorines are especially abundant in the Old World tropics and have wide range of habitats: most of them are associated with monocotyledenous plants, but some are associated with very dry matter, and dicotyledons. Orthognathinae and Cryptoderminae are perhaps intermediate groups between the former taxa, but the relationships between them are not resolved. The Dryophthoridae is considered to be an advanced group among Curculionoidea by some authors (e.g. Kuschel, 1995) in contrast to the treatments by Morimoto (1962) and Zimmerman (1994), who place the family as more basal. Several morphological characters, as well as feeding habitat and host association, support the latter treatment, namely a relatively early split of this group from the main stem, at least prior to the separation of the Curculionidae.

Index terms: Coleoptera, Dryophthoridae, phylogeny, evolution

[3627] PHYLOGENY OF TEMPERATE WATER STRIDERS (GERRIDAE: *LIMNOPORUS, AQUARIUS & GERRIS*) BASED ON COMBINED ANALYSES OF MOLECULAR AND MORPHOLOGICAL DATA

J. Damgaard & N. M. Andersen, Zoological Museum, Univ. of Copenhagen, Universitetsparken 25, DK-2100 Copenhagen, Denmark.

During the past three decades, studies of the ecology and behaviour of the Gerrinae has been focused on the three principal Holarctic genera *Limnoporus, Aquarius* and *Gerris*. So far, however, the phylogeny of these genera has been based on morphological investigations that has been successfull in establishing monophyletic species groups, but not so much in resolving their phylogenetic relationships. The present study provides a broad taxon sampling from the three genera, including representatives of all recognized subgenera and species groups, and the phylogenetic reconstruction is based on a data set comprising 66 morphological characters and two DNA sequence data sets; one from the mitochondrial gene encoding *cytochrome oxidase* subunit 1, and one from the nuclear gene encoding *elongation factor* 1-*alpha*. Based on parsimony analyses of discrete and combined data sets *Limnoporus* is recognized as sister group to *Aquarius* + *Gerris*. The relationship between these two genera is however ambiguous, and while the monophyly of *Gerris* is confirmed, this may not be the case for *Aquarius*, which emerges as a non-monophyletic group in all analyses involving molecular data.

Index terms: Gerrinae, COImtDNA, EF-1α.

[3628] A REVIEW OF THE FAMILY LEVEL PHYLOGENY OF THE NEPOMORPHA (HETEROPTERA)

J. T. Polhemus[1], D. A. Polhemus[2] & S. L. Keffer[3], [1] Colorado Entomological Museum, 3115 S. York, Englewood, CO 80110, USA, E-mail polhemus@stripe.colorado.edu; [2] Dept. of Entomology, Smithsonian Institution, Washington, DC, 20560, USA, E-mail bugman@mail.bishopmuseum.org; [3] S. L Keffer, Dept. of Biology, James Madison University, Harrisonburg, VA 22807, USA.

The phylogeny of the infraorder Nepomorpha was reviewed in depth in 1993 by Mahner, however several discoveries since then necessitate a further analysis. For instance, the current concept of the family Belostomatidae will not accomodate the fossil species of the Triassic and Jurassic. The choices are to broaden the concept of the family Belostomatidae, or to establish a new family for the fossil forms; these choices must be carefully examined to avoid paraphyly. The Naucoroidea form a rather well defined monophyletic group, and the recently described fossil family Leptaphelocheiridae appears to settle comfortably within this clade. The family Potamocoridae was excluded from the Naucoroidea by Mahner, and our analysis also confirms that this family falls outside the clade, although its alternative placement is equivocal. In the Pleoidea, we have a recently discovered new family-level taxon from South America that clearly belongs in this group, being allied to both the Pleidae and Helotrephidae. In regard to character systems, the male genitalia have been especially useful in providing synapomorphies for major clades. Based on the results of these studies, we present a revised cladistic analysis of relationships within the Nepomorpha, which delimits same major clades recognized by Mahner: the Nepoidea, Corixidae, Ochteroidea, Naucoroidea, Potamocoridae, Notonectoidea and Pleoidea.

Index terms: Heteroptera, Nepomorpha, phylogeny, fossils, male genitalia

[3629] THE STRUCTURE OF THE PHALLUS IN CIMICOMORPHA (HETEROPTERA).

I. M. Kerzhner, Zoological Inst., Russian Acad. Sci., Universitetskaya nab. 1, St. Petersburg, Russia 199034.

The phallus in Cimicomorpha consists of four main parts: phallobase (basal plates), phallotheca (forming the outer wall of phallus), ductus seminis and endosoma (which is usually everted during copulation). This basic plan is more or less modified in various groups. For instance, the endosoma is reduced and non-eversible in Joppeicidae and some Reduviidae. Severa lgroups of Miridae developed independently subdivision of the endosoma into the conjunctiva and non-eversible vesica surrounding the distal part of the ductus seminis. Reduction of the phallotheca occurs in Pachynomidae. Nabidae (including Velocipedinae) and Tingidae have the phallotheca with more or less movable apical part sclerotized throughout (Nabidae) or laterally (Tingidae). Pedicel, a sclerotized process of phallobase supporting the proximal portion of ductus seminis, is characteristic for both families of Reduvioidea (Pachynomidae and Reduviidae). Acus, a sclerotized "injector" at the distal end of ductus seminis, is developed in some cimicomorphans with traumatic insemination (Plokiophilidae, some Antocoridae and Nabidae). In groups having a "guiding" paramere, the phallus is simplified. Though many families and some groups of closely related families have characteristic features in the phallus structure confirming their monophyly, there is no clear pattern of transformations sufficient in itself to deduce on the phylogeny within the whole infraorder Cimicomorpha.

Index terms: Heteroptera, Cimicomorpha, phallus, structure.

[3630] FAMILY-GROUP RELATIONSHIPS WITHIN THE CIMICOMORPHA BASED ON DNA SEQUENCES AND MORPHOLOGY

R.T. Schuh[1] & W. C. Wheeler[1], [1]Div. of Invertebrate Zoology, American Museum of Natural History, Central Park West at 79th St., New York, NY 10024, USA, E-mail schuh@amnh.org.

The scheme of family-group relationships for the Cimicomorpha as proposed by Schuh and Stys in 1991 is further tested through the addition of DNA sequence data and refined analytic procedures. Sequences were available for 15 of the 19 families recognized in the work of Schuh and Stys. These results extend the use of DNA sequences to the family level from the 1993 results published by Wheeler, Schuh, and Bang on infraordinal relationships within the Heteroptera.
Index terms: systematics, Heteroptera

[3631] SCENT GLAND MORPHOLOGY AND THE CLASSIFICATION OF THE MIRIDAE.

G. Cassis[1], [1] Centre for Biodiversity and Conservation Research, Australian Museum, 6 College Street, Sydney 2010 NSW Australia.

The higher classsification of the Miridae has been primarily based on the morphology of the pretarsus. The morphology of the efferent system of the metathoracic scent glands reveals new relationships and puts into question the monophyly of some of suprageneric groups. A cladistic analysis of critical taxa is given that combines existing data with the characters of the efferent system. Impacts of the analysis are primarily on the Bryocorinae, Cylapinae and Deraeocorinae.
Index terms: Miridae, higher classification, scent gland morphology

[3632] PHYLOGENY OF THE NEW WORLD PLANT BUG TRIBE CERATOCAPSINI (HETEROPTERA: MIRIDAE: ORTHOTYLINAE)

T. J. Henry, Systematic Entomology Laboratory, Plant Sciences Institute, Agricultural Research Service, United States Department of Agriculture, c/o National Museum of Natural History, Washington, DC 20560-0168, USA.

The New World mirid tribe Ceratocapsini is a relatively large group of taxa, containing at least 12 genera, including the nominate genus *Ceratocapsus* Reuter, and more than 150 species. Despite its size, generic relationships within the tribe have never been investigated. Although Ceratocapsini has been defined based on various external structures, particularly those found on the head, pronotum, and hemleytra, and on the male genitalia, no definitive diagnosis is available. Genera included in the tribe also have been referred to as the "*Sericophanes* group" based on a well-developed collar, some degree of ant resemblance, the lack of spiculi in the male genitalia, hemelytra with maculae, and the restriction of all included taxa to the Western Hemisphere. The one exception has been the inclusion of the Old World genus *Xenofulvius* Bergroth, known from the Philippines, a genus now considered to have only a superficial resemblance to true ceratocapsines. Recently, the validity of the tribe has been challenged. For this study, representatives of more than 20 genera, including outgroup genera from other tribes within the subfamily Orthotylinae, are examined. Character information based on external morphology and male genitalia is used to corroborate the monophyly of the tribe and to hypothesize generic relationships. The relationship of Ceratocapsini to other orthotyline tribes is discussed.
Index terms: cladistic analysis, tribal and generic relationships, classification

[3633] PHYLOGENETIC ANALYSIS OF PENTATOMOIDEA

J. Grazia, Dept. of Zoology, Univ. Fed. Rio Grande do Sul, Av. Paulo Gama s/n, 90046-900 Porto Alegre Rio Grande do Sul, Brazil. E-mail jocelia@vortex.ufrgs.br.

Few tentatives to establish the relationships among families and subfamilies of Pentatomoidea were made using the totality of available evidence, and using explicit cladistic methodology. The majority of previous studies used only one or at most two suites of characters. Furthermore in many of these studies, taxa were based upon symplesiomorphic resemblance. In one of these tentatives were analyzed 41 characters in 13 taxa, and the cladogram was derived by hand. The The superfamily Pentatomoidea was considered by several previous authors as a natural group, but also considered the pentatomomorphan superfamily with the higher degree of disagreement on the relationship among family level and lower categories. In a phylogenetic analysis of the family groups within the infraorder Pentatomomorpha, recently published, were recognized 6 superfamilies (one of them being Pentatomoidea); the author emphasized the monophyly of this superfamily but, also called the attention for the challenged position of the Thaumastellidae which was transferred from Lygaeoidea to Pentatomoidea and reduced to subfamily of Cydnidae, but more recently retained its family status and due to the presence of a m-chromosome may not belong to Pentatomoidea. In the present paper, 66 taxa were studied and the states of 54 morphological characters were examined on specimens and compared with literature. The sotware Hennig86 was used to run the data matrix with the algorithm mh* and bb* combined with sucessive weighting. Three cladograms were obtained. The 62 taxa of the ingroup correspond to all nominal taxa below family level till now proposed to Pentatomoidea. The characters used by previous authors were reevaluated and new characters were added. The binary and multistate characters were coded as 0 (plesiomorphic) and 1, 2, 3 (apomorphic). Polarities were determined by outgroup comparison. One of the outgroups choosen were Idiostolidae which is more closely related to the presumed ancestor of the Tricophora than another taxon; the other one Aradidae was considered as the sister group to the remainder of the infraorder Pentatomomorpha.
Index terms: Heteroptera, true bugs, cladistics

[3634] CLADISTIC AND BIOGEOGRAPHICAL ANALYSIS OF OCHLERINI ROLSTON, 1981 (HEMIPTERA, PENTATOMIDAE, DISCOCEPHALINAE)

L. A. Campos, Dept. of Zoology, Univ. Fed. Rio Grande do Sul, Av. Paulo Gama s/n, 90046-900, Porto Alegre, RS, Brazil, E-mail: campos@portoweb.com.br.

The relationships among Ochlerini's genera are rather obscure, and in the most extensive work including all known genera they were empirically grouped according to diagnostic characters but no formal classification within the tribe was proposed. Furthermore cladistic studies for tribes and genera of Pentatomidae are relatively rare what is probably due to the little concordance among authors about the classification at subfamilial and tribal levels. In a previous study any of the Ochlerini genera were included in the analysis and Discocephalinae was represented by only one genus what does not cover all characters of the subfamily; besides, the whole analysis was done considering the common state within the ingroup as plesyomorphic to character polarization. Another cladistic analysis for Pentatomidae's tribes unfortunately did not include the exclusively Neotropical subfamilies and tribes. In the present study a cladistic analysis for the 30 genera of Ochlerini was performed to test its monophyletic condition and to propose a relationship hypothesis among its genera. Biogeographical considerations for Ochlerini and monophyletic groups among the tribe were done. The Pentatomini genus *Janeirona* and the tribes Discocephalini and Halyini were included in the ingroup to test their relationship relative to Ochlerini genera. Character polarization was made by the outgroup-comparison method and the Pentatomini genera *Marghita* and *Stictochilus* were used as outgroups. Cladistic analysis was done through the software *Hennig86* considering all multistate characters but two as non-additive. The algorithm used was 'mh*;bb*;' combined with successive weighting resulting in 6 cladograms; strict consensus cladogram was calculated. The obtained cladogram indicated that Ochlerini and Discocephalinae *sensu* Rolston are monophyletic groups, but Pentatominae, Halyini + Ochlerini, *Ochlerus* and *Stalius* are merophyletic groups. The topology of the obtained cladogram is shown here in parenthetic notation: (*Janeirona* (Halyini (Discocephalini ((*Adoxoplatys, Neoadoxoplatys*) (*Pseudadoxoplatys* ((*New Genus a* (*Orbatina* (*Coranda* (*Schraderia* (*Ochlerus b* (*Ochlerus a* (*Stalius trisinuatus* (*Stalius a* (*Moncus, Ochlerus handlirschi*))))))))) ((*Eritrachys, Phereclus*) (*Herrichella* (*Lincus* ((*Paralincus* (*Barola, Cromata, Catulona*)) ((*New Genus b*, *Tetrochlerus, Alathetus*) (*Aliiocoris, Parochlerus* (*Schaefferella* (*Miopygium* (*Uvaldus* (*Brachelytron* (*Forstona* (*Clypona, Macropygium*))))))))))))))).

Index Terms: Heteroptera, neotropical region, classification, monophyletic group

[3635] HIGHER CLASSIFICATION AND PHYLOGENY OF PODOPINAE (PENTATOMIDAE: PENTATOMOIDEA)

J. Vilimova, Department of Zoology, Charles Univ., Vinicna 7, Praha 2, Czech Republic, CZ 128 44.

The higher classification and relationships of the subfamily Podopinae within Pentatomoidea are not yet clear and, moreover, the position of certain subordinated taxa is not settled or even it is confused. A comprehensive study and revision of higher classification of the superfamily Pentatomoidea is necessary to explain the relationships within the whole taxon. Altogether 65 genera have been classified within Podopinae. In this contribution, somatic and genital characters were comparatively studied, and transformation series (plesiomorphic – apomorphic state) of selected characters were determined based on the ingroup and outgroup comparisons. The synapomorphies and the monophyletic groups were consequently determined. The monophyly of Podopinae was proved, however, the question of a sister group of Podopinae remains yet open. Five monophyletic groups within Podopinae were distinguished and suggested to be classified as tribes, i. e. Brachycerocorini, Deroploini (both newly established), Graphosomatini, Podopini and Tarisini. The classification within the subfamily Pentatominae was either proved or proposed for some taxa.

Index terms: somatic characters, genital characters, monophyletic groups, tribe

[3636] THE ENIGMATIC "ARROW-HEADED BUG" FROM AUSTRALIA (HETEROPTERA: PENTATOMOIDEA) AND ITS RELATIONSHIP

P. Štys, Dept. of Zoology, Charles University, Viniènà 7, Praha 2, CZ-12844, Czech Republic; E-mail alice.exnerova@atlas.cz

Adults and larvae of the strange "arrow-headed bug" (*AH*) live under scales of bark of a single *Eucalyptus* tree in dune area of Victoria desert in S Australia. A single male of another species was caught at flight in W Australia. The general facies of *AH* is unique, many character states are shared with the Pentatominae but some seem to be exclusive among the Pentatomoidea, Pentatomomorpha and even all the Heteroptera. So far two alternative hypotheses on the relationship may be entertained: (a) *AH* belongs to a new, strongly autapomorphic clade of the Pentatominae (related possibly to Mecideini or Diameniini), or (b) to a new, relict pentatomomorphan family with many homoplasious similarities with the Pentatominae. Anyway, the unique features of AH (overlooked elsewhere?) deserve attention from morphological and functional viewpoints. Holomorphology of *AH* and its phylogenetic position will be assessed. Selection of unique features (polarity not yet assessed) follows. (1) Exclusive general facies (depressed "lygaeid" or aradid-like appearance; pronotum quadrangular; antennae, membrane venation, orifices of metapleural scent glands as in Lygaeoidea; head strikingly long, with lateral preocular expansions). (2) Bases of labrum and labium separated by half the length of head. (3) Apex of anteclypeus much exceeding the apices of mandibular plates, freely protruding in larvae but enclosed by anteriorly expanded bucculae in adults (bucculo-anteclypeal sulcus formed). (4) Labium thin and long, situated within buccular cavity, thoracic tomentose groove, and abdominal supralabial concavity, the apex nearly reaching the genital segments. (5) Pattern of lateral abdominal trichobothria possibly reductionally derived from that of the pentatomoid type (2+2 or less), but with a unique configuration, and supplemented by a set of posteromedial trichobothria (1+1) on several segments. (6) Adults with paired L-shaped stridulitra on sternum 3; larvae IV and V with linear stridulitra along lateral margins of ventral laterotergites 2 and 3 laterad to spiracles. Presence of larval stridulitra in Hemiptera is known in the Reduviidae only; however, the lattter are homologous with those of the adults.

Index terms: morphology, ontogeny, phylogeny, classification.

[3637] PHYLOGENETIC RELATIONSHIPS AMONG BASAL DIPTERA: EVIDENCE FROM MORPHOLOGY AND DNA SEQUENCES

D. D. Judd, Dept. of Entomology, Oregon State University, Corvallis, OR 97331-2907 USA, Phone: 541-737-8174, Email: judd@bcc.orst.edu.

The "Nematocera" are a paraphyletic assemblage of superfamilial cladesconsidered to be primitive within the order Diptera. Some of the nematoceran families, such as Culicidae, Simuliidae and Ceratopogonidae containblood-feeding species that represent some of the most important vectors of human disease. In spite of prolonged research effort, the relationships among basal families of nematoceran flies are still subject to considerable debate. Recent hypotheses based on morphological or molecular characters are in considerable conflict with one another. In this study, characters from larval and adult life stages are combined with new sequence data from the 18S ribosomal RNA gene and published data from the literature to imply a phylogenetic hypothesis for relationships among these lineages, with particular emphasis on the Culicomorpha and Ptychopteromorpha. Relationships implied by data from different sources are compared and contrasted, and stability of the various inferred clades is assessed against the topology based on the combined evidence.

Index terms: Tanyderidae, Culicidae, Dixidae, Chaoboridae, Ptychopteridae

[3638] MOLECULAR EVIDENCE SUPPORTS, FAILS TO REFUTE, OR PROVOKES NEW MORPHOLOGICAL ASSESSMENT IN THE CHIRONOMIDAE (DIPTERA)

P.S. Cranston[1], O.A. Sæther[2] & L. Cook[3], [1] Dept of Entomology, Univ. of California, Davis, CA 95616, USA; [2]Mus.of Zoology, Dept of Zoology; Univ. of Bergen, Muséplass 3, N-5007 Bergen, Norway; Div. of Zoology & Botany, The Australian National Univ., Canberra, ACT 0200, Australia

In a pilot study of the application of molecular data for elucidating and testing pre-existing phylogenies in the Chironomidae, two mitochondrial genes, Cytochrome Oxidase subunit II (COII) and 16S rDNA have been sequenced. Sampling has been extensive to maximise subfamily representation, and selectively intensive at generic level in the subfamily Podonominae and Aphroteniinae, and at species level for the genera *Archaeochlus* and *Afrochlus*. The major robust finding at subfamilial level is confirmation from both molecules under all contraints of Sæther's postulation of the basal position of the subfamily Telmatogetoninae, as sister to the remaining subfamilies, analysed with maximum parsimony and with either Simuliidae or Ceratopogonidae as outgroup. Relationships between other sampled subfamilies show either long branch lengths subtending Orthocladiinae and Chironominae, have either poor support, or suffer saturation of COII signal. Strong support is found from 16S for monophyletic Orthocladiinae + Chironominae (O+C), Tanypodinae(T(O+C), and Aphroteniinae (A(T(O+C). Postulated relationships between the aforesaid and a monophyletic well-sampled Podonominae, monophyletic Diamesinae (Gondwanan Heptagiini + northern DIamesini), and uniquely represented Prodiamesinae are poorly supported or 'float', and evidently require further study. In the Podonominae, for which morphological phylogenies have been presented by Brundin (1966) and Cranston & Edward (1998), postulated generic inter-relationships are not refuted, albeit with weak support, thus far. A major difference from earlier studies is the molecular evidence that the Australian clade of 3 species of *Archaeochlus* Brundin is monophyletic, forming the sister clade to a southern African *Archaeochlus* which is proposed to include the genus-ranked monotypic *Afrochlus*. This contrasts with the previously argued position of *Afrochlus* as sister to African+Australian *Archaeochlus*. Re-examination of the morphology in the light of this hypothesis demonstrates that Cranston & Edward overlooked a structure of the male genitalia, evidently synapomorphic, involving an attenuation of the segment IX, and an asssociated shortening of the transverse sternapodeme in the African taxa, including *Afrochlus*. This feature, if scored for its several components in an already published matrix, overturns the previous morphological support for *Archaeochlus* monophyly, and confirms the molecular-based relationship.

Index terms: Molecular phylogeny, Subfamily, Podonominae, *Archaeochlus*

[3639] CONTRIBUTION OF JUVENILE, CHEMICAL, AND BEHAVIORAL CHARACTERS TO LEPIDOPTERAN SYSTEMATICS

A. V. L. Freitas and K. S. Brown, Jr, Depto. de Zoologia and Museu de História Natural, Instituto de Biologia, Univ. Estadual de Campinas, CP 6109, CEP 13083-970 Campinas, SP, Brazil E-mail baku@atribuna.com.br, phone: 55-19-7888492 FAX: 55-19-2893124.
Financial support: FAPESP, CNPq, CAPES, BSP, CIFOR.

Classical (W. Müller, A. M. Moss, R. F. D'Almeida) and recent studies with immatures of Lepidoptera in Brazil have shown that early stages can be an important source of data for systematics at many levels, especially when characters of adults give insufficient resolution. In the butterfly families Nymphalidae and Papilionidae, characters from eggs, larvae and pupae were important in defining or confirming the positions of many groups with uncertain affinities (ten genera of Ithomiinae, five of Biblidinae = Eurytelinae, five of Satyrinae, positions of *Bia*, *Calinaga* and Coloburini, species-groups in *Adelpha* and *Heliconius*, four genera of Graphiini and all genera/subgenera of world Papilioninae). Similarly chemical characters, both micromolecular and macromolecular (when treated from a perspective of genes, with due caution for lateral transfer and retrosynthetic induction) and behavioral characters (including of larvae, pupae and adults) have been found to be of value in detecting relationships not evident through the usual morphological characters (wing pattern, venation, genitalia, appendages, musculature and sclerites, that also complement each other in useful ways). Indeed, the best approach to the phylogeny of many butterfly groups has been to combine characters from many different aspects of the genome ("Total Evidence"). This demands a careful definition of character states and polarities, in a full range of genera, species and populations in the ingroup and a series of outgroups (not always easily attained for a given family, subfamily or tribe). Typically, separate analyses carried out with different types of data gave cladograms divergent from those using Total Evidence (which has the advantage of reinforcing congruent patterns and cancelling divergent elements). These results show that information from early stages, behavior, and chemistry can be very important in insect systematics, while a study using only adult morphology may be less than satisfactory for obtaining a robust phylogenetic hypothesis for a given group of holometabolous insects.

Index terms: Nymphalidae, Papilionidae, morphology, phylogeny, Total Evidence.

[3640] THE INFLUENCE OF DATA BASED ON BEHAVIOR AND THE MORPHOLOGY OF VARIOUS DEVELOPMENTAL STAGES IN A PHYLOGENETIC ANALYSIS OF EROTYLIDAE (COLEOPTERA)

J.V. McHugh[1] & P.E. Skelley[2], [1]Dept. of Entomology, University of Georgia, Athens, Georgia 30602-2603, USA, E-mail: jmchugh@bugs.ent.uga.edu; [2]Florida State Collection of Arthropods, 1911 SW 34th Street, Gainesville, Florida, 32614, USA, E-mail: afn07376@afn.org.

Erotylidae is a cosmopolitan family comprising about 2,500 species and 125 genera. Because no robust phylogenetic hypothesis is available for the family, the higher level classification is unsatisfactorily vague and evolutionary questions regarding this group remain unanswerable. A phylogenetic analysis is presented which utilizes more than 100 characters based on behavior and the morphology of larval, pupal and adult stages. Taxonomic exemplars include 44 erotylid species representing 25 genera and all five subfamilies. Eight species of Languriidae and Cryptophagidae are included as outgroups. Only a few behavioral characters could be used. No characters of egg morphology were found. Pupal and larval stages are rich sources of informative characters. The phylogenetic signals provided by all data sources are compared. A parsimony analysis of the combined data is discussed and the resulting taxonomic implications are summarized. Some paraphyletic taxa are identified and taxonomic reassignments are suggested.

Index terms: Cucujoidea, Pleasing Fungus Beetles, data congruence, phylogeny, cladogram

[3641] COMBINING DATA IN SYSTEMATICS: WHAT DO WE WANT TO ACHIEVE?

C. M. Penz, Department of Invertebrate Zoology, Milwaukee Public Museum, 800 West Wells Street, Milwaukee, WI 53233, USA and Curso de Pós-Graduação em Biociências, Pontifícia Universidade Católica do Rio Grande do Sul, Av. Ipiranga 6681, Porto Alegre, RS 90619-900, Brazil, tel. (541) 346-4507, fax (541) 346-2364, email: penz@darkwing.uoregon.edu

Combining data from different sources has been regular practice in morphological systematics (e.g., external plus internal anatomy; early stage plus adult), and recent advances in molecular techniques have greatly facilitated the use of multiple sources of data. It is theoretically self-evident that large data sets that combine information from multiple sources are favorable in systematic studies. However, rather than adding support to pre-existing hypotheses, incorporation of new data can alter tree topology, and separate analyses of data from multiple sources may produce different results. Incongruence between independent studies of the same taxa has motivated systematists to search for causes of conflict between data sets, and means for detecting conflict prior to of after analysis. Conflict between data of different sources arises when the evolutionary histories of species and characters are incongruous in one or more partitions. Systematists disagree as to whether conflicting data should be combined. This study identifies conflict between morphological and molecular data sets in passion-vine butterflies (subtribe Heliconiiti) where conflict is confined to a region of the tree involving the relationships among three genera (*Laparus*, *Neruda* and *Heliconius*). An *a posteriori* solution for this problem is presented, and its strengths and limitations are discussed.

Index terms: Heliconius Heliconiini morphology molecules congruence

[3642] THE PHYLOGENETIC UTILITY OF DIFFERENT CLASSES OF MOLECULAR SEQUENCE DATA AND ITS IMPLICATION FOR WEIGHTED ANALYSES

R. H. Baker, The Galton Laboratory, University College London, 4 Stephenson Way, London NW1 2HE, UK, phone:+44 171 504 5067 fax: +44 171 383 2048, E-mail: Richard.baker@ucl.ac.uk.

As the quantity and diversity of molecular data have expanded in systematic studies, there has been an increased emphasis on identifying more reliable types of data and accommodating this information into the tree-building process by either downweighting characters or separating data. Whether these strategies consistently improve phylogenetic estimation, however, is still unclear and there are, as yet, few comprehensive studies examining several diverse gene regions with a wide array of measures. In this study, I examined the phylogenetic utility of different classes of molecular data in a relatively large data set comprised of three mitochondrial and three nuclear gene regions for resolving relationships among 33 species of stalk-eyed flies. Using a number of different measures of utility such as partitioned Bremer support and the incongruence length difference, I focused on the distinction between mitochondrial and nuclear genes, and faster-evolving characters and slower-evolving characters. For the first comparison, by nearly any measure of utility, the nuclear genes are substantially more informative for resolving diopsid relationships than are the mitochondrial genes. The nuclear genes exhibit less homoplasy, are less incongruent both with one another and with the combined data, and contribute more support to the combined analysis topology than the mitochondrial genes. Results from the second comparison, however, provide little evidence of a clear difference in utility. Despite indications of rapid divergence and saturation, faster-evolving characters in both the nuclear and mitochondrial data sets still provide substantial phylogenetic signal. For instance, the nuclear third position sites exhibit some pairwise divergences in excess of fifty percent but contribute more support to the combined analysis tree than all the rest of the data combined and this support is present at all levels of the tree. In general, inclusion of the more rapidly evolving data consistently improves resolution, support and the congruence among partitions.

Index terms: Diopsidae; nuclear genes; saturation; incongruence; partitioned Bremer support.

[3643] THE INTERPLAY OF MORPHOLOGICAL AND MOLECULAR PHYLOGENETIC STUDIES IN THE NOCTUOIDEA

S. J. Weller, Dept. of Entomology, 219 Hodson Hall, 1980 Folwell Ave., St. Paul, MN 55108-6125 USA Phone: 612-625-6253, Email: welle008@maroon.tc.umn.edu

Molecular and morphological phylogenies provide evidence to support a redefinition of Noctuidae to a more restricted group that does not include many of the "quadrifid" subfamilies. As currently and popularly defined, Noctuidae is a paraphyletic grade that neither molecular nor morphological data support as a monophyletic group. The issues surrounding the diagnosis of monophyletic taxa (what is a noctuid? What is a catocaliid?) and both molecular and morphological support for and against traditional groups will be discussed. Finally, are we ready to redefine Noctuidae formally and place the non-noctuids in their own family or families? What further morphological and molecular data are needed for this step?

Index terms: Noctuidae, Catocalinae, Lepidoptera

[3644] TO COLLABORATE, COMPETE, OR IGNORE?

A. V. Z. Brower, Dept. of Entomology, Oregon State University, Corvallis, OR 97331-2907 USA Phone: 541-737-5531, Email: browera@bcc.orst.edu

The proliferation of molecular data in systematics has been accompanied by a proliferation of new analytical methods. Many of these approaches require explicit models of character state transformation, and result in hypotheses of relationship that can only be compared by topological congruence with hypotheses for the same taxa based on data from other sources. This talk will review what I consider to be the goals of systematic research – building on past hypotheses, combining new data with old data, and emphasize the importance of morphology to taxonomic endeavors. The acceptance of philosophically-sound standard approaches will be advocated as the best means to advance robust and stable phylogenetic hypotheses.

Index terms: Parsimony, maximum likelihood, molecular systematics, congruence

[3645] GENOME SIZE IN STREPSIPTERA

S. Johnston, Department of Entomology, Texas A&M University, Texas 77843-2475, U.S.A.

Caenocholax fenyesi (Strepsiptera:Myrmecolacidae) has the smallest genome of any insect measured to date. An order of magnitude smaller than the *Drosophila melanogaster* genome. And almost three orders of magnitude smaller than that of the largest insect genomes, the strepsipteran genome is an additional example of the uniqueness of this insect. The relative small genome size of Strepsiptera is presented in the greater context of the genome size of *D. melanogaster* and other insects. Genome sizes are known for only a few insects of economic interest and for *D. melanogaster*. For this report, nuclear isolation, propidium iodide stain and flow cytometry were used to examine genomic size in a large variety of insects. Using chicken red blood cells (2C=2.54pg.) as a standard, *D. melanogaster* 2C genome as .42 pg. was calculated – which value agrees well with earlier measurements based on scanning densitometry. Strepsiptera genome size was then estimated in comparison to that of *D. melanogaster*. It is to be noted that flow cytometric estimation of genomic size relies upon the stoiciometry of the dye, propidium iodide, and the choice of suitable standards for comparison, and it is shown that flow cytometric genome size estimates as usually, but not always, consistent with earlier reports. The genomic sizes that range from less than 1pg. to over 14pg. per 2C nucleus is reported here. Finally, the possible implications of the relatively small genome of Strepsiptera is discussed, and speculate upon the reason behind the reduced genomic size. The extraordinary reproduction potential of the strepsipteran female is considered a possible driving force maintaining the small genome size.

[3646] BIAS IN ESTIMATING PHYLOGENY WHEN RATES OF SUBSTITUTION VARY AMONG LINEAGES: WHY IS THE STREPSIPTERA PROBLEM SO DIFFICULT?

J. P. Huelsenbeck[1], [1]Dept. of Biology, Univ. of Rochester, Rochester, NY 14627, USA, E-mail johnh@brahms.biology.rochester.edu.

The phylogenetic placement of Strepsiptera with other insect orders has motivated a discussion of the biases present in different phylogenetic methods. Long branch attraction (the artificial joining of distantly related species) has long been recognized as a problem with all phylogenetic methods (although the problem appears to be more severe for the parsimony method which does not account for multiple changes at a site). Motivated by the observation that maximum likelihood does not join Strepsiptera and Diptera as a monophyletic group, it has been argued that long branch repulsion is a bias that is unique to maximum likelihood methods. Here I point out that maximum likelihood analyses are not subject to long branch repulsion under the correct model of evolution. If anything, maximum likelihood is subject to long branch attraction, just as parsimony is (although not as severely), when the model of evolution assumed by the method is incorrect. The phylogeny of Strepsiptera remains a difficult phylogenetic problem because of the extreme rates of evolution in observed sequences. The best hope for resolving this difficult problem is to collect more data (both morphological and molecular) and use phylogenetic methods that are not severely biased in the face of unequal rates of evolution.
Index terms: Strepsiptera, rates, phylogeny

[3647] MITOCHONDRIAL AND NUCLEAR DNA PHYLOGENETIC ANALYSIS OF STREPSIPTERA

N. R. Halbert[1], **J. Kathirithamby**[2], **R. Saff**[1] **& S. Johnston**[1], [1]Department of Entomology, Texas A&M University, Texas 77843-2475,U.S.A. [2]Department of Zoology, South Parks Rd., Oxford OX1 3PS, U.K.

The relationship between *Caenocholax fenyesi* (Myrmecolacidae) males (host: *Solenopsis invicta*) and putative females (host: *Hapithus agitator*) is examined. Further, the relationships between several unidentified myrmecolacid females from Papua New Guinea are determined. Methods were developed for extraction, amplification, and sequencing of mitochondrial and nuclear DNA from Strepsiptera. High-resolution mtDNA and nuDNA sequences obtained by these methods were used in the phylogenetic analysis of Myrmecolacidae. Phylogenetic Analysis Using Parsimony (PAUP) was employed in the investigation of myrmecolacid family structure using segments of the mitochondrial genes Cytochrome Oxidase Subunit I (COI) and 12S ribosomal RNA (12S rRNA) and the nuclear genes 18S rRNA and 28S rRNA. Approximately 1100 bases of DNA were examined between these 4 regions. Initial analysis of the mtDNA COI region showed 30% variation between the *C. fenyesi* male and putative female, 0.7% variation between two unknown myrmecolacid from West New Britain (WNB-A and WNB-B), and 20% variation between the WNB unknown species and an unknown myrmecolacid species from Popondetta (POP). Analysis of the mtDNA 12S region showed similarly high variation between the *C. fenyesi* male and putative female compared with other known members of the Myrmecolacid family. Members from 3 of the other 6 extant families of Strepsiptera (Elenchidae, Halictophagiadae, and Stylopidae) were used as outgroups in generating phylogenetic trees for each of the 4 regions examined. The 18S rRNA and 28S rRNA preliminary trees support the phylogeny established by the mtDNA analysis. The high degree of variation between the *C. fenyesi* male and putative female sequences indicate these individuals are not the same species. Additionally, this data provides evidence of at least three unidentified species from Papua New Guinea (WNB-A/B, WNB-C, and POP).

[3648] MORPHOLOGY AND BIOGEOGRAPHY OF FEMALE MYRMECOLACIDAE PARASITIC IN ORTHOPTERA IN PAPUA NEW GUINEA.

J. Kathirithamby[1], **T. Solulu**[2] , **S. Makai, N. Yaide, S. Nero, R. Caudwell & I. Orrell**[2], [1]Department of Zoology, South Parks Rd., Oxford OX1 3PS, UK, [2]Papua New Guinea Oil Palm Research Association, Dami Research Station, Kimbe, PO Box 97, West New Britain, Papua New Guinea.

In order to investigate the host reservoirs for *Stichotrema dallatorreanum* in Papua New Guinea, which is a parasite of *Segestidea novaeguineae* Orthoptera, a severe pest of oil palm, other orthopteran hosts were sampled for female Myrmecolacidae in the bush, both in the Mainland and West New Britain Province. We collected two hosts of Orthoptera in the West New Britain Province, and one species of Orthoptera in the Mainland parasitized by female Myrmecolacidae. Mitochnodrial DNA and nuclear DNA data has shown that these are indeed three different species and are not related to *S. dallatorreanum*. Here we discuss these three species in relation to the structure of the cephalothorax, microvillate cells, and apron.
Index terms: Orthoptera, apron, microvillate cells

[3649] HOST-PARASITE RELATIONSHIP OF *HALICTOPHAGUS NAULTI* PARASITIC IN LEAFHOPPER PESTS OF MAIZE IN MEXICO

G. Moya-Raygoza[1] **& J. Kathirithamby**[2], [1]Universidad de Guadalajara, Departmento de Botanica y Zoologia, Km 15.5 Carretea, Guadalajara-Nagales Las Aguas Nextipac, ZapopanJalico, Mexico, [2]Department of Zoology, South Parks Rd., Oxford OX1 3PS, UK.

An investigation of strepsipteran that are parasites of the corn leafhopper *Dalbulus maidis* is being conducted in Mexico. Central Mexico is considered the centre of origin of the corn leafhopper and its sister species because the highest diversity of *Dalbulus* occurs in this region. Therefore, we expect to find new parasites of the corn leafhopper. So far only hymenopterans and dipterans have been reported parasitizing the corn leafhopper in Central America and Mexico. A new species of Strepsiptera, *Halictophagus naulti* (Halictophagidae) was described by Kathirithamby and Moya-Raygoza (in press). The parasitized *D. maidis* were collected from maize plantations in Central Mexico, state of Morelos at 850 meters above sea level. The distribution of the new strepsipteran species coincides with the distribution of the corn stunt spiroplasma, which is one of the three pathogens transmitted by the corn leafhopper, which is one of the most important leafhopper pests of maize in Latin America.
Index terms: Strepsiptera, corn stunt spiroplasma

[3650] ECOLOGY OF TWO SPECIES OF STREPSIPTERA PARASITIC ON MANGO LEAFHOPPERS IN THE PHILIPPINES

V. Ocampo & G. M. Añober, Department of Entomology, University of the Philippines Los Baños, College, Laguna, Philippines 4031

The mango leafhopper problem exists wherever mangoes are grown. Of the three species reported in the Philippines - *Idioscopus clypealis, I. niveosparsus* and *Bakera nigrobilineata, I. clypealis* is considered the key pest damaging from 20-100% of the expected production. Two species of Strepsiptera was observed directly parasitizing *I. clypealis* from one of the six collection sites monitored. These two species are identified by Dr. J. Kathirithamby, and confirmed as new species under two different families recorded for the first time in the Philippines specifically attacking *I. clypealis*. The population trend of the parasitoids is density-dependent with its hosts. Based on external protrusions of the parasites, annual parasitization rate from 1994-1999 ranged from 0.64 - 2.79%. Maximum parasitization rate in a week was registered at 67.0%. Properly manipulated, these parasites could partially annihilate pre-flowering low population density of reproductive adult hosts.

[3651] SUPERPARASITISM IN STREPSIPTERA

S. Johnston[1] & J. Kathirithamby[2], [1]Department of Entomology, Texas A&M University, Texas 77843-2475,U.S.A. [2]Department of Zoology, South Parks Rd., Oxford OX1 3PS, U.K.

We report here on high levels of superparasitism of the red imported fire ant by males of *Caenocholax fenyesi*, and compare levels of superparasitism in different ant casts. The largest workers (by weight) have both the greatest average amount of superparasitism 54.4%, and the greatest number of superparasitism was 2-4 *C. fenyesi* per worker, while the minor workers have the lowest levels of superparasitism thus closely reflecting the mean level of parasitism. The probability density function formed by the number *C. fenyesi* males per ant fit that 54.4% of the major workers were stylopised.

[3652] INITIAL OBSERVATIONS OF THE STREPSIPTERAN *XENOS VESPARUM* IN THE PAPER WASP *POLISTES DOMINULUS*

D. Hughes[1], J. Kathirithamby[1] & S. Turillazzi[2], [1]Department of Zoology, South Parks Rd., Oxford OX1 3PS, U.K. [2]Dipartimento di Biologia Animale e Genetica, Universita di Firenza, Via Romana 17, 50125, Firenze, Italy.

The Strepsipteran *Xenos vesparum* is found throughout Europe. It parasitizes the paper wasp *Polistes dominulus*. In Tuscany *X. vesparum*. appears to be bivoltine; the first generation infecting the worker caste of wasps whilst the second invests the sexual caste. Female *X. vesparum* overwinter in the host following sex with free living males in August. They produce the 1st instar stage following host emergence in spring. Approximately 2,500 1st instars are produced by the female and 1st instar emergence is entirely cue driven. The 1st instars are highly mobile and actively search for a new host once on a paper wasp nest. They infest worker destined wasp larvae. Worker wasps that are infected do not to take part in colony activities i.e work and behavioural changes occur. These take the form of aggression by colony members towards parasitized workers and possible 'aggregation behaviour' of parasistized individuals. The latter element may exist to facilitate Strepsipteran reproduction. Following mating of *X. vesparum* 1st instars are then released and these invest the sexual caste larvae. Mating of *X. vesparum* parasitizing the sexual caste occurs in August and following this the females overwinter within female hosts.

[3653] WHY DO MALE AND FEMLAE *PSEUDOXENOS IWATAI* (STYLOPIDAE) EXTRUDE AT DEFINITE POSISITONS ON THE HOST METASOMA?

Y. Maeta[1], K. Gôukon[2] & R. Miyanaga[3], [1]Faculty of Life & Environmental Science, Shimane University, Matsue, 690-8504 Japan; [2]Faculty of Technology, Tohoku-gakuin University, Tagajyo, 985-1115 Japan; [3]Faculty of Life & Environmental Science, Shimane University□Matsue, 690-8504 Japan

Mono-parasitized male and female *Pseudoxenos iwatai* (Stylopidae) extrude the cephalotheca and cephalothorax between 3-4 tergites and 4-5 tergites, respectively. When poly-parasitized, some males and females have to extrude between other tergites. The favored positions (3-4 for females and 4-5 for males) seem to be preferable for propagation. Why they do choose these respective positions for extrusion is difficult to answer, but its advantage can be estimated by comparing their extruding order and size. We traced the development and extrusion by observing the entry of the first instar larva of *P. iwatai* into the host till its extrusion through the host metasoma as pupae (in case of males) and as neotenic adults (in case of females). A total of five instars were recognized in *P. iwatai*. The first instar larva began by piercing a hole with its mandibles at various parts on the chorion of host egg, indicating that no selection of the exact position of entry occurred at this stage. The second instar larva, moulted beneath the cuticle of the host first instar larva, and remained this stage until the host developed into the prepupae. Ecdysis into the third instar occurred when the hosts became prepupa. The third instar larva of *P. iwatai* has projections on the dorsal side of the body, which is characteristic of this instar. The orientation for extrusion seems to be performed at this third instar stage, and the fourth instar larva was already situated at destined positions in the host metasoma from where it would extrude henceforth. It was clear that those individuals who occupied the correct positions developed faster and their body size was larger than those that situated other positions.

Index terms: Parasitic position; development, ecdysis.

[3654] SEASONAL CHANGES IN PARASITISM LEVELS AND SEX RATIOS OF THE STREPSIPTERON *XENOS MOUTONI* PARASITIZING JAPANESE HORNETS COLLECTED WITH BAIT TRAPS

S. Makino, Insect Taxonomy and Ecology Lab., Forestry and Forest Products Research Inst., Kukizaki-machi, Ibaraki Pref., 305-8687, Japan, E-mail makino@ffpri.affrc.go.jp

Xenos moutoni is a parasite of hornets, and recorded from six *Vespa* species in Japan. Parasitized insects do not show foraging activities if they are workers or lose reproductive abilities if males or new queens. More interestingly, parasitized workers sometimes overwinter like new queens. Thus, the parasite can give some effect on population dynamics of the host species. However, bionomic information of the parasite is still insufficient, partly because parasitized hornets are rarely found in the field. I found many stylopized individuals of four *Vespa* species among specimens collected with bait traps which were set in forests or other environments in central and southern Japan. Stylopized hornets were collected between May and mid October. In southern Japan, the overall rate of stylopized female hornets (queens or workers) was largest in *Vespa analis* (11.2 %), followed by *V. mandarinia* (4.3), *V. ducalis* (4.2), and *V. simillima* (1.7). Male hornets were also stylopized in *V. analis* (6.4 %) and *V. ducalis* (1.7). In central Japan, *V. analis* had similar or higher parasitic levels (14 to 18 % in females), while virtually no parasitized individuals were collected in the other *Vespa* species. The following description was based on specimens collected in southern Japan. The number of parasites per host varied from one to five, though 60 % of hosts were singly parasitized. Male parasites were not collected before late July, but they outnumbered females in September and early October. The percentage of stylopized individuals among overwintered queens was estimated at 15 % in *V. analis* and 4 % in *V. mandarinia* and *V. ducalis*. Stylopized workers that had overwintered were found: they accounted for 24 to 44 % of overwintered stylopized females in the three host species. Workers were most frequently stylopized in August in *V. mandarinia* and in September in *V. analis* and *V. ducalis*. Cephalothorax widths of female parasites were positively correlated with head widths of female hosts in *V. analis*, *V. mandarinia* and *V. ducalis*. Multiple parasitism on single females decreased the average size of female parasites in *V. analis*.

Index terms: eusocial wasp, Vespa, parasitism, stylopization, natural enemy

[3655] A SURVEY OF THE STRUCTURE OF THE APRON IN THE EXTANT FAMILIES OF STREPSIPTERA

J. Kathirithamby, Department of Zoology, South Parks Rd., Oxford OX1 3PS.

The female strepsipteran at the late IVth instar extrudes its anterior region (the cephalothorax) through the host cuticle (except in the family Mengenillidae) and becomes neotenic female adult. As from this stage the female has no mouth opening. It was found that ventral to the cephalothorax is a region with several cuticles and one of it is analogous to the peritrophic matrix in the midgut of most insects. This region was named the apron (Kathirithamby, in press). In this region there are openings leading into the female and the number varies from species to species and is one of the few taxonomic characters used for the female. This study is a survey of the apron in extant families of Strepsiptera. The passageway in this region is referred to as the brood canal. Sperm is said to enter the female body via the brood canal opening down the brood canal and into the female body via the trumpets. When the 1st instars are developed they move from the body of the mother via the trumpets, into the brood canal and out to the open via the brood canal opening. Hence the area of the apron serves a dual purpose for the female strepsipteran.

Index terms: cephalothorax, peritrophic matrix, brood canal

[3656] HISTOCHEMICAL AND MOLECULAR EVIDENCE OF PEROXIDASE ACTIVITY IN *SEGESTIDEA NOVAGUINEAE* (ORTHOPTERA) AND *STICHOTREMA DALLATORREANUM* (STREPSIPTERA)

T.Douroupi[1], O.Konstandi[1], J.Kathirithamby[2] & L.H.Margaritis[1], [1]Fac. of Biol., Dep.of Cell Biol. & Biophysics, Univ. of Athens, Panepistimopolis, Kouponia, Athens, GR-15701, Greece, e-mail: lmargar@cc.uoa.gr. [2]Dept. of Zool., Oxford Univ., South Parks Road, Oxford OX1 3PS, U.K. This work was supported by a Royal Society and National Hellenic Research Foundation collaborative project grant to Prof. L.H. Margaritis and Dr. J. Kathirithamby. We thank the Oil Palm Research Association, Papua New Guinea for the insect specimens.

The system of host (*Segestidea novaguineae*) and parasite (*Stichotrima dallatorreanum*) is a complicated and interesting one, since the parasite depends totally on the living host for its survival. The neotenic female strepsipteran is totally endoparasitic in the host and acts as an incubator for the development of germ cells and embryos via heamocoelic vivipary. Stylopization results in severe deformations of the host's morphology and egg structure. Peroxidase activity was detected in light and TEM sections of *S. novaguineae* and *S. dallatorreanum* follicles stained with diaminobenzidine and H_2O_2. Chorion peroxidase has been studied in Diptera and is considered to play a crucial role in chorion hardening via the formation of di- and tri- tyrosine bonds. The endogenous fluorescence observed in the chorion may also be attributed to the presence of such bonds. Primers from conserved regions of mammalian and insect peroxidases were used in polymerase chain reactions on host and parasite genomic DNA. The PCR products were subcloned in PBS KS+ plasmid vector. Sequencing of PCR products revealed high similarities to insect peroxidases and specifically to the cDmPO clone, isolated from a *Drosophila melanogaster* embryonic cDNA library and the *Aedes aegypti* (mosquito) peroxidase.

Index terms: Orthoptera, Strepsiptera, peroxidase, chorion hardening, parasite- host-interaction

[3657] BASAL DIPTERA PHYLOGENY

D. S. Amorim, Depto. de Biologia-FFCLRP, Universidade de São Paulo, Av. Bandeirantes 3900, 14.040-901 Ribeirão Preto SP, BRAZIL. E-mail: dsamorim@usp.br.

The fact the Willi Hennig –the German entomologist who developed the method of phylogenetic reconstruction–, was himself a dipterist has been obviously decisive to move the phylogenetic reconstruction of Diptera evolution a step ahead of maybe any other group. This does not mean that Hennig was correct about all sister group relationships and hypothesis of monophyly proposed. He has correctly assessed the relationships in many of the subgroups of Diptera, but more than that, he fed the literature with a number of ideas, hypothesis and reconstructions that have been used as fuel to put forward the debate in the group. Hennig's main hypothesis for the basal relationships of the Diptera can be synthesized by the scheme (Tipulomorpha + (Psychodomorpha + (Culicomorpha + (Bibionomorpha + Brachycera)))). This means that the "Nematocera" would not be a monophyletic group and, hence, it should be abandoned as a taxon name in the literature. More recent analyses agree that the Nematocera are not monophyletic, but showed a different topology for the relationships among the main dipteran basal stems. The most important of these papers, published by Mounty Wood and Art Borkent considered in detail larval characters, differently from Hennig's strong dependence on adult characters. Some of the main differences of their system concern the Psychodomorpha, which they show not to be monophyletic and the exclusion of the Trichoceridae from the Tipulomorpha. More recently, other analyses considered new data –as thorax morphology–, reanalyzed published information, and now molecular data is beginning to be used in very careful approaches. The picture shows that the phylogenies proposed in the literature (based on different data sources) are at least partially incongruent. However, not much attention has been given to explain in each paper the incongruence with opposing systems. In this paper, the morphological data of immatures and adults is reconsidered, trying to solve the problem of conflict among the phylogenies proposed in the literature.

[3658] AN OVERVIEW OF THE SYSTEMATICS OF THE NEOTROPICAL CULICIDAE

D. S. Amorim.

ABSTRACT NOT RECEIVED

[3659] RECENT ADVANCES ON THE SYSTEMATICS OF THE CROCIDIINAE (DIPTERA, BOMBYLIIDAE)

C.J.E. Lamas[1, 3], N.L. Evenhuis[2] & M.S. Couri[3], [1] Universidade Estadual Paulista – UNESP – Botucatu, São Paulo. (FAPESP fellow, grant 98/07703-5) [2] Bishop Museum, 1525 Bernice Street, Honolulu, Hawaii 96817, USA. [3] Museu Nacional, Quinta da Boa Vista, São Cristóvão, 20940-040, Rio de Janeiro, RJ, Brazil.
E-mail: einicker@acd.ufrj.br.

The Crocidiinae are presently represented by 9 genera and 37 species, known from almost all biogeographical regions, except for Australasian and Oriental. *Apatomyza* (1 spp), *Adelogenys* (3 spp) and *Crocidium* (21 spp) occur in the Afrotropical region, except for one Palaearctic species of *Crocidium*; *Mallophthiri a* (1 spp) and *Megaphthiria* (4 spp) are Neotropical; *Semiramis* (1 spp) and *Timiomyia* (1 spp) are Palaearctic and *Desmatomyia* (4 spp [including 2 fossil]) and *Inyo* (2 spp) are Nearctic. These genera have been considered in various subfamilies (Bombyliinae (Crocidiini), Phthiriinae, Desmatomyiinae). Although the limits of the Crocidiinae remain to be determined, its monophyly is supported by two synapomorphies: midtibial spurs and coxal peg present. The main objective of this study is the revision of the genera and the contribution for the comprehension of the phylogenetic relations among the included taxa. The material examined belongs to "Museo Nacional de Historia Natural" (Chile); "Natal Museum" (South Africa); "South African Museum" (South Africa). The studies include the taxonomic revision of all genera, except *Desmatomyia* and *Inyo*, already revised. A careful morphological examination, specially related to the spermathecae, is providing bases for the comprehension and erection of characters which will be used in the phylogenetic analysis. The first results obtained are concerned with the revision of *Apatomyza* and *Adelogenys*, which proved to be synonyms, *Apatomyza* being the valid name. The genus can be easily distinguished by the very reduced genae, apex of scutellum overtaking the anterior margin of abdominal tergite 1, wings very large and elongate, alula reduced and gonostylus bifid. Besides the redescription of the genus, 2 species were synonymized and 3 new ones were described. The revision of *Crocidium* resulted in the discovery of 6 new species to this genus. *Crocidium* can be characterized by the humped body, the rather sparse pubescence and the absence of bristles and the almost straight R1 vein. Although the taxonomic investigation of the other genera are still in progress, a comparison on the morphology of the spermatheca of all genera can clarify some relationships. Partial results on the study of the morphology showed that the following characters will be used in the cladistic analysis: male eye separation; flagellum length; number of flagellomeres; width of genae; wing pigmentation; discal cell shape; anepimeron vestiture; gonostyli shape; gonocoxal fusion; shape of female sternite 8; and spermathecal sclerotization.
Index terms: Adelogenys, Apatomyza, Crocidium.

[3660] A NEW PHYLOGENETIC CLASSIFICATION OF THE EMPIDOIDEA (DIPTERA: EREMONEURA)

J.M. Cumming[1] & B.J. Sinclair[2], [1]Systematic Entomology Section, ECORC, Agriculture and Agri-Food Canada, Ottawa, Ontario, Canada K1A 0C6; [2]Zoologisches Forschunginstitut und Museum Alexander Koenig, Adenauerallee 160, D-53113 Bonn, Germany.

A phylogenetic classification of the higher taxa of Empidoidea is proposed based on a cladistic analysis of the superfamily. More than 125 characters were scored from nearly 60 exemplar taxa, including many plesiomorphic Southern Hemisphere genera that were overlooked in previously published treatments of the superfamily. Outgroups were selected from basal lineages of the Cyclorrhapha to represent the rest of the Eremoneura and from appropriate taxa of Asiloidea. Four families of Empidoidea are now recognized, namely the Empididae, Hybotidae, Brachystomatidae, and Dolichopodidae, in contrast to either the two or five empidoid families of previous classifications. Four separate lineages are additionally assigned as *incertae sedis* within the superfamily, namely the *Iteaphila* group, the *Ragas* group, *Oreogeton*, and *Homalocnemis*. The Empididae is now restricted to the Clinocerinae, Hemerodromiinae, Hilarini, Empidini, and several flower-feeding genera. The newly proposed Brachystomatidae includes the Brachystomatinae, Trichopezinae and Ceratomerinae. The Dolichopodidae is expanded to include the Parathalassiini and the relatively plesiomorphic genera *Microphor* and *Schistostoma*. The redefined Hybotidae is composed of the Atelestinae, *Nemedina*, *Trichinomyia*, Ocydromiini, *Trichina*, Oedaleini, Tachydromiinae, and Hybotinae (which now includes the *Bicellaria* group). Certain additional empidoid subfamilies will need to be recognized within this classification, either for the first time or by elevating existing tribes to subfamily level.
Index terms: Brachycera, empidoid, Cyclorrhapha, predators, cladogram

[3661] FENNOSCANDIAN *HILARA* SPECIES (DIPTERA: EMPIDIDAE) AND THEIR SUPPOSED CIRCUMPOLAR DISTRIBUTION

M.Chvála, Dept. of Zoology, Charles Univ., CZ-128 44 Praha 2, Czech Republic. E-mail mchvala@prfdec.natur.cuni.cz

A thorough study of the Fennoscandian *Hilara* species in the main collections of the Fennoscandian Museums and Institutions yielded 69 species. Of these only 8 (*H.abdominalis, H.bistriata, H.chorica, H.griseola, H.hybrida, H.intermedia, H.interstincta* and *H.nitidula*) are very common even in the extreme north and are the main possible candidates for circumpolar distribution. The genus *Hilara* is much more purely represented in North America; altogether 40 species were listed in the Nearctic Catalogue in 1965, but a realistic number of Nearctic species (at least 15 awaiting description) would appear to be less than 60. For comparison, in the Palaearctic region the same number of species is known from the Netherlands only. Surprisingly, only one species, *Hilara interstincta*, has been with certainty found to be Holarctic in distribution. It has also been recently discovered in Canada in Labrador, Quebec and Ontario. The published record in the Nearctic Catalogue of the occurrence of the western Palaearctic *Hilara quadrivittata* in Alaska, and included also in the Palaearctic Catalogue in 1989, has not been verified and seems very unreliable. The faunas of northern hemisphere are very different in the New and Old World. The Nearctic *Hilara* are represented for instance by the very characteristic *H.femorata* group of species, for which Frey, in 1952, erected the distinct subgenus *Ochtherohilara*. This monophyletic group is represented in North America by at least 8 species (some await description), it is absent in Fennoscandia and generally in western Palaearctic, but 2 species of this group are known from Japan (*H.mantis, H.mantispa)* and one undescribed species from the Far East (Ussuri region). There are only a few Nearctic species of *Hilara* which apparently have close relatives in Fennoscandia: *H.tristis* is closely related to *H.anglodanica*, *H.nigriventris* to the European *H.hyposeta*, and finally *H.auripila* of the *Hilara maura* group is closely related to the European *H.discoidalis*.
Index terms: Palaearctic, Nearctic, Holarctic, fauna, *Hilara interstincta*.

[3662] BIOLOGY OF *SEPEDONEA*, A NEOTROPICAL GENUS OF SNAIL-KILLING FLIES (DIPTERA: SCIOMYZIDAE)

J. Abercrombie, Davey Resource Group, P.O. Box 5193, Kent, OH 44240, USA, E-mail jabercrombie@davey.com.

The biology of the Neotropical genus *Sepedonea* (Diptera: Sciomyzidae) is reviewed, including observations on geographical distribution, seasonal occurrence, life histories, mating behavior of adults, and feeding behavior of larvae. The review concentrates on six of the twelve species that occur mainly in South America and whose life histories and immature stages are known: *S. guianica, S. incipiens, S. lagoa, S. lindneri, S. telson,* and *S. trichotypa*. These data are compared with two other species (*S. guatemalana* and *S. isthmi*) that are found mainly in Central America and whose life histories have been published previously. The species of *Sepedonea* form a biologically homogenous group. Larvae are active, aggressive predators, killing and devouring many freshwater, non-operculate gastropods during their three stadia. The total duration of larval life ranges from nine to 44 days in the laboratory.
Index terms: *Sepedonea guianica,* snail, aquatic, life history

[3663] A PHYLOGENETIC STUDY OF THE TRIBE *DRYXINI* (DIPTERA: EPHYDRIDAE

W. N. Mathis[1] & T. Zatwarnicki[2], [1]Dept. of Entomology, National Museum of Natural History, Smithsonian Institution, Washington, D.C. 20560-0169, U.S.A; [2]Dept. of Zoology, University of Agriculture, ul. Cybulskiego 20, 50-205 Wroc_aw, Poland.

The shore-fly tribe Dryxini, which now includes eight genera, is revised, including a cladistic analysis at the generic level. Two of the genera, *Omyxa* and *Papuama*, are new, as are their respective type species. Of the remaining six genera, the species are revised for *Dryxo* Robineau-Desvoidy, *Corythophora* Loew, *Oedenops* Becker, and the subgenus *Phaiosterna* Cresson of the genus *Paralimna* Loew. In addition, the species of *Afrolimna* Cogan, *Oedenopiforma* Cogan, and the *limbata* group (*Paralimna*) are reviewed. Our cladistic analysis is based on 30 morphological characters and resulted in a single most parsimonious cladogram of 43 steps with consistency and retention indices of 0.79 and 0.83 respectively. The tribe is divided into two primary sublineages in the resultant cladogram. The first sublineage comprises four genera (number of species indicated in parenthesis), *Afrolimna* (2), *Dryxo* (9), *Corythophora* (2), and *Omyxa* (1), with the first genus as the sister group to the remaining genera and with *Corythophora* as the sister group to *Dryxo* and *Omyxa*. All genera of this sublineage occur in the Old World only, with greatest species diversity in Africa. The second primary sublineage includes five genera and over 95 species. The five genera of this sublineage are grouped into two clades with *Paralimna* (>85) alone as the sister group to *Papuama* (2), *Oedenops* (3), and *Oedenopiforma* (4) and with *Papuama* as the sister group to the latter two genera. *Paralimna*, which currently has greater diversity that the rest of the tribe combined, is pantropical with numerous species ranging into subtropical regions. *Oedenops* is also pantropical and subtropical, but *Papuama* is Australasian/Oceanian and *Oedenopiforma* is Old World, primarily in Africa and Australia.
Index terms: revision, cladistic analysis.

[3664] RECENT ADVANCES ON THE PHYLOGENY AND BIOGEOGRAPHY OF MUSCIDAE (DIPTERA)

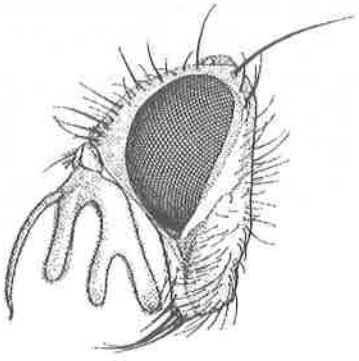
M. S. Couri[1], C. J. B. Carvalho[2], [1]Dept. of Entomology, Museu Nacional, Quinta da Boa Vista, 20940-040, Rio de Janeiro, RJ, Brasil, Email mcouri@ibm.net; [2]Dept. of Zoology, Universidade Federal do Paraná, 81531-990, Curitiba, Paraná, Brasil, Email cjbcarva@bio.ufpr.br.

Passeromyia Rodhain & Villeneuve and *Philornis* Meinert are two of the most interesting muscid genera, regarding the biology of the larvae, which are parasites of birds, ranging from scavengers in the nests to subcutaneous bloodfeeders. *Passeromyia* is known from 5 species (Palaeotropical and Oriental regions; Australasia and the Western Pacific) and *Philornis* is known from 50 species (mainly Neotropical). Besides the similarities of the larval behaviour, they also share in common some morphological characters. Opinions on the relations between them and their systematic position among the Muscidae have varied. This survey aims to clear this discussion and give an overview of the classification of the Muscidae on the bases of cladistic methodology. The material used belongs to Museu Nacional, Rio de Janeiro; The Natural History Museum, London; Canadian National Collection of Insects, Ottawa, and Australian National Insect Collection, Canberra. 24 terminal taxa were analysed based on 59 characters. The cladistic analysis were carried out using Hennig86. The relations showed in the cladogram corroborate previous classification proposals for Muscidae, with the following monophyletic groups and respective synapomorphies: Muscinae (*Morellia+Musca*): tergites of the female ovipositor anchor-type; sternite 8 with strong bristles and egg *Musca*-type; Azelinae, (*Microcalyptra* + *Hydrotaea*): katepisternals 1:1, no setae on posterior apical margin of hind coxa and male distiphallus with the juxta armed with tiny spinules; Mydaeinae (*Scutellomusca+Mydaea*): hypoproct of the ovipositor modified and with spines; and Coenosiinae *(Limnophora+ Coenosia+Neodexiopsis*): reduced number of frontal bristles, labellum reduced, prestomal teeth developed, prealar seta absent, katepisternals 1:1:1 disposed as an equilateral triangle, anal vein short and hypandrium of the male terminalia. *Philornis* and *Passeromyia* formed a monophyletic group with the following synapomorphies: larvae parasites of birds, and the presence of a range in the larval habits. The distribution patterns of these genera suggests that its ancestor may have appeared back in the Early Cretaceous. The relations among *Charadrella+Allaudinella+Aethiopomyia* and *Ocrhomusca* in some ways, also corroborates with this idea. Except for *Aethiopomyia*, whose larval habits are unknown, the other three genera are known as parasites of snails. This character is an exclusive apomorphy for that group. The close relations between *Calliphoroides* and *Reinwardtia*, previously mentioned by many authors are corroborated in this analysis.
Index terms: *Passeromyia*, *Philornis*, Cladistics, Biogeography

[3665] NATIVE NEW WORLD RHINOPHORIDAE (DIPTERA) AND THEIR TRANSANTARCTIC TIES

T. Pape, Dept. of Entomology, Swedish Museum of Natural History, P.O. Box 50007, SE - 104 05 Stockholm, Sweden, E-mail: thomas.pape@nrm.se

Rhinophoridae were hitherto considered absent from the New World, except for a few species introduced from western Europe. New insight into oviposition and morphology of eggs and first instar larvae of an undescribed species of *Bezzimyia* from Venezuela brings substantial evidence that this genus belongs to the Rhinophoridae. *Bezzimyia* was previously known in only two species but is shown to contain more than a dozen species occurring mainly in the warmer parts of the New World, and in the tropical parts especially at middle elevations. Other New World genera with a more corroborated position in the Rhinophoridae are the monotypic *Shannoniella* and *Trypetidomima*; both previously contained in the Tachinidae and with biology and morphology of immatures unknown. Additional Neotropical rhinophorid taxa, still undescribed, occur, which are phylogenetically close to *Bezzimyia*. The native New World Rhinophoridae form a clade containing even the Australasian taxon Axiniidae, as indicated by shared features in male genitalia (surstylus fused to epandrium) and other features of adult morphology. Further support comes from the discovery of undescribed Australian species-group taxa bridging the gap between the morphologically highly derived Axiniidae and the native New World Rhinophoridae. Several character states of adult Axiniidae previously interpreted as plesiomorphic (e.g., non-alternating postocular setae, straight wing vein M, non-divided dorsal sclerotization) are now better considered as reversals or homoplasies. The Austral-asian taxa appear to have a non-basal position within the *Bezzimyia*-Axiniidae clade, indicating a true transantarctic distribution. Phylogenetic affinities of the *Bezzimyia*-Axiniidae clade within the Rhinophoridae need further study, but the currently most corroborated sister-group candidate is the genus *Malayia*, which is the only genus of Rhinophoridae so far known from South East Asia.



Index terms: *Bezzimyia*, Axiniidae, larval morphology, phylogeny.

[3666] PHYLOGENETIC RELATIONSHIPS AMONG THE POLIDEINI (DIPTERA: TACHINIDAE)

J.E. O'Hara, Systematic Entomology Section, Eastern Cereal and Oilseed Research Centre, Agriculture and Agri-Food Canada, Ottawa, Ontario, Canada K1A 0C6.

The newly defined Polideini (=*Lypha* group) is a mostly New World taxon comprising about 150 described species and about 50 currently recognized genera within the subfamily Tachininae. Members of this tribe mainly parasitize Lepidoptera but some species attack the most unusual hosts recorded for the Tachinidae: scorpions, centipedes, spiders, cockroaches and crickets. Species attacking these unusual hosts often have morphological adaptations which are presumably associated with searching for ground-dwelling nocturnal or crepuscular prey. Taxa assigned to the Polideini vary greatly in appearance from large colourful setose flies to tiny black nearly bare flies, with patterned wings in some species and bifid or trifid antennae in some others. These differences in appearance have led authors to disperse polideines among about 10 other tribes and 2 subfamilies of Tachinidae. The Polideini as currently defined is believed to be monophyletic on the basis of the shared possession of such apomorphic states as a long anepimeral (pteropleural) seta, V-shaped opening of the posterior thoracic spiracle, narrow V-shaped process on median lobe of male sternite 5, and uniquely shaped distiphallus. Numerous new species are recognized within the tribe from the Nearctic and Neotropical regions along with several new genera, and a number of new generic synonymies are proposed for the Neotropical taxa. A phylogenetic analysis of the genera of Polideini will be presented with an emphasis on the taxa of America north of Mexico. The monophyletic nature of the Polideini will be reviewed and its position within the Tachininae discussed.

Index terms: tachinid, *Lypha* group, systematics, parasitoids

[3667] PHYLOGENETIC TRENDS IN THE TRIBE MELOLONTHINI (COL., SCARABAEIDAE, MELOLONTHINAE) IN THE HOLARCTIC REGION. A BIOGEOGRAPHIC APPROACH

M. Coca-Abia, Museo Nacional de Ciencias Naturales (CSIC), Dpto. Biodiversidad y Biología Evolutiva, José Gutiérrez Abascal, 2 28006 Madrid (Spain), E-mail: mcnc171@mncn.csic.es

The tribe Melolonthini is one of the most diverse Melolonthinae tribes in the world. In the Holarctic Region it is composed of genera considered to be a large pest of crops in North America, Europe and Asia. Although all these genera produce an economic impact, the generic relationships and the natural groups have never been established, and a biogeographic hypothesis has not even been purposed so far. For that, the aim of this research is to establish the natural groups and their phylogenetic relationships, and to propose an evolutionary hypothesis of the tribe Melolonthini in the Holarctic Region. The data set comprises 58 characters and 53 taxa from external morphology, mouth parts and male and female genitalia. Criteria for tree choice were miniminum length parsimony and parsimony under characters weighted by maximum value of rescalated consistency index. The analysis yielded 4 equally parsimonious cladograms, which after successive weighting resulted in one minimun-length cladogram (CI=0.443, RI=0.743, L=538). This phylogenetic hypothesis suggests that the tribe Melolonthini is a paraphyletic group. Two principal lineages are recognized as subtribes Melolonthina and Rhizotrogina. In addition, the subtribe Diplotaxina should be raised to tribal rank and the genus *Apogonia* has to be included in it, together with *Diplotaxis*. The historical biogeography of the tribe was reconstructed using dispersal-vicariance analysis with DIVA 1.1. The results suggest that the tribe primarily diversified within the Northern Oriental + Eastern Palearctic + Western Nearctic. A first vicariant event separing the tribe Diplotaxini on Eastern Palearctic from the tribe Melolonthini on Northern Oriental and Western Nearctic. Later, a second vicariant event would isolate the subtribe Rhizotrogina on the Western Nearctic where it radiated. The subtribe Melolonthina would remain on the Northern Oriental from where it would have spread towards Western Europe and the Mediterranean basin. After, dispersive processes via Beringia would allow the distribution of the Rhizotrogina toward Eastern Palearctic. Succesive dispersions would end up in the present distribution.

Key words: evolution, cladistic analysis, vicariance, Rhizotrogina, Melolonthina.

[3668] STUDIES ON COSTA RICAN SCARABAEINAE (COLEOPTERA: SCARABAEIDAE)

A. Solís[1] & B. Kohlmann[2], [1]Instituto Nacional de Biodiversidad, Apartado 22-3100, Santo Domingo de Heredia, Costa Rica. E-mail: asolis@inbio.ac.cr; [2]Escuela de Agricultura de la Región Tropical Húmeda, Apartado 4442-1000, San José, Costa Rica. E-mail: bkohlman@ns.earth.ac.cr

Scarabaeinae are important elements of any ecosystem, since they actively degrade feces, dead bodies and dead plant material, thereby competing directly with flies and reducing their numbers, besides loosening soil, improving soil fertility, aeration and rain flow, among other things. They are also a biodiverse group, especially in the tropics, it is estimated that the group comprises around 5,000 species. They can also be used as reliable bioindicators. However, their systematics, ecology, biogeography and general biology remain poorly known. The aim of the present project is to make monographic revisions of the different genera of Costa Rican Scarabaeinae, which are presently estimated at 174 species and 23 genera. The base material for the study comes mostly from the Instituto Nacional de Biodiversidad. Each species account consists of descriptions or redescriptions, complete synonymies, line drawings, photographs, habitus illustrations for new species, distribution maps indicating also altitudinal and monthly distributions, habitat and ecological information, as well as keys. Where necessary, drawings of male internal sacs will be added. Presently the following genera have been published: *Ateuchus, Dichotomius* and *Scatimus* (partially), *Onthophagus* is in press and the following are almost completed: *Canthon, Canthidium* and *Uroxys*. Up to now, around 30%-50% of the species in each genus are new to science. The number of endemics is very high, around 40 species are known only from Costa Rica. An areographic study shows that endemism areas are important along the mountains, especially on the Talamanca Cordillera, the Guanacaste Cordillera, the Sierra de Tilarán and the Central Cordillera in decreasing order. It had been considered that the Sierra de Tilarán and the Guanacaste Cordillera were not centers of endemism, a fact that is here for the first time refuted. The presence of small flightless species on the Talamanca Cordillera seem to support the eocenic insular origin of Talamanca. Moreover, there is an important vicariant process, where sister species are found on the Talamanca Cordillera on one side and on the Guanacaste-Tilarán mountain systems on the other. Other important endemism centers are located along the Atlantic Tropical Forest and the Pacific Tropical Forest. The Atlantic Tropical Forest is here reported for the first time as an important center of endemism. There also exists another important species vicariant process between the Pacific and Atlantic Tropical Forests. Cladistic analyses will be done for some groups in order to try to elucidate the historical biogeography of the group in Costa Rica.

Index terms: Dung Beetles, Neotropics, Biodiversity, Inventory, Biogeography

[3669] SYSTEMATICS AND BIOLOGY OF THE NEW WORLD CERATOCANTHINAE (COLEOPTERA: SCARABAEIDAE)

B.D. Gill[1] & H.F. Howden[2], [1]Centre for Plant Quarantine Pests, Rm. 4125 K.W. Neatby Bldg., 960 Carling Ave., Ottawa, ON, Canada K1A 0C6 Email: GillBD@em.agr.ca and [2]Canadian Museum of Nature, P.O. Box 3443, Station D, Ottawa, ON, Canada K1P 6P4.

The Ceratocanthinae are a pantropical group of small scarab beetles (2-11mm in length) that are typically capable of flexing their bodies into a compact ball or pill shape. This remarkable ability is likely a defensive tactic to avoid predation and gives rise to their common name of pill scarabs. They are closely related to the Hybosorinae but differ in a number of important characters. The New World fauna currently consists of 154 valid species distributed from southern Canada to Chile and Argentina. Over 95% of these taxa (147 species) are placed in 11 genera belonging to the tribe Ceratocanthini. Two genera, *Ceratocanthus* (with 52 spp.) and *Germarostes* (with 68 spp., including taxa formerly placed in *Haroldostes*) account for most of the species richness in the New World. A number of atypical taxa that can not roll into a ball are placed in 2 other tribes, the Scarabatermitini (4 genera; 5 spp.) and the Ivieolini (1 genus; 2 spp.). Some of these species are physogastric and possess large setigerous abdominal glands. Biological information is sparse for most Ceratocanthines. Species of several genera (*Astaenomoechus, Ceratocanthus, Germarostes, Scarabaeinus* and *Scarabatermes*) have been collected in association with termites and are probably inquilines, feeding on fungi or the nest material. Two species of *Germarostes* have been reared from rotting wood and Passalid beetle frass. Most specimens however are collected from woody fungi, beating dead and dying vegetation, sifting leaf litter or through the use of black light, Malaise, and flight interception traps. Flight interception traps in particular are especially productive in capturing members of the Scarabatermitini and the Ivieolini. The biology of this latter group is completely unknown. Larvae have been described for only 2 of the 154 described species.

Index Terms: Ceratocanthines, pill scarabs, inquilines

[3670] THE EVOLUTION OF HABITAT USE AND DIET IN THE SCARABAEOIDEA: A PHYLOGENETIC APPROACH

C.H. Scholtz[1] & S.L. Chown[1], [1]Department of Zoology & Entomology, Univ. of Pretoria, Pretoria 0002, South Africa. E-mail: chscholtz@zoology.up.ac.za

The evolution of habitat use and of diet in the Scarabaeoidea is objectively assessed using character optimization based on a phylogenetic analysis of the superfamily. The ancestral habitat was clearly soil; larval food was microbial- (mainly fungus-) enriched humus; adult food was fungi. The evolution of the major clades is supported by the fossil record. The first major evolutionary event was after the Triassic mass extinction (200 MY) with radiation of the families currently considered to be "primitive" in the Jurassic (180-160 MY). The second major radiation was after the Cretaceous-Tertiary mass extinction (65 MY) when the taxa considered to be "higher" scarabaeoids diversified. The primitive clade is far less diverse than the more modern one. Extinction of taxa in the older clade made way for the diversification of the more modern scarabaeoid groups which was facilitated by the opening of two "new" adaptive zones in the form of the angiosperms and artiodactyl dung. The same themes in the evolution of habitat use and diet are repeatedly played out in both major clades, despite the differences in the floras and faunas of the Mesozoic and the Cenozoic. The phylogenetic tree appears balanced with respect both to its topology and the ecological characters that are mapped onto it since the clades are virtually mirror images of each other (i.e. similar patterns of habitat use and diet have evolved in the post-Triassic, Mesozoic clade, and the post-Cretaceous, Cenozoic one). We propose that scarabaeoid higher classification should reflect the above major radiation events and that taxa accorded family status should be distinct groups that share a common ancestor which originated prior to the Cretaceous-Tertiary boundary (primitive clade), and that younger groups (modern clade) be accorded subfamilial or lower status.
Index terms: mesozoic, caenozoic, detritus, fungus, angiosperms

[3671] HOPLIINI OF THE IBERIAN PENINSULA SCARABAEOIDEA, MELOLONTHIDAE): A BIOGEOGRAPHICAL AND TAXONOMIC STUDY

E. Micó[1], E. Galante[1] & O. Piau[2], [1]Univ. of Alicante. Ctra. San Vicente. E-03080. Alicante. Spain, E-Mail: Galante@carn.ua.es, [2]Univ. Paul Valery. Route de Mende. BP 5043 Montpellier Cedex 1. France.

Hoplia is a widespread genus comprising more than 250 species from Orient to Europe, South Africa, and Madagascar, as well as New World. Only 7 species constitute the Iberian representation of the Hopliinae. However, Iberian *Hoplia* count on a high rate of endemic species. The study of the external morphology of *Hoplia* species shows the existence of few usable diagnostic characters to separate species, and even the examination of male genitalia structures as the phallobase, parameres, and internal sac, was not useful either between closely related species. For these reasons, several species and subspecies have been recognized based on morphological characters such as form and elytral scales disposition, coloration of elytra or body size, which may vary considerably. The aim of this study was to solve the taxonomic problems existing in the Iberian Hopliini using molecular analysis together morphological observations. Molecular analysis was based on the sequence of a fragment of the mitochondrial gene Cytochrome oxidase I, following DNA amplification using the polymerase chain raction. Results show that this gene fragment was useful at species level in this group. A phylogenetical approach of some Iberian *Hoplia*, inferred from these mitochondrial sequences, is also provided.

[3672] SYSTEMATICS AND BIOGEOGRAPHY OF ANOPLOGNATHINI (COLEOPTERA: SCARABAEIDAE: RUTELINAE), A TRIBE ENDEMIC TO THE NEOTROPICAL AND AUSTRALIAN REALMS

A. B. T. Smith, Systematics Research Collections, W436 Nebraska Hall, Univ. of Nebraska, Lincoln, NE 68588-0514, U.S.A. E-mail: asmith@unlserve.unl.edu.

My research examines the systematics and biogeography of the tribe Anoplognathini. This tribe currently contains five subtribes: Phalangogoniina, Platycoeliina, and Brachysternina that occur in the Neotropics and Anoplognathina and Schizognathina that occur in Australia. All the Neotropical genera (*Phalangogonia*, *Platycoelia*, *Aulacopalpus*, *Brachysternus*, and *Hylamorpha*) were revised to complement revisions of the Australian taxa done in the 1950s. The revisions of the Neotropical Anoplognathini will (1) develop our understanding of the biogeography of southern hemisphere scarab taxa, (2) establish monophyly of the tribe and subtribes, and (3) provide base-line data for a group that is restricted to tropical forests that are rapidly disappearing. A phylogenetic reconstruction of the world genera of Anoplognathini is presented with an overview of the diagnostic characters for some of the major clades. Several aspects of the biogeography of the tribe are discussed, including the distributional patterns of the extant species, the geographic origin and age of the tribe, and the dispersal routes across the southern hemisphere.
Keywords: phylogeny, southern hemisphere, distributions, dispersal routes

[3673] A PRELIMINARY OVERVIEW OF THE NEOTROPICAL GENUS *EPECTINASPIS* (COLEOPTERA: SCARABAEIDAE: RUTELINAE: ANOMALINI)

A. Paucar C., Systematics Research Collections, W436 Nebraska Hall, Univ. of Nebraska, Lincoln, NE 68588-0514, U.S.A. Email: aurapc@unlserve.unl.edu

The Neotropical genus *Epectinaspis* (Rutelinae: Anomalini) includes 9 described species. Species in the genus are distributed from central Mexico to Nicaragua and are found at elevations ranging from 500-1500m. Adults of some species feed on flowers of *Hibiscus* (Malvaceae), and others are found in association with flowers of coffee trees (Rubiaceae). Larvae live in the soil, but it is not known if they feed on roots or humus. The genus *Epectinaspis* was established by Blanchard in 1851, but since this time no comprehensive studies have been conducted. No keys to species, no diagnoses of the genus, and no phylogenetic analyses have been conducted for species in the genus *Epectinaspis*. The objectives of this research are to test the monophyly of the genus, to infer the phylogenetic relationships among the species, to determine the phylogenetic relationships of the genus to other genera of Anomalini, to create a taxonomic key to the species of *Epectinaspis* and to the genera of Anomalini, and to treat each species systematically (including descriptions and distributional data).
Keywords: Central America, classification, taxonomy, phylogenetics

[3674] PHYLOGENETIC ANALYSES OF THE SUBTRIBE PELIDNOTINA (COLEOPTERA: SCARABAEIDAE)

M. L. Jameson, Systematics Research Collections, W436 Nebraska Hall, Univ. of Nebraska, Lincoln, NE 68588-0514, U.S.A. E-mail: mjameson1@unl.edu.

Phylogenetic analyses were conducted to address the classification and phylogenetic relationships of the scarab beetle subtribe Pelidnotina (Scarabaeidae: Rutelinae: Rutelini), a group that is distributed in the New World and is most diverse in the Amazon region. Previous phylogenetic analyses demonstrated that the subtribe is paraphyletic. Members form a grade rather than a clade, and the classification is currently unstable. This research analyzed relationships of the 19 genera and subgenera of the paraphyletic group that includes: *Pelidnota, Odontognathus, Chalcoplethis, Ectinoplectron, Pelidnotopsis, Chrysophora, Catoclastus, Mecopelidnota, Heteropelidnota, Homothermon, Xenopelidnota, Hoplopelidnota, Mesomerodon, Eremophygus, Homonyx, Oogenius, Parhomonyx, Parhoplognathus,* and *Pseudogeniates*. Genera in the tribes Rutelini and Anomalini were used as outgroups. Results of these analyses will be used to stabilize the classification of the group, establish monophyletic groups (=genera), examine relationships between species groups of *Pelidnota*, and understand character evolution. Based on the phylogenetic analyses, a new classification will be proposed. Phylogeny, diagnostic characters, natural history, and distributions of these genera are presented.
Keywords: Systematics, cladistics, *Pelidnota*, Rutelinae, Rutelini

[3675] DUNG BEETLE COMMUNITIES IN MOUNTAIN SYSTEMS (COLEOPTERA: SCARABAEIDAE)

J.-P. Lumaret & P. Jay-Robert, Univ. Paul Valéry, route de Mende, F-34199 Montpellier cedex 5, France. E-mail: jean-pierre.lumaret@univ-montp3.fr.

Dung beetles exploit large and medium herbivore droppings and form various assemblages in mountains. In the highest sites, a significant dominance of a few species is observed. Dwellers and small tunnelers constitute the predominant guilds. The mountain dung beetle communities are under the constraint of hard climatic conditions. In a homogeneous bioclimatic area (e.g. Western Europe), it can be assumed that neighbouring massifs should present analogies in species distribution, guilds composition and community structure. However, as their settling was due to successive historical events, each massif having its own history, the dung beetle faunas of neighbouring massifs are expected to be partly different. The objective of this research is to compare the characteristics of dung beetle communities in different massifs of Western Europe considering: i) the variation in species richness with altitude, the altitudinal species turnover and the taxonomical and biogeographical characteristics of beetles; ii) the relationships between abundance and body size according to the resource partitioning in communities.
Keywords: West European mountains, guilds, ecology, altitude

[3676] A SYNOPSIS OF THE NEW WORLD HYBOSORIDAE (COLEOPTERA: SCARABAEOIDEA)

F. C. Ocampo, Systematics Reasearch Collections, W436 Nebraska Hall, Univ. of Nebraska, Lincoln, NE 68588-0546, U.S.A. Email: focampo@unlserve.edu.

The family Hybosoridae contains 28 genera world-wide and about 180 species. The group is most diverse in the tropics. Fourteen genera and 54 species occur in the New World and one genus (and one species) was introduced from the Old World. *Phaeochrous emarginatus*, a species that occurs in Africa, Australia, and India, was once reported from California, but the species is not established in California and the record was probably in error. The following are the New World genera and their number of species: *Anaides* (6), *Apalonychus* (4), *Callosides* (2), *Chaetodus* (19), *Coilodes* (10), *Cremastochilodius* (1), *Cryptogenius* (2), *Daimothoracodes* (2), *Dicraeodon* Erichson (3), *Hapalonychoides* (1), *Hybochaetodus* (1), *Hybosorus* (1), *Pachyplectrus* (1), *Metachaetodus* (1). Members of the Hybosoridae are distinguished from other scarabaeoids by their prominent mandibles and labrum and by their 9 to10-segmented antenna with a 3-segmented club in which the basal segment is hollowed out to receive the penultimate and last segments. The Hybosoridae is considered as a family within the Scarabaeoidea or as a subfamily of the family Scarabaeidae. Larval characters support the hypothesis of monophyly for the Hybosoridae. The Hybosoridae is hypothesized to be intermediate between the Ochodaeidae and Ceratocanthidae or intermediate between the Trogidae and Ceratocanthidae. Aside from revisions of some genera and listings in catalogs, little systematics work has been conducted on this group. Within the Hybosoridae, no phylogenetic analysis has been conducted, and a key to the genera does not exist. My research will provide a revision and phylogenetic analysis of the New World genera, keys with illustrations, and detailed descriptions of the genera and species. I provide an overview of the New World genera of Hybosoridae and discuss biogeographic and phylogenetic patterns of the group.
Keywords: Phylogenetics, classification, taxonomy, biogeography

[3677] TOWARDS A MOLECULAR PHYLOGENY OF SCARABAEID DUNG BEETLES

D. J. G. Inward[1,2], C. Wilsher[1,2]& A. P. Vogler[1,2], [1]Department of Entomology, The Natural History Museum, Cromwell Road, London, SW7 5BD, and [2]Department of Biology, Imperial College at Silwood Park, Ascot, Berks SL5 7PY, UK

The 'true' dung beetles (Scarabaeidae, Coleoptera) are a well studied, monophyletic group of insects, which have radiated relatively recently with the large herbivorous mammals upon whose dung they are primarily dependent. They exhibit a diversity of morphologies and behaviour which can be conveniently defined in terms of functional groups. The most important of these pertains to the dichotomy in nesting behaviour of the 'rollers' and 'tunnellers', with other groupings based on diet (particularly coarse and fine grain dung, and carrion), body size, and diel or seasonal activity. Behavioural characters are implied in the traditional taxonomy of the group which currently comprises twelve tribes, of which six are rollers and six are tunnelers. These tribes are considered to have originated at different evolutionary periods, with the Canthonini and Dichotomini representing the oldest lineages of rollers and tunnelers, respectively. Existing hypotheses of dung beetle evolution and radiation based on this taxonomic scheme remain untested and speculative without a formal phylogenetic analysis. We have generated a phylogenetic hypothesis based on mitochondrial 16S rRNA and CO1 genes, from a total of 100+ taxonomically diverse species. Our analysis supported the monophyly of some of the presumably younger and most species rich tribes, including Oniticellini, Onthophagini and Onitini (the three of them being a monophyletic group), but failed to recover the presumed most ancient Canthonini and Dichotomiini. We are testing if the overall low fit with the traditional separation of tribal groups recovered is due to low strength of signal in the data, or if it reflects a recurrence of similar morphologies and behavioural strategies in independent lineages which have been taken as the main criterion for classification. A particularly critical point is our apparent inability to recover the roller-tunneller dichotomy. A morphological-character based phylogeny reconstruction by our collaborators at the University of Pretoria, South Africa has resulted in similar results and appears to support the polyphyly of the rolling behaviour. The phylogeny is being applied to assess ecological, morphometric and functional data, to identify the major processes structuring dung beetle assemblages at global, regional and local scales. Having well defined boundaries and resources, accurate species composition data for different assemblages have been gathered by trapping, and the group presents an ideal model to investigate the role of competition within communities and its effect on the diversification of the lineage.
Index: mtDNA, morphometrics, communities, resource segregation

[3678] A FAUNISTIC SURVEY OF THE DYNASTINAE (COLEOPTERA: SCARABAEIDAE) OF CENTRAL AMERICA

B. C. Ratcliffe, Systematics Research Collections, W436 Nebraska Hall, Univ. of Nebraska, Lincoln, NE 68588-0514, U.S.A. Email: bratcliffe1@unl.edu

The Dynastinae is one of the most conspicuous subfamilies of Scarabaeidae because of their rich species diversity, often large size, and presence of impressive horns in some species. The Dynastinae is comprised of about 1,400 species (although the actual world fauna may reach 2,000 species), and it occurs in all the major biogeographic regions of the world. More species are found in the New World tropics than in any other realm, but the New World tropical fauna remains poorly studied. Adults are known to feed on rotting fruit, slime flux, flowers, and plant roots. Larvae are primarily saprophagous or phytophagous and live beneath the surface of the ground or in decaying logs and stumps. The objective of this research is to monograph all Dynastinae in Central America. The first stage, Costa Rica and Panama, is completed (33 genera and 180 species). Panama has 142 species; 29 (18% of the total) are not shared with Costa Rica. Costa Rica has 137 species; 24 (15% of the total) are not shared with Panama. The second stage of the project, Honduras, Nicaragua, and El Salvador, is in progress (33 genera and approximately 162 species). The last stage, Mexico, Guatemala, and Belize, will begin in 2004. The surveys will provide the first extensive documentation of the taxonomic, geographic, and temporal distribution of dynastines in Mesoamerica and will provide the means to identify all the taxa with both English and Spanish keys. To accomplish this, dynastines already residing in systematics research collections in the United States, Canada and Central America are being intensively surveyed to gather data on spatial and temporal distribution and life history or habitat information associated with the specimens. Extensive collecting is being conducted in all countries utilizing a program designed to provide complete geographic coverage and taking into account seasonality as it affects activity of adult dynastines. Authoritatively identified collections of Dynastinae are being established at the principal collections in Central America. New genera and species are being described. Three monographic treatments of the Dynastinae of Central America will result, and each will include a brief introduction that addresses climate, land forms, and dynastine biology and distribution. Each tribe and genus will be characterized and discussed, and taxonomic keys (in English and Spanish) will be given for all tribes, genera, and species. Each species account will consist of complete synonymies, descriptions, distributional and temporal data, habitat and ecological information, and larval and life history information. Each monograph will be profusely illustrated with habitus drawings, line drawings of body structures, distribution maps, and photographs of principal habitats.

Keywords: Scarab beetles, Neotropics, biodiversity, inventory

[3679] PHYLOGENY OF THE HOLOMETABOLOUS INSECT ORDERS: STATE OF MORPHOLOGY

N. P. Kristensen, Zoological Museum, Universitetsparken 15, DK-2100 Copenhagen OE, Denmark, E-mail npkristensen@zmuc.ku.dk

Morphological support for the monophyly of the Endopterygota/Holometabola comes primarily from the specialized larva with degradable compound eyes and internal wing and genitalia rudiments. In contrast, morphological specializations of the quiescent last immature stage (the pupa) in the endopterygote groundplan remain unrecognized, and endopterygote groundplan autapomorphies in the adult stage are at best little operational. The putative support for a Coleoptera + Neuropterida clade in cervical musculature (loss of cruciate muscles) deserves renewed scrutiny, and so do the adult insects' coxal mera (on which Boudreaux based his taxon 'Meronida', i.e., Neuropterida + Mecopterida); interesting new evidence for the Coleoptera + Neuropterida monophyly has been identified in the wing base by Hörnschemeyer. A Hymenoptera + Mecopterida clade may be supported by the single-clawed larval leg and the completely sclerotized sucking pump floor in the adult insect. The monophyly of the Neuropterida is plausibly corroborated by member taxa's synapomorphies in ovipositor structure, but their intrinsic phylogeny remains intriguing; this is particularly true for the evidence from ovariole structure against megalopteran monophyly. Recent molecular evidence for subordination of the fleas within the Mecoptera (as close relatives of the Boreidae) had been foreshadowed by findings on larval and, particularly, on ovariole structure. In contrast, available evidence that the Mecoptera could be paraphyletic in terms of the Diptera is weak. Morphological support for the monophyly of the Lepidoptera + Trichoptera clade as well as for each of its costituent taxa is impressive. The Strepsiptera remain a real puzzle: the putative morphological support for their much-publicised possible sistergroup relationship to dipterans (as indicated by parsimony analysis of rDNA data) is highly ambiguous.

Index terms: Endopterygota, Neuropterida, Mecopterida, Strepsiptera

[3680] PHYLOGENY OF THE HOLOMETABOLOUS INSECT ORDERS: STATE OF THE MOLECULES.

M. F. Whiting,, Dept. of Zoology, Brigham Young University, Provo, UT 84602, USA.

A review of molecular studies addressing phylogenetic relationships within the Holometabola is presented, with an emphasis on the ribosomal DNA sequence data and the areas of phylogenetic controversy. The monophyly of most holometabolous insect orders is supported by these data, though some outstanding phylogenetic issues remain unresolved. In particular, the sister group to the Coleoptera and Hymenoptera does not appear robustly supported by these data. The controversial placement of Strepsiptera as sister group to Diptera is discussed in the light of new evidence. The use of the insert in the homeodomain of the gene engrailed is shown to be a poor phylogenetic marker for interordinal relationships within the Holometabola, because of homoplasy at the ordinal level. Future needs of molecular research on Holometabola arediscussed.

Index terms: Strepsiptera, Coleoptera, Hymenoptera, engrailed, molecular phylogeny

[3681] PALAEONTOLOGY, WING MECHANICS, AND THE EVOLUTION OF HOLOMETABOLA

R.J.Wootton, Sch. of Biological Sciences, Exeter Univ., Hatherly Laboratories, Prince of Wales Road, Exeter, EX4 4PS, UK. E-mail: r.j.wootton@exeter.ac.uk

In the insect fossil record, wings are the structures most frequently and best preserved, and palaeoentomologists have used them extensively for classification and phylogenetic reasoning. Too often, however, their conclusions have been based solely on venation patterns, with little attention to wing shape, proportions and relief and to lines and areas of flexibility. These characters, together with some knowledge of the flight techniques of extant forms, can give useful information on the flight adaptations of extinct groups. This in turn assists in the identification of homoplasies and correlated character sets, and can help explain evolutionary trends and events. These points will be discussed with reference to some groups of Holometabola, where several broad categories of wing design are recognisable. Early Antliophora and Amphiesmenoptera tend to have wings approaching bilateral symmetry around a central, longitudinal flexion line. This design is found today in many Mecoptera and Trichoptera and some Lepidoptera, often combined with a transverse flexion line which allows ventral bending and some distal torsion in the upstroke. In contrast neuropteroids, extinct and extant tend to have rigid leading edge spars, with oblique, pinnately-branching veins filling the main wing area, favouring aeroelastic torsion and camber-generation often in association with flight versatility. The early evolution of the wings of Diptera can be interpreted as a similar development from the early antliophoran pattern, here associated with extreme hind-wing reduction; and the Order now reaches extremes of versatility and manoeuvrability. Hymenoptera and several lepidopteran lineages achieve comparable performance, by combining fore and hind wings into a single aerofoil. Coleopteran hind wings show some functional parallels to Diptera, but are special in their folding adaptations.

Index terms: Holometabola, flight, wing design.

[3682] WING-BASE MORPHOLOGY AND THE EVOLUTION OF THE HOLOMETABOLA

T. Hörnschemeyer, Inst. f. Zoologie & Anthropologie, Abt. Morphologie & Systematik, Berliner Str. 28, D-37073 Göttingen, Germany, E-mail thoerns@gwdg.de

The wing base of insects consists of a set of highly complex structures, which contain important information about phylogenetic relationships. Brodsky (1994) compiled a wealth of information about insect flight but until now this huge amount of characters has only rarely been used for the study of insect phylogeny. Investigation of the wing base of several holometabolous taxa yielded the following results: A sistergroup relationship of Acercaria and Holometabola is supported by possible synapomorphies. The Holometabola are characterized as a monophyletic group by autapomorphies in the wing locking apparatus. Within the Holometabola autapomorphic characters for Coleoptera and Neuropterida could be found. Some characters, especially of the second axillary, support the view that Coleoptera and Neuropterida are sistergroups (Hörnschemeyer 1998). Another well known derived character is the existence of a muscle at the first axillary, which is a synapomorphy of Amphiesmenoptera and Antliophora. It could be demonstrated that wing base characters are highly informative for the investigation of phylogenetic relationships among insect taxa. Incorporating these so far seldom-used characters in phylogenetic studies can help to resolve still open questions. These characters have been used for investigations on different taxonomic levels (Browne & Scholz 1996) but because the structures of the wing base are very conservative in evolution they promise to be most useful for the study of higher level phylogenetic relationships.
Index terms: Coleoptera, Neuropterida, Amphiesmenoptera, Antliophora

[3683] BASAL RELATIONSHIPS IN COLEOPTERA INFERRED FROM RIBOSOMAL DATA

A. P. Vogler.

ABSTRACT NOT RECEIVED

[3684] PHYLOGENY OF THE BEETLE SUBORDER ADEPHAGA AND FAMILY CARABIDAE, AS INFERRED USING RIBOSOMAL DNA AND THE *WINGLESS* GENE

D. R. Maddison[1], M. D. Baker[2], & K. A. Ober[1], [1]Dept. of Entomology, Univ. of Arizona, Tucson, AZ 85721, USA, E-mail beetle@ag.arizona.edu; [2]DNA Sequencing and Synthesis Facility, 1184 Molecular Biology Building, Iowa State Univ., Ames, IA 50011, USA.

The beetle suborder Adephaga has radiated since the Triassic into more than 30,000 species arranged in 8 to 11 extant families, with the majority of species in the family Carabidae. Six of the families have aquatic members (together loosely termed "Hydradephaga"), with the remaining families having terrestrial individuals ("Geadephaga"). Morphological evidence has suggested that aquatic habits have evolved three times, and that the small terrestrial family Trachypachidae is more closely related to predacious diving beetles (Dytiscidae) and their relatives than to other terrestrial adephagans. The placement of several other major lineages has been controversial. DNA sequences of both the 18S ribosomal RNA gene (18S rDNA) and the *wingless* gene suggests that in fact trachypachids are related to other terrestrial adephagans, not dytiscoids. Both genes suggest that Geadephaga is monophyletic, including carabids, rhysodines, cicindelines, and trachypachids. 18S rDNA suggests that Hydradephaga is the monophyletic sister group of Geadephaga; the *wingless* data suggests that Hydradephaga may be monophyletic, but that it is also possible that gyrinids are instead the sister to Geadephaga. These data thus suggest a single or at most two origins of the aquatic way of life, rather than three as has been proposed. Within Geadephaga, the relationships of rhysodines, cicindelines, and paussines are unclear. Phylogenies based on 18S rDNA sequences place these three lineages together with scaritines near the derived subfamily Harpalinae, an unexpected result that may be due to long-branch attraction. The *wingless* gene does not so group these enigmatic lineages, and suggests a more basal placement within Geadephaga of both rhysodines and paussines. Within Carabidae, some of the major lineages established based on morphological and cytogenetic evidence, such as the supertribe Trechitae, are further supported as monophyletic.
Index terms: Coleoptera, Geadephaga, Hydradephaga, Trachypachidae, 18S rDNA

[3685] PHYLOGENY OF THE NEUROPTERIDA

U. Aspöck, Naturhistorisches Museum Wien, Zweite Zoologische Abteilung, Burgring 7, A-1014 Wien, AUSTRIA, E-mail ulrike.aspoeck@nhm-wien.ac.at.

Neuropterida, with about 6500 known species - living fossils in a way - are generally regarded as a monophylum comprising Raphidioptera, Megaloptera and Neuroptera with a systematic position at the base of Holometabola as the sistergroup of Coleoptera. Commonly Megaloptera+Raphidioptera are understood as sistergroups. Recent results support a Megaloptera+Neuroptera relationship. Raphidioptera (about 210 species, 2 families) are undisputedly monophyletic. The monophyly of Megaloptera (about 300 species, 2 families) serves as an operational hypothesis but it has occasionally been and still is questioned. Neuroptera (about 6000 species, 18 families) are a strong monophylum, with the sucking tubes of the larvae being the most spectacular autapomorphy. The construction of the larval head capsules indicates three evolutionary lines (suborders): Nevrorthiformia, Myrmeleontiformia and Hemerobiiformia. NEV are the adelphotaxon of MYR+ HEM, or, alternatively of MYR only. NEV represent an enigmatic family of amazingly similar vicariant ("thetis" distribution) genera. Traditional classification of monophyletic MYR results in Psychopsidae+(Nemopteridae+(Nymphidae+(Myrmeleontidae+Ascalaphidae))). A recent approach results in (Psychopsidae+Nemopteridae)+(Nymphidae+(Myrmeleontidae+Ascalaphidae)). HEM are based on the "maxillary head" concept. Family relationships within this monophylum are still conflicting. Only the ithonid clade: Ithonidae (+Rapismatidae)+Polystoechothidae and the dilarid clade: Dilaridae+(Mantispidae+(Rhachiberothidae+Berothidae)) seem to be based on robust criteria. The relationships of the remaining families are uncertain. The concept of Hemerobiidae+Chrysopidae (on the basis of similarity) and of Coniopterygidae as an early offshoot (on the basis of autapomorphies) should not be perpetuated. As new hypotheses Chysopidae+Osmylidae and (Hemerobiidae+ (Coniopterygidae+ Sisyridae))+dilarid clade should be considered. Aquatic larvae have formerly been regarded as an autapomorphy of Megaloptera and an independently evolved apomorphy of Nevrorthidae and Sisyridae. However, in the above context aquatic larvae are interpreted as a synapomorphy of Megaloptera+Neuroptera and thus plesiomorphic within these groups. Terrestrial larvae (with cryptonephry to solve osmotic problems) consequently are apomorphic. Aquatic larvae without cryptonephry, all malpighian tubules ending free, as in Nevrorthidae, are plesiomorphic. Aquatic larvae with cryptonephry of one malpighian tubule, as in Sisyridae, are conflicting: the larvae may have become secondarily aquatic, after a terrestrial intermezzo.
Index terms: Raphidioptera, Megaloptera, Neuroptera, aquatic larvae, cryptonephry.

[3686] PHYLOGENY OF THE HYMENOPTERA: A REVIEW OF THE SUPPORT FOR CURRENT HYPOTHESES

M.J. Sharkey, Dept. of Entomology, Univ. of Kentucky, Lexington KY 40546-0091, USA, E-mail msharkey@ca.uky.edu.

The Hymenoptera are among the most species-diverse orders of insects and undoubtedly the most diverse in terms of their life histories, with enormous phytophagous, predaceous, and parasitoid lineages. Morphological evidence has recently been summarized and analyzed in a cladistic context at the familial level. These studies are augmented with new data. The results show great support for many major clades. The strengths and weakness of current hypotheses of relationship are presented, and specific character phylogenies are discussed when they appear to have had a strong influence on hymenopteran diversity.
Index terms: Hymenoptera, phylogeny, cladistics, biodiversity.

[3687] MOLECULAR EVIDENCE FOR THE BASAL RADIATION OF THE LEPIDOPTERA

B.M. Wiegmann[1], J.C. Regier[2] & C. Mitter[3], [1]Dept. of Entomology, North Carolina State Univ., Box 7613, Raleigh, NC, 27695-7613, USA, E-mail bwiegman@unity.ncsu.edu; [2]Center for Agricultural Biotechnology, Univ. of Maryland, College Park, MD, 20742, USA; [3]Dept. of Entomology, Univ. of Maryland, College Park, MD, 20742, USA.

Nucleotide sequence data have been applied in increasing frequency to questions in higher-level phylogenetics of the Lepidoptera. Here we review molecular evidence for relationships among the basal clades of Lepidoptera. Data from three nuclear genes, 18S ribosomal DNA, phosphoenolpyruvate carboxykinase (PEPCK), and dopa decarboxylase (DDC) is compared and combined with morphological characters. Combined analysis of 18S rDNA and PEPCK strongly supports morphology-based hypotheses of relationships at the base of the Lepidoptera. Molecular and morphological evidence for the monophyly and position of the Eriocraniidae, Acanthopteroctetidae, Neopseustidae, and relationships of the 'monotrysian' families is presented in light of recent quantitative phylogenetic analyses of all available evidence. Parsimony and likelihood analyses of nucleotide and amino acid sequences of DDC recover some previously proposed hypotheses. Relationships among the five main heteroneuran groups (four monotrysian superfamilies plus Ditrysia) is individually low, but two of three previous hypotheses are ruled out by analyses of DDC. Major competing hypotheses for the origin and divergence of the Ditrysia are reviewed and discussed in light of molecular evidence.
Index terms: Ditrysia, Eriocraniidae, phylogeny, ribosomal DNA, dopa decarboxylase

[3688] THE HIGHER LEVEL PHYLOGENY OF *TRICHOPTERA* WITH AN EMPHASIS ON THE RELATIONSHIPS AMONG SUBORDERS

K. M. Kjer[1], R. J. Blahnik[1,2] & R. W. Holzenthal[2], [1]Rutgers Dept. of Entomology, New Brunswick, NJ, USA 08901 E-mail: kjer@aesop.rutgers.edu [2]Univ. of MN, Dept. of Entomology, St. Paul, MN, USA 55108

Trichoptera are holometabolous insects with aquatic larvae. Their sister taxon status to Lepidoptera is among the most highly corroborated of all insect order relationships, but the relationships among the three suborders of *Trichoptera*; *Annulipalpia* (net-makers/retreat makers), *Integripalpia* (tube case makers) and *Spicipalpia*, have been controversial. All three possible relationships among suborders have been proposed or suggested. Further, while the monophyly of the suborders *Annulipalpia* and *Integripalpia* are widely agreed upon, the monophyly of *Spicipalpia* is less clear. We evaluated sequence data from three fragments of nuclear ribosomal RNA (rRNA), a fragment of mitochondrial COI, and morphological characters. These data support the monophyly of the *Annulipalpia* and *Integripalpia*. *Spicipalpia* consistently grouped with the *Integripalpia*. However, the monophyly of *Spicipalpia* is equivocal, with different analyses resulting in either paraphyletic or monophyletic alternatives. Within *Integripalpia*, the monophyly of the superfamilies *Limnephiloidea*, *Leptoceroidea*, and *Sericostomatoidea* were supported, with the limnephiloids basal to the other two superfamilies. Case-making behaviors vary among the suborders, and the evolution of these behaviors will be discussed in the context of the phylogeny.
Index terms: *Spicipalpia, Annulipalpia, Integripalpia*

[3689] PHYLOGENY OF MECOPTERA AND SIPHONAPTERA: EVIDENCE FOR TWO NEW HOLOMETABOLOUS INSECT ORDERS

M. F. Whiting, Dept. of Zoology, Brigham Young University, Provo, UT 84602, USA.

Relationships among the Siphonaptera and Mecoptera at the family and generic levels have never been investigated using a formal quantitative phylogenetic analysis. Molecular and morphological data sets have been assembled for an extensive set of taxa representing the major diversity of Mecoptera and Siphonaptera. Mecoptera sequences were generated for ~100 taxa, and represent all families and most extant genera. Siphonaptera sequences were generated for ~140 taxa , representing most families and genera, and contain the bulk of flea diversity. Molecular data consist of complete nucleotide sequences for the genes 18S ribosomal DNA, 28S ribosomal DNA, Elongation Factor 1-alpha, and Cytochrome Oxidase II (~6.4kb per taxon). A morphological matrix for Mecoptera has been assembled, and a preliminary matrix for Siphonaptera is discussed. Molecular and morphological data support the monophyly of all families within Mecoptera. The clade (Choristidae (Panorpidae + Panorpodidae)) is well supported; the placement of other families is less robust, though the Nannochoristidae appear to be the most basal taxon. The genera *Bittacus* and *Panorpa* are clearly paraphyletic. In contrast, many families within the Siphonaptera are paraphyletic (e.g., Ctenophthalmidae, Pulicidae, Rhopalopsyllidae, Leptopsyllidae), though the Siphonaptera itself is monophyletic. The Ischnopsyllidae and Ceratophyllidae appear monophyletic, as does the Ceratophylloidea (Ceraophyllidae (Leptopsyllidae + Ischnopsyllidae)). Both data sets support Boreidae as sister group to Siphonaptera, making the Mecoptera as currently constituted paraphyletic. Morphological data supporting this relationship is discussed. An argument is presented for the formal recognition of the Nannomecoptera and Neomecoptera as additional holometabolous insect orders.
Index Terms: Molecular Phylogeny, Holometabola, Panorpidae, Bittacidae, Ctenophthalmidae.

[3690] PHYLOGENETIC RELATIONSHIPS OF NEMATOCEROUS DIPTERA BASED ON MOLECULES AND MORPHOLOGY

V. L. Kulasekera, Department of Invertebrate Zoology, American Museum of Natural History, 79th St. at Central Park West, New York, NY 10024, USA, E-mail varuni@amnh.org.

The lower Diptera, known as Nematocera, is a paraphyletic group of 26 taxa defined by the pleisiomorphic character, elongated antennae. There is little consensus among the numerous hypotheses of Nematoceran relationships. The most recent phylogenetic analysis based on morphology defines six infraorders. Except for Culicomorpha, the other infraorders have little character support. The major difference between these hypotheses is the placement of Tipulomorpha, which is considered to be the sistergroup to rest of the Diptera, closer to Brachycera (higher Nematocera clade). The recent molecular character data for Nematocera support the monophyly of Culicomorpha, but failed to resolve the basal relationships of Diptera. In the light of these results, it is apparent that phylogenetic relationships among the Nematocera have been difficult to resolve based on morphology or molecules alone. A large portion of 18S and 28S ribosomal RNA has been sequenced for combining with the published morphological data. The results of the simultaneous phylogenetic analysis support the sistergroup relationship of Tipulomorpha and Brachycera, and resolved the basal relationships of Diptera.
Index terms: Diptera, Ribosomal genes, phylogeny, simultaneous analysis.

[3691] THE PHYLOGENY OF BRACHYCERAN DIPTERA: A SYNTHESIS OF MORPHOLOGICAL EVIDENCE

D. K. Yeates, Dept of Zoology and Entomology, The University of Queensland, Brisbane, 4072 AUSTRALIA, E-mail d.yeates@mailbox.uq.edu.au.

With over 80,000 described species, Brachycera represent one of the most diverse clades of insects with an early Mesozoic origin. Larvae of the majority of early lineages are detritivores, however Brachycera are ecologically innovative and they now employ a diverse range of feeding strategies. Brachyceran relationships have been the subject of numerous qualitative analyses using morphological characters. These analyses are often based on characters from one or a few character systems and general agreement on relationships has been elusive. In order to understand the evolution of basal brachyceran lineages, just over 100 discrete morphological characters were scored and compiled into a single dataset. Terminals were scored at family level, and the dataset includes characters from adults and larvae, internal and external morphology, and male and female terminalia. Results show that all infraorders of Brachycera are monophyletic and that Stratiomyomorpha, Tabanomorpha, and Xylophagomorpha together form the sister-group to Muscomorpha. Xylophagomorpha and Tabanomorpha are sister-groups. Within Muscomorpha, the paraphyletic Nemestrinoidea form the two most basal lineages. There is weak evidence for the monophyly of Asiloidea, and Hilarimorphidae appear to be more closely related to Eremoneura than other muscomorphs. Results will be presented on the relationships of the Asiloidea, including the position of the Apsilocephalidae and Scenopinidae. Molecular evidence bearing on brachyceran relationships will be presented in this symposium by B.M. Wiegmann.
Index terms: Stratiomyomorpha, Tabanomorpha, Xylophagomorpha, Muscomorpha.

[3692] INVENTORY AND CLADISTICS OF NON-DITRYSIAN MOTHS: SOME RECENT ADVANCES

N. P. Kristensen, Zoological Museum, Universitetsparken 15, DK-2100 Copenhagen OE, Denmark

The discovery of several species of Micropterigidae in Madagascar ranks among the most significant recent advances in the inventory of the extant primitive Lepidoptera. A somewhat similar significance can be attributed to the finding of a new S. African micropterigid taxon overall similar to some of the SW. Pacific *Sabatinca s.str.* A new Peruvian species of Acanthopteroctetidae represents the first finding of the family in S.America; its affinities remain unsettled. The finding of another specimen of the enigmatic neopseustid genus *Nematocentropus* enables us to make new inferences of the ground plan of the family. While the inter-relationships between the family-group taxa in the homoneurous grade among the lowest Lepidoptera are largely resolved (the hepialoid 'families' excepted), there has been much uncertainty about the phylogeny of the families constituting the non-ditrysian grade within the Heteroneura.. Evidence indicating the paraphyletic nature of the monotrysian assemblage is now accumulating. In the mid 1990s Löfstedt and his coworkers showed that the Nepticuloidea are outside a group comprising all other examined Lepidoptera-Heteroneura and characterized by long-chain female pheromones and a female 'calling' behaviour with oviscapt protrusion. This group, to which the name Eulepidoptera may be applied (it was introduced in this sense by Kiriakoff in 1948) has now been found by Krenn & Kristensen to be apparently also characterized by some apomorphies in the adults' mouth parts, viz., the presence of distinct pilifers and the proboscis being linked ventrally by primary *and* secondary 'legulae', and bearing ribbed styloconica. According to Petersen it is also in the Eulepidoptera that an asymmetrical expansion of the stomodaeum, a 'lateral crop', is first encountered, and it may well be considered another groundplan autapomorphy of this entity. A sequencing study of the dopa decarboxylase gene by Regier and coworkers also discloses a basal position of the Nepticuloidea within the monotrysian-heteroneuran assemblage, which according to the analytical procedure employed may, or may not, come out as a paraphyletic in terms of the Ditrysia. Finally there is evidence that the Tischerioidea are closer to the Ditrysia than both the Nepticuloidea and the Incurvarioidea. To the putative tischerioid/ditrysian synapomorphy in the female frenulum structure identified in the 1980s by Nielsen can now be added the three-layered egg chorion discovered by Fehrenbach and the presence of female sex chromatin discovered by Lukhtanov. It should be noted that the state of the two lastmentioned characters so far remains unknown in palaephatids.
Index terms: Neolepidoptera, homoneurans, monotrysians, phylogeny.

[3693] OLETHREUTINE PHYLOGENY FROM AN AUSTRALIAN PERSPECTIVE (LEPIDOPTERA, TORTRICIDAE)

M. Horak, CSIRO Entomolgy, GPOBox 1700, Canberra, ACT 2601, Australia.

The Olethreutinae are one of the two large subfamilies of the leaf-roller family Tortricidae. The monophyly of the Olethreutinae is convincingly supported by two unique apomorphies, (1) the fused juxta/caulis complex and (2) a reduction of the antennal scaling to one scale ring per flagellum, but the tribal level classification is still tentative only. In the taxonomically crucial male gentialia differentiation within the subfamily is characterised by a combination of reduction of teguminal structures and diversification and elaboration of valval morphology. This process occured parallel within several lineages, sometimes within a genus, resulting in very diverse male genitalia within some genera (*Gatesclarkeana*, *Ancylis*) but also in superficially similar-looking, highly reduced structures in different tribes. In a first step towards an olethreutine phylogeny the genera occurring in Australia have been redefined and their groundplan hypothesised. Synapormophies have been found to confirm some of the established groups and to link other lineages, to the point where alternative phylogenetic scenarios can now be proposed to be tested with molecular and other datasets. Biological information including host plants serve as a first verification of the validity of groupings based on morphological synapomorphies.
Index terms: Olethreutinae, tribal classification

[3694] RECENT DEVELOPMENTS IN THE HIGHER SYSTEMATICS OF NOCTUOID MOTHS

L.J. Kitching[1], [1]Department of Entomology, The Natural History Museum, Cromwell Road, London SW7 5BD, UK, E-mail ijk@nhm.ac.uk.

The phylogeny of the superfamily Noctuoidea has been considered one of the more intractable problems in Lepidoptera classification. This has been ascribed to the large size of the group (over 40,000 species), coupled with a high degree of morphological homogeneity. Furthermore, it is widely recognized that many of the features used to subdivide Noctuoidea are superficial in nature and subject to high levels of homoplasy. Recently, however, a series of studies of novel data sources, derived from both morphology and molecular sequences, has begun to provide improved resolution of relationships within the superfamily. I shall focus on the family Noctuidae and discuss recent developments in our understanding of its classification. In particular, I will review morphological evidence suggesting that Noctuidae are not monophyletic but that the so-called "quadrifine" noctuids are, in fact, more closely related to Lymantriidae and Arctiidae than they are to the "trifine" Noctuidae. Furthermore, it would appear that the "quadrifine noctuids" themselves form a paraphyletic group, although there is currently little consensus regarding how the constituent subfamilies are interrelated, while the position of Nolidae also remains unresolved. Detailed study of the morphology of both adults and immature stages, integrated with data derived from molecular sequences, will be necessary to resolve these issues.

Index terms: Lepidoptera, Noctuoidea, Noctuidae, phylogeny, classification

[3695] MOLECULAR PHYLOGENY OF NOCTUOIDEA: THE NOCTUIDAE REDEFINED

A. Mitchell[1] , **C. Mitter**[2] **& J. C. Regier**[3], [1]Dept. Biological Sciences, CW-405 Biological Sciences Building, Univ. Alberta, Edmonton, Alberta, T6G 2E9 Canada, E-mail: aml6@ualberta.ca. [2]Dept. Entomology, Univ. Maryland, College Park, MD 20742, USA. [3]Center for Agricultural Biotechnology, Univ. Maryland Biotechnology Inst., College Park, MD 20742, USA

A comprehensive molecular systematic survey of Noctuidae was performed, based on the nuclear, protein-coding genes, *elongation factor-1α* (*EF-1α*) and *dopa decarboxylase* (*DDC*). We sequenced 1.2kb and 0.7-1.1kb of each gene, respectively, from over 200 exemplar species. Taxa sampled include multiple representatives of at least 25 noctuid subfamilies, single representatives of eight additional noctuid subfamilies, five arctiids, four lymantriids, and seven notodontids (the outgroup). Parsimony, distance, and limited maximum likelihood analyses were performed with the PAUP*4.0 software package, using approximately one year of CPU time in total, on the fastest desktop computers available. Levels of support for nodes were estimated with bootstrap resampling methods and competing hypotheses were assessed by means of Kishino-Hasegawa Tests and nonparametric tests. Phylogenetic relationships that were well supported by morphological evidence were also recovered by the molecular data with strong support, with few exceptions. Noctuidae *s.l.* is not recovered as a monophyletic group because (Arctiidae + Lymantriidae) is placed as sister group to (Herminiinae + Aganainae) within a quadrifine noctuid clade. Nolinae *s.l.* is the basal-most group in this clade. We propose that quadrifine noctuid subfamilies be raised in rank to full families, and that the name Noctuidae *s.s.* be applied to trifine noctuids only. Our data supports a monophyletic trifine clade, as delimited by Poole (1995). Relationships within trifines agree broadly with Poole (1995): Plusiinae are basal, followed by Acontiinae *s.l.* Next is a large clade containing Pantheinae, Raphiinae, Dilobinae, Cuculliinae *s.s.*, Oncocnemidinae, Agaristinae, Amphipyrinae *s.s.*, Psaphidinae [paraphyletic], Stiriinae and Acronictinae. Sister group to the previous clade is the "pest clade," containing Condicinae, "Caradrinini" [polyphyletic], Heliothinae, Bryophilinae, Phosphilini, Eriopinae, and a very strongly supported group (Noctuinae *s.l.*) containing Noctuinae *s.s.*, Glottulinae, Hadeninae [paraphyletic], Phlogophorini, Xylenini, Ufeinae, and Apameini. This establishes a relatively robust phylogenetic framework to serve as a launching point for future work on the higher-level systematics of Noctuidae.

Index terms: Arctiidae, Lymantriidae, classification, systematics, taxonomy

[3696] PHYLOGENY OF ARCTIIDAE (LEPIDOPTERA: NOCTUOIDEA) BASED ON IMMATURE STAGES AND ADULT MORPHOLOGY

S. J. Weller & N. L. Jacobsen, Dept. of Entomology, 219 Hodson Hall, 1980 Folwell Ave., St. Paul, MN 55108-6125 USA Phone: 612-625-6253, Email: welle008@maroon.tc.umn.edu

Phylogenetic relationships for the Arctiidae are proposed based on a cladistic study of morphological features of larval, pupal and adult stages. We examined 40 arctiid species and 8 outgroup species. The data set consisted of 66 characters and 196 states; both new and traditional characters were included. Our analysis resulted in 8 trees. The Arctiidae are monophyletic and we found support for 3 monophyletic subfamilies: Lithosiinae, Syntominae and Arctiinae. Six tribes of the Arctiinae are recognized, although two of these are paraphyletic as normally constituted. We present these results and preliminary data from studies that include both molecular and morphological components.

Index terms: Tiger moths, systematics, cladistics

[3697] BUTTERFLIES (PAPILIONOIDEA): NOT ALL CHARACTERS ARE EQUAL

R. K. Robbins[1] **& C. L. Huser**[2], [1]Dept. of Entomology, Smithsonian Institution, Washington, DC 20560-0127, USA, E-mail Robbins.Robert@NMNH.SI.edu; [2]Staatliches Museum für Naturkunde [State Museum of Natural History], Rosenstein 1, D-70191 Stuttgart, Germany, E-mail 113217.3422@compuserve.com.

Attempts to resolve phylogeny of the true butterfly families (Papilionoidea) have sometimes included large numbers of characters, probably with the idea that increasing the number of characters, no matter how homoplastic, was likely to provide a better estimate of phylogeny. However, the analyses of these data showed very high levels of homoplasy and resulting consensus cladograms were poorly resolved . This approach is challenged by presenting criteria to be used in determining whether a character is appropriate for inclusion in a "higher level" phylogenetic analysis. Our basic premise is that it makes little sense to ignore more than a century of knowledge accumulated on butterfly morphology and function. Three character sets are used to illustrate our criteria. On this basis, a review of the phylogenetic relationships of true butterflies at the subfamily level is presented. Finally, we suggest a list of likely informative characters that may be useful to develop in the future.

Index Terms: Phylogeny, butterfly families, systematic characters

[3698] PHYLOGENY OF NYMPHALIDAE, AS INFERRED FROM *WINGLESS* AND MTDNA SEQUENCES

A.V. Z. Brower, Dept. of Entomology, Oregon State University, Corvallis, OR 97331-2907 USA, phone:541-737-5531 e-mail: browera@bcc.orst.edu

The Nymphalidae, or brush-footed butterflies, are one of the most familiar insect families, including many of the largest and most beautiful species (such as the attractive specimen illustrated on the flyer advertising this Congress). However, despite 200 years of research, the relationships among tribes and subfamilies remain controversial. In this study, the phylogenetic relationships among most of the families and tribes nymphalid butterflies are inferred by cladistic analysis of DNA sequences from mitochondrial COII and the nuclear *wingless* gene from exemplar species. These results are compared to published hypotheses based on morphological data.
Index terms: Danainae, Satyrinae, Limenitidinae, Heliconiinae

[3699] PAPILIONIDAE PHYLOGENY: MOLECULES AND MORPHOLOGY CONVERGE

F. A. H. Sperling[1,2] & M. S. Caterino[2,3], [1]Dept. Biological Sciences, CW-405 Biological Sciences Centre, Univ. Alberta, Edmonton, Alberta, T6G 2E9 Canada. [2]Division of Insect Biology, 201 Wellman Hall, Univ. California, Berkeley, CA, 94720-3112 USA. [3]Dept. Entomology, The Natural History Museum, Cromwell Rd., London, SW7 5BD, U.K.

Swallowtail butterflies (Papilionidae) have been the subject of substantial basic and applied study, yet phylogenetic relationships among the major lineages of the family remain contentious. We have sequenced 3.3 kb of mitochondrial (COI/COII - 2.3 kb) and nuclear (EF1a - 1.0 kb) DNA for 40 swallowtails, including representatives of all 3 subfamilies and most lower genera, and an additional 15 moth and butterfly outgroups. Parsimony and maximum likelihood analyses support tribal relationships perfectly congruent with traditional classifications of Papilionidae: (Baroniinae ((Parnassiini, Zerynthiini) (Graphiini (Troidini, Papilionini)))), contrary to several recent phylogenetic studies.
Index terms: Papilio, phylogeny, parsimony, maximum likelihood

[3700] MOLECULAR PHYLOGENETIC ANALYSIS OF THE BRACHYCERA (DIPTERA)

B.M. Wiegmann, Dept. of Entomology, North Carolina State Univ., P. O. Box 7613, Raleigh, NC 27695-7613, USA, E-mail bwiegman@unity.ncsu.edu.

Relationships among the major groups of brachyceran Diptera have been difficult to resolve by comparative morphology alone. DNA sequence data offer a potential wealth of new evidence on higher-level fly phylogeny. Here the contribution of molecular data to questions in brachyceran phylogenetics is reviewed. Relationships among the four monophyletic infraorders, Xylophagomorpha, Tabanomorpha, Stratiomyomorpha, and Muscomorpha are assessed based on sequences from 28S ribosomal DNA and several additional nuclear genes. Parsimony and maximum-likelihood based analyses suggest a basal position for the Stratiomyomorpha, but support for this arrangement is not strong. Combined analysis with morphological characters supports instead a basal clade joining Stratiomyomorpha, Xylophagomorpha and Tabanomorpha. Bayesian Divergence Times (BDT) analysis is used to estimate ages of origin for major brachyceran clades from molecular data without the assumption of a molecular clock. This evidence confirms that all major lower brachyceran lineages had their origins in the mid-Jurassic contemporaneous with the origin of flowering plants (Angiosperms). Individual molecular systematic analyses of major groups within the Brachycera, including Xylophagomorpha, Tabanomorpha, Asiloidea, Empidoidea, and basal Cyclorrhapha are also presented, and the position of key phylogenetically enigmatic taxa are discussed in light of molecular and morphological support for their placement.
Index terms: Cyclorrhapha, Muscomorpha, Stratiomyomorpha, systematics, ribosomal DNA

[3701] LEIODIDAE BEETLES: A NEW ZEALAND PERSPECTIVE

R. A. B. Leschen[1] & A. Newton[2], [1]Research, Private Bag 92 170 120 Mt Albert Road, Auckland, New Zealand , leschenr@landcare.cri.nz; [2]Field Museum of Natural History, Division of Insects, Roosevelt Road at Lake Shore Drive, Chicago, IL, 60605, newton@fmnh.org

The New Zealand fauna is composed of 16 genera and 69 described species and an additional 33 undescribed species and 10 undescribed generic-level taxa. Camiarinae has a high number of endemic genera (Neopelatopini: 1 genus (1 undescribed); Camiarini: 5 genera (2 undescribed); Agyrtodini: 5 genera (1 undescribed)) and of these Agyrtodes occurs in Australia and Chile. Leiodinae has a fewer number of genera (Sogdini: 1 genus (2 undescribed); Leiodini: 1 genus; Pseudoliodini: 2 genera)) and of these Zeadolopus occurs world wide and Colenisia occurs in Asia and Australasia. There are three genera of Anemadini Cholevinae (Pseudonemadus, a member of the Eunemadina and occurs in Australasia and Indonesia) and Mesocolon and Paracatops, both members of the endemic Paracatopina. The high number of endemic species and genera is probably due to the insular nature of New Zealand, a landmass that has been adrift and separated from Gondwana for 60 million years or so. Some taxa, such as Colenisia and Pseudonemadus, with one species each in New Zealand, may represent recent introductions possibly from Australasia, while most of the remaining taxa are members of south temperate clades. The systematics of Camiarinae, a basal paraphyletic grouping of Leiodidae, requires detailed systematic study that would help to elucidate biogeographic patterns and affinities of the New Zealand fauna. The biology of the family is poorly known though it is likely that most species are saprophagous while some species of Argyrtodini feed on wood rotting fungi (Polyporaceae) and an undescribed genus of Neopelatopini is a specialist on slime moulds (Myxomycetes). A preliminary phylogenetic analysis of the Neopelatopini shows that slime mould feeding in Camiarinae has evolved at least two times.

[3702] THE TURTLE LEIODID - A CHILEAN ENIGMA (COLEOPTERA: LEIODIDAE)

A. F. Newton[1], [1]Dept. of Zoology, Field Museum of Natural History, 1400 South Lake Shore Drive, Chicago, IL 60605, USA, E-mail: anewton@fmnh.org

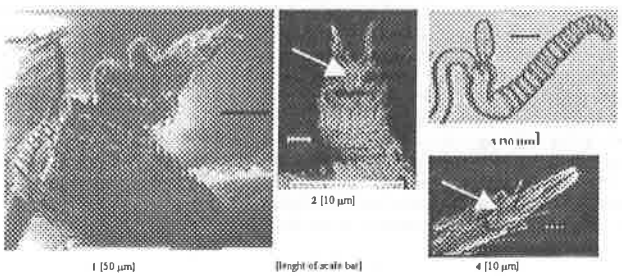
The unusual structure, distribution, and systematic placement of the genus *Chelonodes* are reviewed. Among unique features are laterally foveate elytra and a retractile head that can be completely concealed under an enlarged semicircular pronotum. The five known allopatric species are all small, lightly pigmented, blind and flightless saprophages in litter or soil of temperate forests between 35° and 43° south latitude in southern Chile; a record of one species from eastern Australia is probably an accidental introduction or mislabeled specimen. Most species are found in coastal ranges but absent from similar habitats in the adjacent Andes, possibly as a result of Pleistocene glaciations in the Andes plus low dispersal ability of the species. Placement of the genus within Leiodidae is problematic because of many highly modified or reduced features. Evidence from adults and larvae is used to justify placement of the genus as a tribe Chelonodini in the subfamily Catopocerinae, which until now included two tribes and genera of blind, flightless leiodids from temperate forests and caves of North America and northeastern Asia. The combination of this amphitropical distribution pattern, presumed low dispersal abilities of the species, and retention of some plesiomorphic features in comparison to other Leiodidae, suggests an ancient origin of Catopocerinae in the new sense.

Index terms: *Chelonodes*, Catopocerinae, Pleistocene, amphitropical, soil fauna.

[3703] THE STRANGE GENUS *BARYODIRUS* AND THE PHYLOGENY OF PTOMAPHAGINI

M. Perreau, Université Paris 7, case 7020, 2 place Jussieu, 75251 Paris cedex 05 France

The tribe Ptomaphagini is well known to have a widespread distribution area in all continents except Antarctica and subsaharian Africa. Two genuses: *Ptomaphaginus* and *Pandania* are living in Indonesia and Malaysia. A new, presently monospecific, genus: *Baryodirus* Perreau, 2000, discovered in Sarawak presents quite unusual characters: the female protarsi are tetramere and largely dilatated (fig. 1). The mesosternal carina is large which setae on the ventral surface. All tarsi of *Baryodirus* are characterized by a waved structure on the onychium of all tarsi, behind the tarsungula (fig. 2 for protarsi, (arrow)). The pronotum and the elytra have two kind of setae, some sparce long setae, and many small ones. By its unusual characters, *Baryodirus hammondi* takes a special place among Ptomaphagini. The tetramere protarsi occur among cholevinae only in Leptodirini. The large mesosternal carina occurs also in a few genus of Leptodirini (*Henrotiella*, *Adelopsella*). Also the two kind of setae on pronotum and elytra occur mainly in some Leptodirini genuses (Ptomaphagini have only the small setae). The large female protarsi are unique for Cholevinae, and occurs among Leiodidae only in Coloninae. But these similar characters with Coloninae or Leptodirini, are probably homoplasic. The other characters are those of Ptomaphagini: metasternal carinas, apical combs of spines to tibias, prolongated in protibias by a row along the external side and a sclerified spermatheca (fig. 3), as in *Ptomaphaginus*, *Pandania* and *Proptomaphaginus*. The special structure at the apical part of onychium is also found in the genus *Eucatops* (fig. 4, (arrow)), but not in the other genuses of Ptomaphagini. This reinforce the assumed phylogenetic relationships between Eucatopini and Ptomaphagini. The male is still unknown, so the morphology of the edeagus cannot be compared to the other genuses of Ptomaphagini.



[3704] PHYLOGENY OF *CHOLEVA AGILIS* SPECIES GROUP (COLEOPTERA: LEIODIDAE: CHOLEVINAE): MORPHOLOGICAL AND MOLECULAR POINT OF VIEW

J. Ruzicka, Dept. of Ecology, Faculty of Forestry, Czech Agricultural University, CZ-165 21 Praha 6 – Suchdol, Czech Republic, E-mail: ruzicka@lf.czu.cz.

Presented are results of a morphological study, leading to reclassification of the *Choleva agilis* species group. Recently, 8 valid species are recognized, incl. polytypic *C. lederiana*. Phylogenetic analysis failed in finding any apomorphy for the entire *C. agilis* species group. Two subsets seem to be supported by characters based on external morphology: first one, containing *C. matthiesseni*, *C. bedeli* and *C. emgei*; and second one, containing the rest of species. *C. agilis* and the polytypic *C. lederiana* (with widely distributed nominotypical subspecies and isolated cave-dwelling subspecies in Central Europe) have fallen to wide polytomy. This complex is evaluated also by molecular tools, using AFLP study on selected populations of both species from Central Europe.

Index terms: taxonomy, subterranean habitats, Palaearctic region

[3705] PHYLOGENY, EVOLUTIONARY RATES, AND MORPHOLOGICAL ADAPTATION TO CAVE LIFE IN BATHYSCIINE BETLEES: CALIBRATING THE CLOCK FROM THE MITOCHONDRIAL COI GENE

V. Sbordoni & A. Caccone.

ABSTRACT NOT RECEIVED

[3706] CIRCANNUAL LIFE-CYCLE PATTERNS IN MICROCAVE-DWELLING CHOLEVIDAE

W. Topp, Dep. of Zoology, Univ. of Cologne, D-50923 Koeln. Germany. This study was supported by the DFG.

Most species of the genera *Choleva* and *Catops* may have diversified during the Tertiary epoch within the remnants of the Hercynian mountain chains. Survival through the ice ages could have been successful if species evolved adaptations to the cold. During the postglacial stage some species retreated to the coldest zones. Others escaped the warm climate of the temperate zone by 1. preferring cool sites during the warm season, 2. living in subterranean habitats, and by 3. shifting their activity and development from the warm season to the cold of the winter months. We studied three different systems with species living mainly in the Atlantic climate of western Europe but varying in their intensity of euedaphic life and addressed the following questions: 1. What are the temperature requirements for optimizing development? 2. Are there any cues for stabilizing development during the varying seasons? 3. Are there mechanisms to ensure development in unpredictable and changing environments? All species exhibited the highest reproductive efforts and survival rates within a small thermal window ranging from 5 ° to 10 °C. Fitness of individuals decreased at higher and lower temperatures. The lower thermal threshold for all developmental stages ranged from +2 °C to -5 °C. Metabolism of adults was independent of temperature in the dormant as well as in the non-dormant stage. Reproduction was mainly semelparous with optimal dates in the autumn or winter months. These dates were determined by the duration of an obligatory adult aestivation. In the more epedaphic species (C. *nigricans*), this duration was tuned by exogenic factors such as photoperiod and temperature. The more euedaphic species (*Ch. elongata*) showed a homeostatic response pattern. This was manifested by a constant duration of aestivation, independent of temperature and photoperiod. All species matched the vagaries of climate by risk-spreading. 1. Aestivation ranged from several weeks to a whole year. 2. Duration of aestivation was governed by heritability (h2) < 0.26. 3. The period of oviposition could be extended for over a year in the laboratory and may result in iteroparous oviposition patterns in the field. 4. Risk-spreading was more pronounced in the euedaphic species than in the epedaphic species. 5. Risk-spreading among local populations and full siblings facilitated all species to cope with the vagaries of climate with average winter temperatures deviating from the mean. 6. In euedaphic species risk-spreading was extremely intense and may have served as a mechanism for development along a subglacial fringe. 7. Spreading the risk is even so pervasive that it enables the euedaphic species to survive in local environments even when climate changes tremendously, as documented for the glacial and interglacial stages of the Pleistocene.

[3707] ULTRASTRUCTURE OF FILTERING MOUTH PARTS IN HIGHLY SPECIALIZED TROGLOBITIC LEPTODIRINAE (COLEOPTERA, CHOLEVIDAE)

A. Casale[1], **M.Carcupino**[1] **& P.M.Giachino**[2], [1]Dept. Zoologia e Antropologia Biologica, Via Muroni 25, 07100 Sassari, Italy, Email zoologia@ssmain.uniss.it; [2]Museo Regionale di Scienze Naturali, Via Giolitti 36, 10126 Torino, Italy.

In cold oligotrophic caves of temperate regions, various troglobitic organisms have adapted to life on the wet, vertical surfaces of stalagmitic walls, and are regular saprophages of the film of mud and organic matter, which flows on the stones and walls of caves after floods. Some constitute the animal associations living in a peculiar, extreme environment known as the "hygropetricum". Certain adaptive features of leptodirine cholevids (Coleoptera) adapted to this way of life are well known, for example the narrow prothorax, wide elytra, long antennae and legs, and large tarsal claws. In some ultra-specialized taxa, such as species of the genera *Hadesia*, *Radziella*, *Tartariella* and *Cansiliella*, the hydrophobic pubescence, the hollow mandibles and the short pubescent maxillae are adapted to feeding by filtering water and organic matter. In the present study, the ultrastructure of mouth parts was examined by SEM. The modifications and evolution patterns of sclerites and sensilla are discussed. The character transformation series of these morphological features is traced in relatively unspecialized (such as *Ovobathysciola*) to highly specialized taxa (such as *Antroherpon* and *Radziella*) and confirms that they are convergent in different phyletic lineages, without any particular systematic value.

[3708] MOLECULAR PHYLOGENY OF THE SUBFAMILIES IN GEOMETRIDAE (GEOMETROIDEA: LEPIDOPTERA)

D. Abraham[1], **N. Ryrholm** [2], **H. Wittzell**[3] **& C. Löfstedt**[1], [1]Pheromone research Group, Department of Chemical Ecology, Lund University, Sölvegatan 37, SE-22362 Lund, Sweden E-mail David.Abraham@ekol.lu.se; [2] Department of Animal Ecology, Evolutionary Biology Centre, Uppsala University, Norbyvägen 18 D, SE-75236 Uppsala, Sweden, [3]Department of Theoretical Ecology, Lund University, SE-22362 Lund, Sweden.

The Geometridae is one of the largest families of moths. Relatively little is known about the phylogeny of this family, since most phylogenetic research is concentrated on the genus level. In the present study we investigate the phylogenetic relationships between the subfamilies within Geometridae and between Geometridae and Drepanidae, using sequence data from three gene fragments: The ND1 mitochondrial gene, the first expansion segment and the second expansion segment of the 28S ribosomal RNA gene. Although the alignment of the second expansion segment contained regions with many gaps, it provided the most resolution of the used gene fragments. Parsimony analysis of the combined data resulted in a phylogeny in which species belonging to Drepanidae, Larentiinae and Sterrhinae form monophyletic groups. The Archiearinae and Geometrinae (represented by one species per group in the present study) are basal to the Ennominae. The species belonging to the Oenochrominae resides under the Ennominae.
Index terms: Maximum parsimony, mitochondrial, ribosomal

[3709] GENERIC REVISION AND PHYLOGENY OF THE FAMILY STEPHANIDAE (HYMENOPTERA)

A. P. Aguiar, The Ohio State University, Museum of Biodiversity, 1315 Kinnear Road, Columbus OH 43212, USA.

What are stephanids? For more than 150 years entomologists, and intrigued amateurs as well, have been trying to answer this question, without much success. Stephanids are far from being an easy group to investigate, and current scientific consensus about these insects does not go much further than classifying them in the order Hymenoptera. The 'invulnerability' of the group to scientific scrutinity, however, does not stop here. In spite of the fact that only 11 stephanid genera have been proposed, a minimum agreement has not yet been reached about which genera should be maintained, which ones should be synonymized, or how relevant are the characters used to define them. Species level classification also remains mostly chaotic, and species recognition is often impossible without consultation of type specimens. The contribution of this work is that it provides the first objective interpretation of the classification and evolution of Stephanidae, based in the largest and most diverse sample of specimens of this group ever examined. Specifically, I revised the generic classification of the family on the basis of a cladistic analysis, using conventional and weighted parsimony methods. Fifty five stephanid species and 176 informative characters were evaluated, producing results which suggest relationships and groupings significantly different from traditional hypotheses. The subfamily Stephaninae (including Schlettereriinae) is paraphyletic according to the analysis, but was maintained as a valid taxon for practical reasons. The monophyly of the genus *Schlettererius* could not be assessed, but it was maintained as a valid taxon based on its "distantly basal" position in relation to other stephanids. Newly discovered (putative) synapomorphies, strongly supported the monophyly of each of the following genera: *Stephanus*, *Hemistephanus*, and *Parastephanellus*. The widely-distributed *Megischus*, was retrieved as a distinct but highly paraphyletic lineage, composed of several independent clades, but in order to preserve taxonomic stability this taxon was redefined and maintained as valid. The essentially Oriental *Foenatopus*, *Madegafoenus*, *Neostephanus* and *Diastephanus* were invariably recovered as a single large monophyletic group with very poor internal resolution, suggesting that these taxa should be synonymized into a single genus (*Foenatopus*). Results also support the monophyly of the Foenatopinae, but its original sense was expanded to include a new monotypic genus from Africa. Finally, results from an analysis of combined literature data did not support the often-cogitated sister group relationship of Stephanidae and Orussidae, suggesting instead a basal position of stephanids, together with non-ceraphronoid evaniomorphs, within the Microhymenoptera clade of a biphyletic Apocrita.
Index terms: *Stephanus*, *Schlettererius*, *Megischus*, *Parastephanellus*, *Foenatopus*.

[3710] ABUNDANCE, TEMPORAL PATTERNS OF ACTIVITY AND FLORAL PREFERENCES OF *CENTRIS* BEES (HYMENOPTERA, APIDAE) FROM BRAZILIAN CAATINGA

C. M. L. Aguiar, Depto. de Ciências Biológicas, Univ. Estadual de Feira de Santana, BR 116, km 3, Feira de Santana, Bahia, Brasil, CEP 44031-460, E-mail:claguiar@uefs.br

Centris bees are pollinators of many flowering plants in Neotropical region. Despite their ecological importance, there is little knowledge about these bees in xeric areas in South America. The aim of this work was identifying *Centris* species living in a Caatinga area, in Northeastern Brazil, and providing data about their abundance, temporal patterns of activity (seasonal and daily) and floral resources. The work was carried out at Itatim (12º 42' S; 39º 41' W), Bahia State, Brazil. The climate in this area is semiarid. The annual average of rain is 551 mm and there are at least five dry months per year. The vegetation is an open shrubby Caatinga, with scarce trees. It's characterized by falling leaves during the most time through the year. The bees were collected on flowers along a transect of 3 km length, using entomological nets. Samples were taken from September/1996 to November/ 1997, once a month. Ninety-one individuals from ten species were obtained: *C. (Centris) aenea, C. (Centris) caxiensis, C. (Centris) leprieuri, C. (Centris)* sp 1, *C. (Hemisiella) tarsata, C. (Hemisiella) trigonoides, C. (Paracentris)* n sp, *C. (Ptilotopus) moerens, C. (Ptilotopus) sponsa, C. (Trachina) fuscata*. They visited eleven plant species. *Melochia betonicifolia* (Sterculiaceae) and *Solanum paniculatum* (Solanaceae) were the most important ones. In general, the annual activity period started in late September and its duration was variable according to each species. *C. aenea* and *C. fuscata* had the most prolonged flight season. Most species were active on late dry season and early rainy season. The highest abundance of these bees was from October to December. The bees visited flowers from 07:00 AM – 5:00 PM. Males started activity about one hour after females and were more abundant on early evening (01:00-02:00 PM). The females had peak of activity on early morning (08:00 – 09:00 AM). Species richness of *Centris* bees in this area was medium to high, comparing it to other ecosystem in Brazil. They showed a typically seasonal pattern of activity.

Index terms: Centridini, xeric areas, daily activity, seasonality

[3711] PHYLOGENETIC ANALYSIS OF THE HYBOTINAE (DIPTERA: EMPIDOIDEA)

R. Ale-Rocha[1] & C. J. B de Carvalho[2], [1]Coordenação de Pesquisas em Entomologia, Instituto Nacional de Pesquisas da Amazônia-INPA, C.P. 478, 69011-970, Manaus, Amazonas, Brazil. E-mail alerocha@inpa.gov.br; [2]Departamento de Zoologia, Universidade Federal do Paraná, C.P. 19020, 81531-990, Curitiba, Paraná, Brazil. E-mail cjbcarva@bio.ufpr.br

The phylogenetic relationships among the world genera of Hybotinae (Empidoidea) were investigated using Hennig 86 program. The analysis comprised 11 ingroup terminal taxa, representing 100% of the subfamily genera until now, 3 new genera and 70 adult male and female characters. Characters were polarized using Tachydromiinae, Ocydromiinae and Atelestinae as outgroups. The monophyly of Hybotinae was corroborated in this analysis by the following synapormophies: proboscis directed forwards; eyes divided by a sclerotized horizontal line; hind leg modified for raptorial use; inner surface of palpi glabrous; palpi long and slender; labellum longer than prementum. A cladogram of relationships between the genera is presented with the following topology: ((*Lamachella* + *Stenoproctus*) + *Chillcottomyia* + (*Acarterus* + (*Afrohybos* + (*Syneches* + *Hybos* + (New Genus A + ((*Lactistomyia* + *Syndyas*) + New Genus B + (New Genus C + (*Cerathybos* + *Euhybos*))))))))).

Index terms: Empidoidea, Hybotinae, phylogenetics, morphology

[3712] REVISION OF THE BRAZILIAN SPECIES OF *PSEUDAUGOCHLORA* (HYMENOPTERA: HALICTIDAE)

E. A. B. Almeida[1], [1]Laboratório de Sistemática e Ecologia de Abelhas, Depto. de Zoologia, Univ. Federal de Minas Gerais, C.P. 486, Belo Horizonte, MG 31270-901, Brazil. E-mail: ealmeida@mono.icb.ufmg.br.

Pseudaugochlora was described by Michener to include species previously considered in *Pseudaugochloropsis*. Seven species were previously known in the genus, among which, only two – *P. graminea* and *P. pandora* – were known from Brazil. *P. graminea*, type species of the genus, shows the widest distribution in this taxon: from Texas (USA) to Argentina; *P. pandora* occurs in the Brazilian states of Bahia, Espírito Santo, Goiás, Maranhão, Mato Grosso, Minas Gerais, Paraíba, Pernambuco, Rio de Janeiro, Rio Grande do Norte e Tocantins. In this work, three new species, known up to now only from Brazil, are described. The first of them is distributed through the states of Espírito Santo, Minas Gerais, Paraná, Rio de Janeiro, São Paulo and in the Distrito Federal; another occurs in Goiás, Mato Grosso, Minas Gerais, Pará, Paraíba and São Paulo and the last one in Goiás and in the Distrito Federal. The lack of taxonomic revisions for this genus makes the identification of the species difficult and, for this reason, diagnoses of each of the Brazilian species and an identification key for them (based on external morphology and genitalia) is given.

Index terms: Augochlorini, taxonomy, Neotropics, bee

[3713] NEW INFORMATION ABOUT *HETEROPTERA* IN THE NORTHWEST OF THE IBERIAN PENINSULA PONDS

J. Álvarez & J. Garrido, Dept. de Ecología y Biología Animal, Univ. De Vigo, Lagoas-Marcosende 36200 Vigo, Spain, E-mail jorgea@uvigo.es and jgarrido@uvigo.es.

In this paper we studied the aquatic heteropteran (*Heteroptera*) present in four Galician´s ponds (Northwest of the Iberian Peninsula). The samples were collected once a season during 1998. Along with the fauna some physical-chemical parameters were collected (oxigen concentration, temperature, salinity, TDS(Total Disolved Solid), pH and conductivity) giving us information about the water of the ponds. We try to give new knowledges about the distribution and ecology of the species in the ponds. With this study we also want to show how important the conservation of these ecosistems is 18 species of 7 families have been collected. As far as the families is concern *Corixidae* is the most important with 7 species. The most of the animals collected belong to *Corixidae* too. Three of the ponds (Boideira, Vixán and Xuño) are in the shore. The fourth pond (Cospeito) is inland, and is the one with more number of species.

Index terms: aquatic heteropteran, ponds

[3714] GENERA OF ANOMALONINAE (HYMENOPTERA:ICHNEUMONIDAE) FROM VENEZUELA

W. Amaro[1] & F. A. Díaz[1]. [1]Univ. Centroccidental Lisandro Alvarado, Decanato de Agronomía, Dpto. de Ciencias Biológicas, Tarabana 3023, Lara, Venezuela. E-mail: dbfrancis@hotmail.com.

The subfamily Anomaloninae is widely represented in all zoogeographic regions of the world. There are 38 genera and 718 species known in the world. Members of this subfamily are koinobiont endoparasitoids of Coleoptera and Lepidoptera larvae. There is no previous record of this subfamily in Venezuela. Based on the examination of 150 specimens present in the insect collection at the Museo Dr. José M. Osorio (UCOB), Tarabana, Lara state, seven genera are found, *Anomalon, Agrypon, Corsoncus, Ophionellus, Ophiopterus, Podogaster* and *Trichomma*. The Venezuelan distribution of each genus is given.
Index terms: *Anomalon, Agrypon, Corsoncus, Ophionellus*, koinobiont

[3715] A NEW PHYLOGENY AND PHYLOGENETIC CLASSIFICATION FOR THE CANTHYLOSCELIDAE (DIPTERA: PSYCHODOMORPHA)

D. S. Amorim. Depto. de Biologia-FFCLRP, Universidade de São Paulo, Av. Bandeirantes 3900, 14040-901 Ribeirão Preto SP, BRAZIL. E-mail: dsamorim@usp.br.

A phylogenetic analysis of the Scatopsoidea is performed, based on 59 characters of adult male and females morphology, as well as of some immature features. A sister-group relationship between Canthyloscelidae and Scatopsidae is accepted and the monophyly of the Canthyloscelidae is corroborated, including *Exiliscelis*, *Synneuron*, *Hyperoscelis* and *Canthyloscelis*. An earlier phylogenetic analysis for the group is considered, in which *Synneuron* was accepted as the sister-group of the Scatopsidae and *Exiliscelis* was considered the sister-group of (*Synneuron* + Scatopsidae). Some apomorphic similarities between the larvae of all genera of Canthyloscelidae —especially the reduction of the head capsule— are considered true synapomorphies. *Exiliscelis* is considered the sister-group of the remaining set of the family and placed in a new subfamily, Exiliscelinae. In the Canthyloscelinae, *Synneuron* is the sister-group of (*Hyperoscelis* + *Canthyloscelis*). A phylogenetic classification is proposed for the group. *Prohyperoscelis rohdendorfi* Kovalev, 1985, of the Middle Jurassic of Russia, is accepted as the sister-group of *Canthyloscelis*. Pictorial cladograms with wings, male and female terminalia are given.

[3716] INTERNATIONAL TAXONOMIC COLLABORATIONS: DEVELOPING AND MAINTAINING NORTH-SOUTH LINKAGES WITHIN THE AMERICAS

R. S. Anderson, Canadian Museum of Nature, P.O. Box 3443,, Station D, Ottawa, ON. K1P 6P4, Canadá, E-mail: randerson@mus-nature.ca

In these times of increasing awareness that levels of global species diversity likely exceed even the most extreme predictions, resources for documenting this diversity are in perilous decline. Increasing cooperation among individuals researchers and institutions, both within and between nations is essential to ensure effective and efficient use of limited funds and expertise. Nowhere is the problem more acute than between North America (where most expertise and resources exist) and Central and South America (where most species diversity exists). Examples of fruitful collaborations between institutions in Canada and the U.S.A. and Honduras, Costa Rica, Bolivia and Ecuador will be used as illustrative.

[3717] CLADISTIC ANALYSIS OF THE CERESINI GENERA: A REAPPRAISAL (HEMIPTERA, AUCHENORRHYNCHA, MEMBRACIDAE)

G. S. Andrade[1] & G. S. Carvalho[2], [1] Dept. de Ciências Biológicas, Univ. Est. do Oeste do Paraná, Rua Universitária, 2069, 85814-110, Cascavel, PR, Brasil, E-mail gsa@certto.com.br; [2] Dept. de Biologia, Pont. Univ. Católica do Rio Grande do Sul, Av. Ipiranga, 6681, Prédio 12 D, Sala 44, 90619-900, Porto Alegre, RS, Brasil, E-mail gervasio@pucrs.br.

KOPP & YONKE (1979) presented the first cladogram for Membracidae in Ceresini and, although solved the main questions within the tribe, some other questions remains obscure. We presented a cladistic reanalysis in this group, using new discovered characters and reinterpretation of other used formerly. The genus *Melusinella* was not see and the male genitalic features of *Clepsydrius* were examined for first time, which along other data indicate that various characters formerly interpreted as apomorphies are actually simple autapomorphies. We analyzed 22 characters corroborated as apomorphies, which were polarized using the outgroup comparison method through genera of Amastrini and Polyglyptini. Using the program Hennig 86, version 1.5 (FARRIS, 1988), with aid of the interface Tree Gardener, version 2.2 (RAMOS, 1997), with characters polarized and ordered, and by means of ie command, the analysis results a single cladogram with 27 steeps, consistence index 100% and retention index 100%, with the following parenthetical notation (*Amblyophallus* + *Tapinolobus*) + (*Ceresa* (*Trichaetipyga* (*Stictolobus* (New genus + *Vestistilus*))) (*Anisostylus* + *Spissistilus*) (*Hadrophallus* (*Stictocephala* + *Tortistilus*))) + (*Paraceresa* (*Penichrophorus* (*Antonae* (*Poppea* (*Proxolonia* (*Cyphonia* + *Eucyphonia*)))))), showing three branches which are proposed as subtribes. These branches includes one of genera without none pronotal ornation, other with suprahumeral horns as the unique ornation and, the more advanced, with some pronotal modifications. For the intermediary branch the male genitalic characters are the strong way for genera distinguishment, but in the branch that includes genera with various pronotal modifications this structure is sufficient for genera identification. A new genus is proposed to accomodate some species previously classifyed as *Ceresa* and *Vestistilus*, and the genera *Clepsydrius* and *Parantonae* are synonymized with other by pronotal and male genitalic features data.
Index terms: phylogeny, classification , taxonomy

[3718] PHYLOGENETIC RELATIONSHIPS OF THE GENUS *ZABRUS* (COLEOPTERA, CARABIDAE) BASED ON MORPHOLOGICAL, KARYOTYPIC, AND MOLECULAR DATA

A. Andújar, J. Galián, J. F. Sánchez-Gea & J. Serrano, Dept. de Biología Animal, Fac. de Veterinaria, Univ. de Murcia. Aptdo. 4021. 30071 Murcia (Spain). E-mail jserrano@fcu.um.es.

The genus *Zabrus* has a circummediterranean distribution, reaching to the East the Himalayas and Northwestern China. It includes about 105 species distributed into 14 subgenera. The systematics of the group is currently based on morphological traits and needs a holistic approach including additional morphological characters, karyotypic, and molecular data. 1) *Zabrus* is well differentiated with regard to *Amara* (probably its sister group) by apomorphies in the external morphology of adults and larvae, female genital tract, chromosome number, and sequence of the mitochondrial cytochrome oxidase gene. 2) Most of the subgenera currently based on morphological grounds are probably monophyletic except for the largest ones, *Pelor* with 52 species and *Iberozabrus* with 22 species. 3) The nominal subgenus *Zabrus* shows many plesiomorphic character states and is probably closely related to the ancestors of the genus. 4) The four subgenera endemic to the Iberian Peninsula and Western France appear closely related in maximum parsimony and neighbor-joining trees based on the sequence data of the cytochome oxidase gene, although they don't show any synapomorphy on morphological traits. 5) *Iberozabrus* sensu Jeanne (1968) seems to be a more natural group than *Iberozabrus* sensu Ganglbauer (1915) and Freude (1986). Only Z. *(Iberozabrus) consanguineus* seems to form a distinct lineage on the basis of morphological and molecular data. The subgenus *Iberozabrus* includes conflicting species groups when morphological and molecular data sets are compared; further research is needed for obtaining adequate congruence. 6) A number of taxonomic decisions must be adopted in agreement with the results herewith reported, including the description of new species and the description of new subgenera for grouping the species into monophyletic lineages.

Index terms: morphology, karyotypes, mtDNA, cytochrome oxidase, cladistics

[3719] PHYLOGENY AND SEXUAL DIMORPHISM OF STAG BEETLES (COLEOPTERA, LUCANIDAE)

K. Araya[1], T. Hosoya[2] & M. Kon[3], [1]Graduate School of Human and Environmental Studies, Kyoto University,Yoshida, Sakyo, Kyoto 606-8501 Japan, [2]Graduate School of Science, Kyoto University, Kitashirakawa, Sakyo, Kyoto, 606-8502 Japan, [3]School of Environmental Science, the University of Shiga Prefecture, Hassaka-cho, Hikone, Shiga, 522-8533, Japan, E-mail: araya@zoo.zool.kyoto-u.ac.jp.

Stag beetles (Coleoptera, Lucanidae) are widely distributed almost over the world and abundant especially in the humid tropics. They are popular for their remarkable sexual dimorphism, which takes the shape of mandibles in many species. However, few species have been studied ethologically, ecologically, and/or evolutionarily. Eight subfamilies are generally recognized in the family Lucanidae, but their phylogenetic relationships remain uncertain due to the difficulty in choosing informative adult morphological characters for phylogenetic studies. Thus, we carried out phylogenetic analyses based on the mitochondrial DNA and the larval morphological characters for some representative taxa belonging to each subfamily. Based on the suggested phylogenetic trees, we analyzed the evolution of sexual dimorphism with reference to the mating systems of Lucanidae. It was surmised that (1) the common ancestor of Lucanidae possessed weak sexual dimorphism; (2) strong sexual dimorphism was independently evolved more than once with the habit of males fighting each other for mates at the sap-exuded sites on trees; (3) sexual dimorphism vanished in connection with the habit that both sexes live together with their young in the gallery dug into decayed logs just like observed for the family Passalidae.

Index terms: mating system, mitochondrial DNA, morphology

[3720] MOLECULAR PHYLOGENY OF *BEMISIA TABACI* (*HOMOPTERA; ALEYRODIDAE*) USING A MITOCHONDRIAL MARKER, THE 16S RIBOSOMAL SUBUNIT GENE

G. K. Banks[1], J. Farquhar[1], D. R. Frohlich[2], I. D. Bedford [1] & P. G. Markham [1], [1]Dept. of Virus Research, John Innes Centre, Norwich Res. Park, Norwich, Colney Lane, Norfolk NR4 7UH, UK. [2]Dept of Biology, Univ. of St. Thomas, 3800 Montrose Boulevard, Houston 77006, Texas, USA

Bemisia tabaci is an insect pest and disease vector of major agricultural and econome importance worldwide. As a species it comprises a number of different biotypes which cannot be distinguished morphologically but some can be differentiated biochemically, by using esterase profile variation, and molecularly, by using RAPD PCR pattern polymorphisms. Biological differences also exist in relation to host plant preference and efficiency of transmission of certain plant viruses, especially among the geminiviruses of the genus *Begomovirus*. The taxonomy and systematics of *B. tabaci* are controverisal and to examine the relationships among the biotypes a molecular phylogeny was carried out based on sequence from the 16S ribosomal subunit gene. The results show that different populations of *B. tabaci* can be distinguished using sequence data from the mitochondrial 16S rDNA. Three methods of phylogenetic analysis were used and yielded identical relationships. We present data from the maximum likelihood analysis, carried out using quartet puzzling. Seven clades represent a worldwide spread of *B. tabaci*. Silverleafing biotypes from different geographic locations can be seen to cluster together reinforcing that a population of silverleafing whitefly has been transported around the world. However, this analysis also shows that some non-silverleafing biotypes are genetically, at least at the level of mitochondrial evolution, very closely related to silverleafing biotypes and *vice versa*. This is the first evidence to show that not all silverleafing B biotypes are genetically identical and that not all non-silverleafing *B. tabaci* are genetically distinct from those that do silverleaf. The phylogenetic position of the various biotypes in the data set is discussed as well as the question of what defines a biotype and the evidence against the legitimate naming of *B. argentifolii* as a separate species.

[3721] PRELIMINARY CLADISTIC ANALYSIS OF THE FAMILY AULACIGASTRIDAE SENSU LATO (DIPTERA, CYCLORRHAPHA)

R. Baptista, Dept. of Entomology, University of Maryland, College Park, MD, 20560, USA). E-mail: baptista.alessandra@nmnh.si.edu

The Aulacigastridae sensu lato (superfamily Opomyzoidea) is a poorly known family of acalyptrate Diptera with worldwide distribution. Besides the core genus *Aulacigaster* Macquart, it includes genera currently classified in the family Periscelididae (*Planinasus* Cresson, *Stenomicra* Coquillett, *Cyamops* Melander) and Neminidae (*Ningulus* McAlpine, *Nemo* McAlpine, *Nemula* McAlpine). The limits of the Aulacigastridae and its phylogenetic relationships are in dispute, in part because, like other acalyptrates, aulacigastrids present a puzzling combination of highly homoplastic and highly derived characters. In addition, previous phylogenies for the group rest in part on incompletely specified, a priori assumptions about hypothetical ancestors, character evolution and weighting schemes. A cladistic analysis was carried out with two main goals: to define the boundaries and phylogenetic relationships of the Aulacigastridae, and to evaluate the performance of characters employed by previous studies. The in-group consisted of representative species of a subgroup of the Opomyzoidea defined by a single character, "femora robust", and includes the families Aulacigastridae, Periscelididae and Neurochaetidae. Outgroups were chosen among the opomyzoid families Clusiidae, Anthomyzidae and Asteiidae. A matrix with 27 exemplar species and 91 morphological characters was analyzed using PAUP.064. Multistate characters were treated as non-additive. Analysis under equal character weights was followed by successive weighting. Support levels were measured using bootstrap and decay indices. The results support the classification of *Stenomicra*, *Planinasus* and *Cyamops* in the Periscelididae, and the exclusion of the Neminidae genera from the Aulacigastridae. The genus *Aulacigaster* was found to be more closely related to the Anthomyzidae.

Index terms: *Aulacigaster,* Opomyzoidea, Phylogeny, Systematics

[3722] AN APPROACH TO EVOLUTIVE TAXONOMY OF THE APHID GENUS *ANURAPHIS* (RHYNCHOTA APHIDIDAE)

S. Barbagallo[1], I. Patti[1], G. E. Cocuzza[1] & M. C. Mosco[2], [1]Dip. di Scienze e Tecnologie Fitosanitarie – Univ. of Catania, via Valdisavoia 5, 95123 Catania, Italy, E-mail sebarbag@mbox.unict.it; [2]Dip. di Genetica e Biologia molecolare – Univ. of Roma "La Sapienza", via Lancisi 29, 00161 Roma, Italy.

The genus *Anuraphis* belongs to a rather homogeneous natural group of aphids (ex Anuraphidinae *sensu* Börner) presently ascribed to the tribe Macrosiphini of the subfamily Aphidinae. "Anuraphidine" are inclusive of about a dozen genera, which show some peculiar morphological features inside the Macrosiphini, such as a low or sinuose frontal profile (being the antennal tubercles little developed), a short cauda, and a number of dorsal tubercles (either marginal and spinal); ecologically they are mainly associated to Rosaceae (Maloideae and Prunoideae) as primary hosts. The genus *Anuraphis*, as quoted nowaday, includes ten species, of which six (*A. cachryos*, *A. catonii*, *A. farfarae*, *A. ferulae*, *A. pyrilaseri*, *A. subterranea*) have a rather well defined taxonomic status, compared to the remaining four checked taxa, mostly recorded from Eastern Palaearctics. *Anuraphis* shares with a few other genera of the same group a typical spinulose ornamentation of siphunculi and has, at least on apterae, a rather complete set of well developed spinal and marginal tubercles. Most similar is *Nearctaphis*, which may be considered as the vicariant taxon of Nearctic region, but lacks spinal tubercles and alternates between Maloideae (others than *Pyrus*) and Leguminosae or Scrophulariaceae. It is assumed that the above six species of *Anuraphis* are native from Western Palaearctics (likely from ponto-mediterranean area), where they are widely distributed and live on *Pyrus* (usually *P. communis*), which represent their primary host. From this host plant they radiate on secondary hosts, which are Umbelliferae, except for *A. farfarae* which lives on some Compositae. All known species are rather similar morphologically and show a more or less degree of overlapping, though biometrically separable. An electrophoretic study was carried out on 13 enzyme loci in order to evaluate the genetic relationships among six *Anuraphis* species: *A. pyrilaseri*, *A. farfarae*, *A. cachryos*, *A. subterranea*, *A. catonii*, and an undescribed taxon from Sicily. An UPGMA dendrogram, based on population allele frequencies, evidenced two clusters: one including *A. pyrilaseri* and *A. farfarae*, the other one including the remaining four species. The average genetic distance between the two clusters was found to be $D_{Nei} = 0.77$. At the genetic level *Anuraphis* sp. is poorly differentiated from *A. subterranea* (D_{Nei} average genetic distance = 0.19). Nevertheless the two species seem to be reproductively isolated in the field: no individuals with a hybrid genome were detected in sympatric areas.

Index terms: aphid taxonomy, allozyme, genetic distance.

[3723] THE AFFINITIES OF NEW GUINEAN SPECIES OF EMPIS (DIPTERA: EMPIDIDAE).

P. L. Th. Beuk, Zool. Mus. Univ. of Amsterdam, Dept. of Entomology, Plantage Middenlaan 64, NL-1018 DH Amsterdam, Netherlands; E-mail beuk@bio.uva.nl.

Only few species currently assigned to the genus *Empis* (Diptera: Empididae) are recorded from the Australasian/Oceanian Region. Little recent work has been done on them and the phylogenetic affinities are largely unknown. It is likely that some species will have to be referred to other (most likely new) genera. Some recent work already resulted in the description of a new genus (*Thinempis* Bickel).
A short survey is carried out, examining the species so far recorded from New Guinea. There affinities are discussed and they are compared with species known to occur elsewhere in the Indo-Malaysian Archipelago. Some remarks will be made about the biogeographic implications.

Index terms: dance flies, phylogenetic affinity, Indo-Pacific area, Australasina/Oceanian Region

[3724] THE MORPHOLOGY OF THE IMMATURE STAGE OF *PHORACANTHA RECURVA* (COLEOPTERA: CERAMBYCIDAE) AND A KEY TO LARVAE OF THE SPECIES OF *PHORACANTHA* IN URUGUAY

M. Bianchi[1], E. Morelli[2] & A. Sánchez[3], [1,3]Facultad de Agronomía. Departamento Forestal. Avenida Garzón 780. Montevideo Uruguay. C.P 11900 e-mail phoracantha @ yahoo. com, [2]. Facultad de Ciencias. Sección Entomología.Iguá 4225. Montevideo. Uruguay. C.P 11400; e-mail emorelli@ fcien.edu.uy.

During the last ten years species of the *Eucalytus* genus have been widely planted in Uruguay with industrial purposes. As a consequence of this, some insects pest have been detected with eventually could cause serious economic damage. *Phoracantha semipunctata* was detected in 1932 and *Phoracantha recurva* has been recently found in 1998 which have been accidently introduced. Larvae of these beetles bore trough the bark and mine along the cambium of stressed trees, usually killing its host. *P. semipunctata* and *P. recurva* larvae were reared in the laboratory on its natural host (on *Eucalyptus globulus ssp. globulus* logs).Neonate larvae were manually transferred to logs which were kept in a controlled environment chamber (25ºC and photoperiod 12 hs.). Mature larvae and pupae were removed from these logs to make its description. Diagnosis of the larvae was based on Duffy (1960), Costa, Vanin & Casani-Chen (1988) and Stehr (1991). Key to larvae of the species of *Phoracantha* in Uruguay: Temples with broad ferruginous cuneiform band behind the antennal bases. Supraocelar area with 7 setae, 3 of them in a straight towards the pronotum. Abdominal tergite X with a uniform setose area with a distinctly central seta at each median lobe - *P. semipunctata*. Temples without the broad ferruginous cuneiform band. Supraocelar area with 5 fine setae in a well - defined region. Abdominal tergite X with less abundant chaetotaxy and a pair of long setae in the border of each median lobe - *P. recurva*

[3725] A PREDICTIVE MODEL TO ENHANCE SAFEGUARDING CAPABILITIES AGAINST WEEVILS BASED ON ECOLOGY, BEHAVIOR AND PHYLOGENY

S. Bloem[1], R. F. Mizell III[2] & M.J. Oraze[3], [1]USDA-APHIS-NBCI, at NFREC-Monticello, Univ. of Florida, Rt. 4, Box 4092, Monticello, FL 32344, USA; NFREC-Monticello, Univ. of Florida, Rt. 4, Box 4092, Monticello, FL 32344, USA; USDA-APHIS-NBCI, 4700 River Rd., Riverdale, MD 20737, USA. [1]E-mail: ksbloem@nettally.com.

Weevils (Coleoptera: Curculionidae) are extremely important both as plant pests and as biological control agents for noxious weeds. Over 7,000 species are currently recognized in North America. Thousands of foreign species, particularly from the Caribbean and Southeast Asia, are potential invaders of the United States following the path of such destructive exotic pests as the white fringed beetles, *Graphognathus* spp. and the sugarcane rootstalk borer weevil, *Diaprepes abbreviatus*. The breadth and diversity in the Curculionidae offers a grand array of biologies, ecologies and behaviors that can be useful in elucidating their evolutionary relationships. In addition to providing novel insights into relatedness, the inclusion of ecological and behavioral characters into phylogenetic trees strengthens these trees and allows one to predict life history traits of related but poorly known species or groups. Stimulated by the results of recent innovations in monitoring methods and an initial examination of selected literature on the ecology and behavior of key weevil species, we have developed a theoretical model on the evolutionary significance and relationships of vision and response to odorants (plant volatiles and pheromones) in the Curculionidae relative to their phylogeny. The model and some of its predictions will be presented and the direction of its future validation will be discussed.

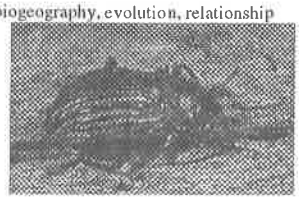
Index Terms: Curculionidae, sensory modalities, invasive species, risk assessment, detection.

[3726] SYSTEMATICS OF WET TROPICS COELOMETOPINI (COLEOPTERA: TENEBRIONIDAE: COELOMETOPINAE) FROM AUSTRALIA: RADIATION IN HIGH ELEVATION RAINFORESTS

P.B. Bouchard[1]& D.K. Yeates[1], [1]Dept. Zoology and Entomology, Univ. Queensland, Brisbane, QLD 4068, Australia. E-mail: p.bouchard@ento.uq.edu.au.

The family Tenebrionidae is one of the largest in the order Coleoptera with over 16000 described species worldwide. The subfamily Coelometopinae is thought to be one of the better supported higher clades within the family based on features of the defensive glands, ovipositor and female genital tube. Members of the tribe Coelometopini occupy forests in the subtropical and tropical regions of the world and form a diverse assemblage of both winged and flightless beetles. The adults are known to browse nocturnally on fungal and algal growths on the surface of living and dead trees and the larvae can be found in dead and decaying wood. Approximately 100 species in the tribe have been described from Australia. The 20 Australian genera are either endemic or shared with New Guinea, South East Asia and/or the Pacific Islands. Recent surveys of the high altitude rainforests of northern Queensland's wet tropics have yielded more than 50 undescribed species of flightless Coelometopini. These beetles all have very narrow distributional ranges, being often restricted to the summit of a single mountain. The bulk of the new species have metallic coloration on the elytra and are thought to be closely related to the genus *Apterotheca* while other species, dull colored and very convex, appear to form a natural assemblage near the genus *Caxtonana*. *Apterotheca* presently contains three described species which were separated from the genus *Chariotheca* based on their lack of functional hind wings as well as the presence of hind tibial tooth in males. Members of *Caxtonana* (see *C. costata* below) resemble flightless species that inhabit high elevation rainforests of New Guinea. Our current research aims to elucidate the phylogenetic relationships of the wet tropics coelometopines. In so doing, we will accurately circumscribe *Apterotheca* and *Caxtonana* and assess the relationship of these groups to other genera from Australia and elsewhere. We will also examine the number of times that flightlessness has evolved in this tribe and the correlated changes in functional morphology of the elytral locking mechanism (also see abstract in SESSION 16 of this conference). Our ultimate goal is to provide insights into the historical biogeography of the wet tropics using information from these phylogenetic studies.

Index terms: phylogeny, biogeography, evolution, relationship



[3727] COMMENTS ON THE GENEALOGY OF THE GENUS *TRICHOMYIA* (DIPTERA, PSYCHODIDAE), WITH SPECIAL REFERENCE TO GROUP B

F. Bravo, Dept. of Biology, Univ. Estadual of Feira de Santana, Av. Universitária s/n, 44031-460, Feira de Santana, BA, Brazil, E-mail fbravo@uefs.br.

The division of *Trichomyia* in two groups, A and B, to classify most of the species of this genus, has been very useful just as a taxonomic device. The species of the group A are characterized, mostly, for they have 4 segments in the maxillary palpus, and because the first and second segments are united by a complete articular membrane. The species of the group B characterize, mostly, because they have three segments in the maxillary palpus. The neotropical species with 4 palpomeres, but with the two first of them partially fused, were not contemplated for this former division, that turns it incomplete. Besides, this division does not carry in counts evolutionary parameters, i.e, the groups A and B do not have a sinapomorphies. Is proposed in this work, that the group formatted by species of *Trichomyia* with 3 segments (species traditionally placed in the group B), by the type-species of *Trichomyia*, *T. urbica*, by *T. biloba* and by the neotropical species with the two first palpomeres partially fused, is a monophyletic táxon. Two sinapomorphys, at least, are proposed for this unnamed táxon: 1) sternite 8 absent and 2) female tergite 8 narrow, like a ribbon. Thus, the type-species of *Trichomyia*, *T. urbica*, would be more close genealogically to the species with three palpomeres that with the species of the group A.. The táxon constituted by the species with the palpomeres 1 and 2, partially or totally fused is sustained for two sinapomorphies: 1) flagellomeres short, with the round base, and 2) partial fusion of the two first palpomeres. In the species of the group A, the flagellomeres are long and cylindrical, similar to that is observed in other species of Psychodidae. In the basal groups of Diptera, as well as in species of Bruchomyiinae and Phlebotominae, the maxillary palpus have 5 palpomeres, and this number is known as being plesiomorphic for Diptera. The reduction to 4 palpomeres is observed in the species of Sycoracinae, Psychodinae and some species of *Trichomyia*. The reduction for 4 palpomeres is a apomorphic condition and it is plesiomorphic to *Trichomyia*. Thus, it is assumed that partial fusion of the palpomeres, in the species with 4 segments, would be the first step before the reduction for 3 palpomeres. Therefore, the species that have 3 palpomeres are a monophyletic group. The species of the group A were not considered in this work.

Index terms: Diptera, Psychodidae, *Trichomyia*, genealogy

[3728] TAXONOMIC REVISION AND PHYLOGENY OF THE NEOTROPICAL GENUS *SESIOCTONUS* (HYMENOPTERA: BRACONIDAE)

R. A. Briceño, Univ. Centroccidental "Lisandro Alvarado" (UCLA), Decanato de Agronomía, Dept. de Ciencias Biológicas, Sección Entomología. Núcleo Tarabana, Apdo. 400. Cabudare, Edo. Lara. Venezuela, E-mail: rabricen@telcel.net ve

Sesioctonus is a neotropical genus of the subfamily Agathidinae that, with the genus *Earinus*, its sister-group, conform the tribe Earinini. Members of *Sesioctonus* have color patterns very showy and the size varies between 3,0 - 20,0 mm. Despite the color patterns and the size, this genus is very rare in the insect collections and the information that we have about it is very poor. Related with the biology, there is very few information about it. Members of *Sesioctonus*, as all agathidines, are parasitoids of Lepidoptera larvae. The unique described specie of the genus, *Sesioctonus parathyridis* is mentioned as a parasitoid of larvae of *Parathyris perspicua*, (Lepidoptera: Arctiidae). The genus *Sesioctonus* (Hymenoptera: Braconidae) is reviewed to include thirty four new species. The unique described specie so far, *parathyridis*, is redescribed. Phylogenetics relationships are proposed for all the species. Geographical distribution maps are given for the species.

Index terms: Agathidinae, sistematics, parasitoids, *parathyridis*

[3729] MOLECULAR PHYLOGENY, ECOLOGY AND SOCIAL EVOLUTION IN ALLODAPINE BEES

Nicholas J. Bull[1,2], Michael P. Schwarz[1] & S. J. B. Cooper[2], [1]School of Biological Sciences, Flinders University of South Australia, GPO Box 2100, Adelaide, 5001, Australia. [2]Evolutionary Biology Unit, South Australian Museum, North Terrace, Adelaide, S.A. 5000, Australia

A phylogeny based on DNA sequence data from one nuclear and two mitochondrial genes is presented for the Australian allodapine bee genera and several key representatives of African and Asian fauna. The Australian species fall into two groups; a monophyletic group (the *'Exoneura'* group) comprising four genera (*Exoneura s.s., Exoneurella, Brevineura* and *Inquilina*) with arid central and temperate coastal distributions, and the genus *Braunsapis*, which has an African, southern Asian, Indian and mostly northern Australian distribution. Monophyly of each of the four *Exoneura*-group genera is well supported, as is the sister-clade relationship between *Exoneura s.s.* and its associated parasitic genus *Inquilina*. However, maximum parsimony analyses do not fully resolve a polytomy involving the three non-parasitic groups. The analyses indicate very short branch lengths separating the groups, suggesting a rapid divergence between these genera. Interestingly, these three groups differ strongly from each other in morphology, ecology and voltinism, suggesting that their rapid divergence involved major differentiation of key life history traits. Trait optimization on our phylogeny indicates three origins of primarily social life-history strategies (i.e. modal colony size > 1): one in *Braunsapis*, one in the ancestor of *Exoneura s.s.* and one in *Exoneurella tridentata*. These clades differ strongly in terms of colony demography and climatic traits: *Exoneura s.s.* is univoltine and lives in wet Bassian forests and heathland, *Exoneurella tridentata* is bivoltine and lives in semi-arid woodland, and *Braunsapis* exhibits year round brood-production and is most abundant in subtropical and tropical regions (but occupies a diverse range of habitats, ranging from arid to rainforest). This suggests that colony demography and climatic traits are not prime selective factors promoting group living in allodapine bees.

Index terms: *Exoneura*, Molecular phylogenetics, life history evolution

[3730] THE PHYLOGENY OF BASAL INSECTS: MOLECULAR AND MORPHOLOGICAL DATA COMPARED

A. Carapelli[1], F. Frati[1], F. Nardi[1], R. Dallai[1] & C. Simon[2], [1]Dept. of Evolutionary Biology, Univ. of Siena, Italy, E-mail: carapelli@unisi.it; [2]Dept. of Ecology and Evolutionary Biology, Univ. of Connecticut, USA.

Five basal orders of insects, Protura, Collembola, Diplura, Microcoryphia and Zygentoma, are traditionally included in the group Apterygota. According to many morphological features, it is now accepted that the Apterygota are not a monophyletic assemblage. In particular, the order Zygentoma is considered to be the closest relative to the pterygote insects for sharing with them a dicondylic articulation of the mandibles. The Microcoryphia are regarded as their closest sister-group, sharing with them the presence of external mouthparts (ectognathy). The remaining three orders (Diplura, Protura and Collembola) are usually included in the taxon Entognatha, defined by the presence of cuticular folds of the head capsule which enclose mandibles and maxillae. More recently, alternative hypotheses to the traditional view have been proposed for the phylogeny of these basal insects orders. These hypotheses include the rejection of Entognatha, with the Diplura placed on the ectognathan lineage, and paraphyly of Diplura. Partial sequences from the nuclear EF-1α and of the 28S rRNA genes have been analyzed for several representatives of the five apterygotan orders to compare competing hypotheses on phylogenetic relationships among Entognatha, and to assess the monophyly of Diplura. The myriapodan genera Scutigera and Scolopendra have been used as outgroups. DNA sequences were compared to infer evolutionary relationships using different methods of phylogenetic reconstruction. In the 28S rRNA gene, the secondary structure of the molecule was also studied to investigate the presence of conserved and/or variable motifs and secondary structure models were used to improve the alignment. In general, the monophyly of the orders Collembola and Diplura is well supported by both genes. The 28S gene suggests Protura as the sister group of Collembola (Ellipura), whereas the EF-1α confirms the monophyly of the orders Microcoryphia and Zygentoma. In addition to sequence data, phylogenetic information was also obtained by the presence/absence of several introns in the EF-1α gene.
Index terms: Entognatha, Ellipura, Diplura.

[3731] KEY TO THE GENERA OF ANISOPTERA (ODONATA) LARVAE OCCURRING IN THE STATES OF RIO DE JANEIRO AND SÃO PAULO, BRAZIL

A. L. Carvalho[1] & E. R. Calil[2], 1. Depto Entomologia, MN, Universidade Federal do Rio de Janeiro (UFRJ), Caixa Postal 68044, Cidade Universitária, 21944-970, Rio de Janeiro, RJ, BRAZIL, E-mail alagoc@acd.ufrj.br; 2. Depto Zoologia, IB, UFRJ. This research was sponsored in part by CAPES-UFRJ, CNPq, FAPERJ, and FUJB.

There are few papers on the identification of larval Brazilian Anisoptera. Of the four families recorded in this country, only the genera of Aeshnidae (Carvalho, 1989, Odonatologica 18(4); 325-332) and Gomphidae (Belle, 1992, Odonatologica 21(1): 1-24) were keyed. Both keys need revisions and up-to-date versions. There is not any published key to the genera of Brazilian Libellulidae, the largest family of the suborder. Due to the lack of adequate keys, the currently used method to identify the Brazilian genera of Anisoptera is the comparison of material directly with the descriptions and illustrations available in the vast literature. This procedure is arduous and not always successful. Thus, the preparation of a key to identify the genera of Anisoptera occurring in Rio de Janeiro and São Paulo states is necessary and workable. Such a key is the first step to a future one to be used in the whole country. Fifty-six genera (with about 180 species) of Anisoptera are recorded from Rio de Janeiro and São Paulo states: 10 genera of Aeshnidae (*Aeshna*, *Anax*, *Castoraeschna*, *Coryphaeschna*, *Gynacantha*, *Limnetron*, *Neuraeschna*, *Remartinia*, *Staurophlebia*, *Triacanthagyna*), 12 genera of Gomphidae (*Aphylla*, *Archaeogomphus*, *Brasiliogomphus**, *Cacoides*, *Cyanogomphus*, *Epigomphus*, *Gomphoides*, *Phyllocycla*, *Phyllogomphoides*, *Praeviogomphus*, *Progomphus*, *Zonophora*), 4 genera of Corduliidae (*Dorocordulia**, *Navicordulia**, *Neocordulia*, *Santosia*), and 30 genera of Libellulidae (*Anatya*, *Brachymesia*, *Brechmorhoga*, *Dasythemis*, *Diastatops*, *Dythemis*, *Edonis**, *Elasmothemis*, *Elga*, *Erythemis*, *Erythrodiplax*, *Gynothemis*, *Idiataphe*, *Libellula*, *Macrothemis*, *Miathyria*, *Micrathyria*, *Nephepeltia*, *Oligoclada**, *Orthemis*, *Pantala*, *Perithemis*, *Planiplax*, *Rhodopygia*, *Tauriphila*, *Tholymis*, *Tramea*, *Uracis**, *Ipirangathemis**, *Zenithoptera*). In order to include in the key those genera whose larvae of the species from Rio de Janeiro and São Paulo are unknown, representatives from other regions were considered. The 7 genera marked with an asterisk were not included in this version of the key because no larvae of their species are described or known in collections.
Index terms: dragonflies, identification, Southeastern Brazil.

[3732] TAXONOMIC STATUS AND NOTES ON BIOLOGY OF *ACROGONIA* FROM CITRUS: *ACROGONIA TERMINALIS* OR A NEW SPECIES?

R.R. Cavichioli[1], R.C. Marucci[2], T.A. Giustolin[2], J.R.S. Lopes[2], [1]Depto. de Zoologia, Setor de Ciências Biológicas, UFPR, C.P 19020, Curitiba, PR 81531-990, Brazil, E-mail cavich@bio.ufpr.br, [2] Depto. Entomologia, Fitopatologia e Zoologia Agrícola, ESALQ/USP, C.P. 09, Piracicaba, 13418-900, Brazil.

One of the main vectors of the bacterium *Xylella fastidiosa*, causal agent of citrus variegated chlorosis in Brazil, is a sharpshooter species of the genus *Acrogonia* (Hemiptera: Cicadellidae: Cicadellinae), whose taxonomic identification is still uncertain. This species is similar in the dorsal aspect with *A. terminalis* and *A. gracilis*, differing mainly in the aspect of the aedeagus. Its aedeagus does not present the ventral projection in the base as observed in *A. gracilis*, and it is not as long as the aedeagus of *A. terminalis*. Because of these differences, this important vector has been treated as a possible new species of *Acrogonia*. Eggs are laid externally on the citrus leaves, in groups of 5-15 per egg mass, preferably on the lower (adaxial) surface. First-instar nymphs present distinctive dark stripes in the margins of the body. Nymphs of the other instars are very similar, differing basically in size, pigmentation and development of the wing pads. This species has been registered on citrus in the Center, Southeast and South of Brazil and Paraguay. One-year sampling with yellow sticky cards in northern State of São Paulo showed that this vector is a dominant leafhopper species not only in citrus orchards, but also in the vegetation of swamps and "Cerrado". Nymphs and adults have been found feeding on various trees and shrubs, specially *Aloysia virgata*, *Croton floribundus* and *Cheflera* spp. (Research supported by FUNDECITRUS).
Index terms: Cicadellidae, sharpshooter vector, systematics, morphology, host plants

[3733] 2REVIEW OF *CHALCOLEPIDIUS* (ELATERIDAE, AGRYPNINAE, HEMIRHIPINI)

S. A. Casari,. Museu de Zoologia da Universidade de São Paulo, Caixa Postal 42 694, 04299-970 São Paulo, SP, Brasil. E-mail: casari@pop.usp.br.

The tribe Hemirhipini includes 26 genera and about 400 species worldwide distributed. The generic revision, with a cladistic analysis, was published in 1994 (Casari-Chen). This work revealed that several species were not congeneric and the revision of some genera to specific level were required. The study of six genera were published, and that of *Chalcolepidius* Eschscholtz, 1829 is now presented. The *Chalcolepidius* are recognized especially by integument clothed with colorful scale-like setae, scutellum "triangular" or folded and borders of mesosternal cavity horizontal without suture at base. It was established for four species from *Elater*, *E. porcatus* F., *E. striatus* F., *E. sulcatus* F. and *E. virens* F., and three new species, *C. limbatus*, *C. smaragdulus* and *C. zonatus*. Next, several species were described, always based only on the coloration of scale-like setae and shapes of scutellum and 3rd antennal segment. The only revision of this genus is that of Candèze (1857), who presented also a catalogue in 1891 and published several new species. At that time the genus was formed by 33 species, but later many species were described, totalizing 88, with about 160 nominal species. During this work, 8,750 specimens belonging to 85 valid species, including 55 types, were studied. Three species were not examined because the types were not located and any material corresponding to original description was found. For each studied species, a colored picture was taken and the antennae of male and female, pronotum, scutellum, borders of mesosternal cavity, fore leg of male and genital segments and genitalia of male and female were illustrated. The analysis of these characters, together with the pubescence coloration were useful to define the species, now redescribed. The analysis revealed that three species, *C. alici* Pjatakowa, *C. haroldi* Candèze and *C. unicus* Fleutiaux, are not congeneric and should be tranferred to *Alaus*, 36 species are synonyms, one was revalidate and 11 new species are described. The genus is now composed by 64 species.
Index terms: Coleoptera, Elateridae, systematics.

[3734] A CLADISTIC ANALYSIS OF THE MOTH TRIBE OURAPTERYGINI, WITH THE DESCRIPTION OF TWO NEW GENERA (LEPIDOPTERA: GEOMETRIDAE, ENNOMINAE)

A.E. Chalup, Instituto Superior de Entomología (INSUE) "Dr. Abraham Willink", Fac. Cs. Naturales e Instituto Miguel Lillo, Univ. Nac. de Tucumán, Miguel Lillo 205, 4000 Tucumán, Argentina, e-mail: instlillo@infovia.com.ar

A matrix of 48 taxa and 101 characters was cladistically analyzed as a first attempt for understanding the classification of the tribe Ourapterygini. A total of 13 of the 19 Ourapterygini genera are scored: *Sericoptera*, *Sabulodes*, *Acrosemia*, *Frochoerodes*, *Nepheloleuca*, *Euclysia*, *Microgonia*, *Anoplofurca* gen.n., *Dognina* gen.n., *Hygrochroma*, *Bassania*, *Herbita* and *Oxydia*; 24 morphological characters are used for the first time. The data matrix was analyzed with the method of implied weighting implemented by Pee-Wee version 1.5.1 (Goloboff, 1996). The relationships and groupings suggested by the most parsimonious tree differ significantly from the current classification. The monophyly of the tribe Ourapterygini is supported by just one non-homoplastic synapomorphy of the male genitalia (the articulation between uncus, tegumen and vinculum). Only two genera, *Oxydia* and *Herbita*, resulted paraphyletic, *Oxydia* in terms of *Sigmathyris*, and *Herbita* in terms of *Herbita somnoleta*, both genera are redelimited. The relationships of genera and species are analyzed and discussed.
Index terms: Ourapterygini, phylogeny, classification, systematic.

[3735] DESCRIPTION OF IMMATURES OF *PHILONTHUS QUADRATICEPS* BOHEMAN AND *P.PAUXILLUS* SOLSKY (COLEOPTERA: STAPHYLINIDAE)

M. R. Chani Posse, Fundacion Miguel Lillo, Instituto Superior de Entomologia (INSUE), Miguel Lillo 205, (4000) Tucuman, Argentina. E-mail: **Erro! Indicador não definido.**.

The immature stages of the species of *Philonthus* belong to those among Staphylinidae that were discovered very early but their knowledge still lags greatly behind that of the adults, particularly in the tropics where scores of species still remain undescribed. A further limitation to studies of immatures belonging to New World *Philonthus* species has been the lack of a consistent reference framework within which to compare structural features among superficially similar larvae. Previous studies for the New World of immatures belonging to this genus did not provide much detailed description. In the present work additional study of immatures for the genus is provided based on the description of *Philonthus quadraticeps* and *P. pauxillus*. Objectives were to develop a comparative system that illustrates the diversity of characteristics in chaetotaxy, antennal structures and other features in order to represent a comprehensive base for study of immatures in the genus. Both adults and immatures of these New World species are frequently found in cow dung. Larval rearing techniques are described and morphological data of third instar larva and pupa of *Philonthus quadraticeps* and *P. pauxillus* are described for the first time. Illustrations of structural feartures are provided.
Index terms: *Philonthus*, New World, larva, pupa, morphology

[3736] VERTICAL STRATIFICATION OF CHRYSOMELID FAUNAS IN PANAMA

E. Charles, Tropenbos-Guyana Programme, 12E Garnett St, Campbelville, Georgetown, Guyana. Email: tropbos@guyana.net.gy

A community study of Chrysomelidae was conducted at a wet and a dry forest in Panama, in the canopy and understorey. Canopy access was facilitated by a construction cranes at both sites. In both forests, a projected area of 8100m^2 area was surveyed in the understorey and canopy. During 8 months, sampling effort with beating (n=1000 samples), flight-intercept traps (n=10) was similar in each stratum of each forest type. Chrysomelids collected with beating were tested for feeding on the foliage of the plant from which they were collected. All insects were sorted to morphospecies. In total, 5412 individuals were collected representing 286 species. Although the species richness was similar at the two forest types (176 and 165 species at the dry and wet sites, respectively), their abundance and species diversity differed significantly between the two sites (3313 individuals collected in the dry forest). Thirteen subfamilies were represented with Alticinae, Eumolpinae, Cryptocephalinae and Galerucinae being the most abundant and diverse groups. Cassidinae, Cryptocephalinae, Eumolpinae and Hispinae were more abundant in the dry forest. Over 70% of the number of individuals at each site were collected from the canopy, which was more diverse than the understorey at both sites. At the dry site, Hispinae and Megascelinae were more abundant within the understorey than in the canopy, whereas Cryptocephalinae and Lamprosomatinae showed the reverse. Out of 29 common species (n ³ 16 individuals), 13 species were more abundant in the canopy, 8 species were more abundant in the understorey, and 8 species were indifferent with regard to the strata. At the wet forest site, Alticinae, Chlamisinae, Crytocephalinae, Eumolpinae, and Lamprosomatinae were more abundant in the canopy than in the understorey. Out of 26 common species, 18 species were more abundant in the canopy, 3 species were more abundant in the understorey, and 5 species were indifferent with regard to the strata. Some of the species collected were host-specific, whilst others were generalists. The production of young leaves and flowers was significantly higher in the canopy than the understorey at both forest sites. This may explain some of the differences observed in chrysomelid faunas between the two strata. At both forest sites, the proportion of non-feeding individuals was significantly higher in the understorey than in the canopy. This suggests that food resources may be more scattered in the understorey than in the canopy and the implications for chrysomelids resident in the two strata are shortly discussed.
Index terms: Canopy; Chrysomelidae; Species diversity ; Stratification

[3737] A NEW SPECIES OF *ATHRIPSODES* (INSECTA TRICHOPTERA: LEPTOCERIDAE) FROM CENTRAL-SOUTHERN ITALY

F. Cianficconi & P. Salerno, Dipartimento di Biologia Animale ed Ecologia, Università di Perugia, Via Elce di Sotto, 06123 Perugia, Italy.

In Italy the genus *Athripsodes* Billberg, 1820 comprises 5 species in the peninsula (*A. albifrons* Linnaeus, *A. aterrimus* Stephens, *A. bilineatus*. Linnaeus, *A. cinereus* Curtis, *A. leucophaeus* Rambur) and 1 species in Sardinia (*A. genei* Rambur). After the appearance of a new species from Albania (*A. shqiperiensis* Chwojka, 1997) and the revision of the *Athripsodes bilineatus* group from the Aegean area by Malicky (1999), some male and female specimens of *A. bilineatus* from central-southern Italy were re-examined. They did not belong to any species or subspecies of this group. Malicky (specialist of European and Asian Trichoptera) and Morse (specialist of Leptoceridae) confirm that they constitute a species new to science. The aquatic instars of this insect prefer meta-iporhithral zones. The adult flies in summer (June-August) above pools or slow flowing sections of streams, is day-active, especially in the afternoon in sunlight and, during the night, is occasionally attracted by light traps. A detailed morphological study of the male and female genitalia is presented and illustrated.

[3738] THE SPILOMELINI OF VENEZUELA (LEPIDOPTERA:CRAMBIDAE: PYRAUSTINAE)

J. A. Clavijo & Q. A. Arias, Museo del Instituto de Zoología Agrícola "Francisco Fernández Yépez" (MIZA) Univ. Central de Venezuela, Maracay Apdo. 4579 Aragua 2101-A – Venezuela E-mail: clamiche@telcel.net.ve.

The Spilomelini species of Venezuela are presented for the first time on the basis of the study of the material present at the Smithsonian Institution (Washington, D.C.) and our museum. It was studied 119 genera and 343 species, which represent 69.19% and 26.75% of the total of the neotropical species of this tribe respectively. The genera with the largest number of species were: *Diaphania* (38), *Omiodes* (18), *Desmia* (15) and *Polygrammodes* (10). It is expected that the number of genera and species would increase when more extended collections will be done, specially on the Amazon region, the llanos and the arid zones of Venezuela. All the species studied are full illustrated and distribution maps of each of it are presented in an electronic format to reduce cost of production; and they will also appear on the web page of our museum.
Index terms: Neotropical, moths, distribution, Pyraloidea

[3739] REESTABLISHMENT OF THE GENUS *TRICHESTHES* (COL., SCARABAEIDAE, MELOLONTHINAE), INCLUDING ITS GENITALIA AND EXTERNAL MORPHOLOGY.

M. Coca-Abia, Museo Nacional de Ciencias Naturales (CSIC), Dpto. Biodiversidad y Biología Evolutiva, José Gutiérrez Abascal, 2 28006 Madrid (Spain), E-mail: mcnc171@mncn.csic.es

The genus *Trichesthes* was described to included a single species, *Melolontha tristis*. Later, this genus was suppressed considering it to be distinguised by insufficient characters and merging the main of its species into different groups of *Phyllophaga*. This work tries to demonstrate that external, and male and female genitalic features consistently distinguish *Trichesthes* species from the other species considered to be *Phyllophaga*. The material studied included specimens from collections keep at National Museum of Natural History (Smithsonian Institution), Washington D.C and Museum of Natural History (London). This study discloses that the male and female genitalia, as well as the external morphology, provide distinctive generic taxonomic characters. *Melolontha tristis*, the type species of the genus *Trichesthes*, shares external and genital features with some species included until now in the subgenera *Phytalus*, *Listrochelus* and in some groups of *Phyllophaga (s. str.)* such as □Anodentata□, □Setidorsis□, □Porodera□, □Rugipennis□ and □Testaceipennis□. Every these species are transferred to *Trichesthes*. Some other species considered until now belonging to *Phyllophaga*, but which never had been mentioned or reviewed after having been published or which were considered as *incerta sedis*, are reclassified here as *Trichesthes*. In contrast, some of the species originally included in the genus *Trichesthes* do not share the external and genital features which characterize this genus, these species are removed from *Trichesthes*. On the basis of its distinguishing morphological characteristics, *Trichesthes* is reestablished as an available genus.
Key words: characters, genitalia, morphology, reclassification.

[3740] CLADISTIC ANALYSIS OF THE GENUS *BRACHYPREMNA* OSTEN SACKEN 1886 (DIPTERA, TIPULIDAE)

E. Collucci[1] & D.S. Amorim[2]. [1,2] Departamento de Biologia, FFCLRP, Universidade de São Paulo. Av. Bandeirantes, 3900. Ribeirão Preto, São Paulo.
[2] E-mail: dsamorim@usp.br.

The genus *Brachypremna* Osten Sacken is a relatively small group in the subfamily Tipulinae, with 38 extant species described as yet. Among these species, 35 are known from the Neotropical Region, one from southern Nearctic and northern Neotropics, and the remaining two from the Australian Region. Only two fossil species have been described: one from Baltic and another from Dominican amber. In the present paper, an analysis was performed to determine the phylogenetic relationships among the species of *Brachypremna* based on a study of adult morphology of the group. Species of other Tipulinae genera and other families of Diptera were taken as outgroups. Prepared specimens and literature information were used as source of data. *Megistocera* –shown by some characters to share some unique synapomorphies with *Brachypremna*– was considered the immediate outgroup in order to solve some of the problems of character polarization in which there was conflict among outgroups. A taxonomic revision of the genus was prepared and five new species were described. The monophyly of *Brachypremna* is corroborated, supported by the very arcuated R_2, crossvein r-r absent, and the presence of spots on the abdominal sternites. A total of 50 transformation series were obtained, resulting in a fairly well resolved cladogram for the genus.

[3741] NEW AND INTERESING MORPHOLOGICAL ANOMALIES OF ICHNEUMONIDS IN ROMANIA

R. Constantineanu[1] & I. Constantineanu[1], Lab. of Ecology, Biol. Res. Inst., 6600 Iasi, ROMANIA, E-mail: racon@uaic.ro

We present 9 anomalies of ichneumonids in M. & R. Constantineanu collection, besides those described in other 6 papers from this collection. Ichneumonids presented in this paper were collected in different years and localities in Romania. These anomalies are at the head, thorax and abdomen levels. A. Head: 1. *Pimpla arctica* ♀ - **the 2-9 articles of the flagellum** of right antenna are deformed. 2. *Phaeogenes invisor* ♂ - **the flagellum of the right antenna** is deformed, excepting the last 7 articles. 3. *Ichneumon monostagon* ♀ - **the right genna** presents an obvious tooth. B. Thorax: 4. *Coleocentrus excitator* ♂ - **the hind part of the** propodeum ends in a processus with [4]a horn shape, which has a broad basis. 5. *Coelichneumon ferreus serenus* ♂- **at the front wings from the second intercubitus vein** remains a rudiment inserted on cubital vein. 6. *Pimpla instigator* ♀ - **at the front wings the** areolet is opened. C. Abdomen: 1. *Amblyjoppa fuscipennis* ♂ - **the second and third tergites** are deformed. 2. *Pimpla padella* ♀ **the second and third tergites are united in the right side.** 3. *Ichneumon luteipes* ♂ - **the fourth tergite is greater in the right side and of the fifth tergite** remains only a half in the left side. We suppose that these anomalies were produced by different factors: climatic (temperature, moisture), diet, mechanic, chemical and genetic (crossing between different species and genera).
Index terms: antenna, processus, genna, areolet, tergite.

[3742] INMATURE STAGES OF *ZELUS LEUCOGRAMMUS* (HETEROPTERA: REDUVIIDAE)

M. del C. Coscarón [1], P. M. Dellapé & K. Del Claro [2], [1] Departamento Científico de Entomología, Facultad de Ciencias Naturales y Museo, Paseo del Bosque 1900 La Plata, Argentina. E-mail: coscaron@netverk.com.ar; [2] Departamento de Biociencias, Universidade Federal de Uberlândia. Cx. P. 593, Uberlândia, M. G. 38400-902. Brasil. E-mail: delclaro@ufu.br.

The genus *Zelus* Fabricius 1834 belongs to the Harpactorinae and it is widely distributed in the american continent, from Canada to Argentina. According Maldonado Capriles (1990) listed a total of 60 species. Species of the genus are predators of insects and usually found in low trees, grass and crops. *Zelus leucogrammus* has a Neotropical distribution up to Brazil, including Bolivia, Paraguay, Argentina and Uruguay. The purpose of this study is to describe the eggs and nymphs I-V of *Zelus leucogrammus*. The material used in this study consist of eggs and specimens reared in the laboratory at the Universidade Federal de Uberlândia, Brazil. The measurements are given in millimeters. The morphological characters and miristic were analysed with the help of binocular and electronic microscope. The eggs and nymphs I-V are described in order to complete the knowledge of the life cycle of this species.
Index terms: *Zelus leucogrammus*, predator, egg, nymphs.

[3743] BIODIVERSITY OF CIMICOMORPHA AND PENTATOMORPHA (HETEROPTERA) FROM ARGENTINA

M. del C. Coscarón & N. D. Cuello, **Departamento Científico de Entomología, Facultad de Ciencias Naturales y Museo, Paseo del Bosque s/n 1900 La Plata, Argentina. E-mail: coscaron@netverk.com.ar**

The purpose of this contribution is to give a list of the species of terrestrial Heteroptera (Cimicomorpha and Pentatomorpha) from Argentina. Since Pennington (1921) no list of the entire groups have been done. Detailed conclusions concerning the Heteroptera of Argentina must be made with great caution because the state of our knowledge about the insects in Argentina is probably quite incomplete (with many undescribed species, many relatively uncollected areas, and inadequate observations on most forms. The information was gathered from the bibliography. Up to this moment it has been recorded Cimicomorpha: Pachynomidae: 1gen. 1 spp.; Reduviidae: 64 gen. 193 spp.; Thaumastocoridae: 1 gen. 2 spp.; Miridae: 151 gen. 437 spp.; Tingidae: 18 gen. 54 spp.; Nabidae: 2 gen. 7 spp.; Anthocoridae: 3 gen. 5 spp.; Cimicidae: 3 gen. 6 spp.; Polyctenidae: 1 gen. 6 spp. Pentatomorpha: Aradidae: 13 gen. 40 spp.; Acanthosomatidae: 19 gen. 38 spp.; Cydnidae: 11 gen. 31 spp.; Pentatomidae: 60 gen. 140 spp.; Scutelleridae: 13 gen. 18 spp.; Berytidae: 4 gen. 4 spp.; Colobathristidae: 1 gen. 25 spp.; Lygaeidae: 61 gen. 130 spp.; Largidae: 1 gen. 1 spp.; Pyrrhocoridae: 3 gen. 9 spp.; Alydidae: 1 gen. 1 spp.; Coreidae: 50 gen. 96 spp.;
Index terms: Inventary - Argentina - Cimicomorpha - Pentatomorpha.

[3744] INMATURE STAGES OF *ZELUS LONGIPES* (HETEROPTERA, REDUVIIDAE)

M.C. Coscarón [1], M.C. Melo [1] & B.F. Amaral Filho [2], [1]Departamento Científico de Entomología, Facultad de Ciencias Naturales y Museo, Paseo del Bosque s/n, 1900. La Plata, Argentina. E-mail: coscaron@netverk.com.ar; [2]Departamento Zoología, Instituto de Biología, Universidade Estadual de Campinas, CP 1170, Campinas 13100, S.P., Brazil.

The predatory assassins bugs are among the largest and morphological diverse of true bugs. The genus *Zelus* is comprissed of 60 species (Maldonado Capriles, 1990). *Zelus longipes* is distributed in the southern North America, Central and South America up to Argentina, except Chile. The porpuse of this paper is to describe the egg and nymphs of *Zelus longipes* in an effort to complete the knowledge of the life cycle of this species. The material used in this study consists of eggs and specimens reared in the laboratory at the Instituto de Biología, UNICAMP (Universidad do Campinas), Campinas, São Paulo, Brazil. The measurements are given in millimeters. The morphological characters and meristic were analysed with the help of binocular and electronic microscope. The eggs and nymphs I-V are described. This contribution will help in different fields, as it is, the biological control and to delucidate (in part) the phylogeny of the Harpactorinae.
Index terms: *Zelus longipes*, predator, egg, nymph.

[3745] A NEW GENUS OF ACANTHOSOMATIDAE (HETEROPTERA) AND THE INMATURE STAGES

M. del C. Coscarón [1], P. M. Dellapé [1] & A. P. Martinez[1], [1] Departamento Científico de Entomología, Facultad de Ciencias Naturales y Museo, Paseo del Bosque, 1900 La Plata, Argentina. E-mail: coscaron@netverk.com.ar.

The Acanthosomatidae are Pentatomoidea and are gathered in 45 genus with 180 species in all the world. The geographic distribution of this family is mainly Austral. The material that we have studied is from Neuquen, Argentina and was collected in *Notophagus sp.* The purpose of this study is to describe a new genus with its nymphs. This contribution will increase the little knowledge of the biology of the austral species of Heteroptera.
Index terms: Acanthosomatidae, new genus, nymphs, *Notophagus sp.*

[3746] A NEW SPECIES OF *CORDULIIDAE* FROM RIO DE JANEIRO, BRAZIL AND ITS AFFINITY WITH OTHER SPECIES OF THE SUB-GENUS *NEOCORDULIA* (ODONATA: ANISOPTERA)

J.M.Costa & T.C.Santos, Dept. of Entomology, Museu Nacional, UFRJ, Quinta da Boa Vista, Rio de Janeiro, RJ 20942-040, Brazil, E-mail jcosta@unisys.com.br. This research was supported by CNPq and FAPERJ.

Neocordulia mambucabensis spec. nov. is described and illustrated, and its affinities are discussed. Key to identify the species of subgenus *Neocordulia* is provided. In 1991, MAY recognized eight species of *Neocordulia*, considered *N. longipollex* a subspecies of *N. batesi* and recognized two subgenera: 1) *Neocordulia sensu strictu*, including *N. androgynis, N. biancoi, N. carlochagasi, N. setifera* and *N. volxemi*; 2) *Mesocordulia*, including *M. batesi, M. campana* and *M. griphus*. In this same paper MAY transferred *N. luismoojeni* to *Lauromacromia*. *N. mambucabensis* is included in subgenus *Neocordulia* as it presents the characteristics mentioned by MAY (1991). The position of the new species in the genus *Neocordulia* is supported by the characteristics mentioned by MAY (1991).This author justifies the division of the genus in 2 different groups with status subgeneric: *Neocordulia* sensu strictu and *Mesocordulia*. *N. mambucabensis* belongs to the subgenus *Neocordulia* because of the presence, on the sternum of the 8th abdominal segment, of a prominent biconical protuberance; superior appendage (cerci) with ventrobasal tooth. Analyzing specimens of *N. androgynis* from Minas Gerais, the holotype of *N. carlochagasi* from Minas Gerais and 1 specimen from São Paulo (identified for us as belonging to this species), specimens of *N. setifera* from Rio de Janeiro and São Paulo and specimens of *N. volxemi* from Minas Gerais, Goiás and Mato Grosso, we believe that *N. mambucabensis* presents more affinities with *N. setifera* and *N. volxemi* because of its superior appendage (cerci) with a mediobasal angulations and a tuft of setae in the distal end. No specimen of *N. biancoi* was analyzed; however in the illustration of MAY (1991 Fig. 4–A, B) and that of the original description by RACENIS (1970) these characteristics are absent. MAY (1991), included *androgynis, biancoi, carlochagasi, setifera and volxemi* in the sub-genus *Neocordulia*, and based on the striking similarity of the superior appendage (cerci), considered that the first three of these species may form one natural species group within the subgenus and the last two a second group. SANTOS (1967) considered *N. carlochagasi* nearer of *N. setifera*. *N. mambucabensis* may be included in the second group because of the superior appendages (cerci) of the same standard, i.e. mediobasal angulations and tuft of long setae; the last characteristic was not cited by MAY for *N. volxemi*

[3747] A SYNOPSIS OF THE GENUS *STAUROPHLEBIA* WITH A REDESCRIPTION OF *STAUROPHLEBIA RETICULATA BOSQI*, NEW STATUS (ANISOPTERA: AESHNIDAE)

J.M. Costa[1] & T.C. Santos[1], [1] Dept. of Entomology, Museu Nacional-UFRJ, Quinta da Boa Vista, Rio de Janeiro, RJ 20.940-040, Brazil, E-mail jcosta@unisys.com.br This research was supported by CNPq and FAPERJ.

The results of a study of morphological characters of males and females of *Staurophlebia* is presented with a redescription of *S. reticulata bosqi*, new status. Diagnoses and keys for all species are provided. The latest treatment of the neotropical aeshnid genus *Staurophlebia* considered six species, *S. auca, S. platyura, S. bosqi, S. gigantula, S. reticulata* and *S. wayana*, as valid. WALKER (1915) described *S. reticulata guatemalteca*, from Guatemala and *S. reticulata obscura* from Trinidad. We report the results of a study of 48 males and 7 females of *S. reticulata*, 10 males and 3 females of *S. gigantula*, 1 male and 1 female of *S. auca*, and 1 male of *S. wayana*, all from Brazil, and 1 male of *S. reticulata obscura* from Chiriqui, Panama. An analysis of 40 morphological characters of *S. reticulata* from different sites in Brazil revealed it to be a polytypic species consisting of a northern subspecies (*S. reticulata reticulata*), and a southern subspecies (*S. reticulata bosqi*). These populations seem to be parapatric at around parallel 10°S with intermediates occurring in this area. Early in our study, we suspected that these intermediates might represent *S. bosqi*, whose type we were not able to study. We sent illustrations and photos of specimens from southern populations of *S. reticulata* to Dr. Javier Muzón (**ILPLA**) asking him to compare these specimens with a topotype female of *S. bosqi*. After studying a male and a female of *S. bosqi* from the Parana delta he expressed his opinion that *S. bosqi* is a synonym of *S. reticulata*. According to Muzón, a female of *S. bosqi* in Museo de La Plata collected 15.II.1926, in Delta del Parana, Abra Vieja is a topotype. It is the same specimen photographed, without comment, by NAVÁS (1927). GEIJSKES (1959) provided illustrations and a translation of the original description of the male described by Navás. He was unable to examine the holotype male and its location is unknown. GEIJSKES (1959:158) commented on the female topotype, which he did not see, as follows: "The female specimen photographed, very probably belonging to the same species [*S. bosqi*], is undoubtedly a species of *Staurophlebia*". Although Geijskes considered *S. bosqi* a good species belonging to the *reticulata* group, we consider it the southern-most subspecies of *S. reticulata*.

[3748] OCCURRENCE OF *TIGRIAGRION AURANTINIGRUM* IN PARAGUAY AND BOLIVIA (SOUTH AMERICA) AND NEW SITES IN BRAZIL (ZYGOPTERA: COENAGRIONIDAE)

J.M.Costa[1] & T.C.Santos[1], [1]Dept. of Entomology, Museu Nacional-UFRJ, Quinta da Boa Vista, , Rio de Janeiro,RJ 20.940-040, Brazil, E-mail jcosta@unisys.com.br. This research was supported by CNPq and FAPERJ.

Tigriagrion aurantinigrum, formally known from only Chapada, Brazil, has now been reported at other sites and two other countries from South America (Bolivia, Paraguay). Some additional characters including penis structure in the male and the prothoracic hind lobe, mesostigmal plates and caudal appendages of the female are described and illustrated. Many Coenagrionidae from South America are inadequately or, worse, incorrectly described and illustrated. This and the concurrent lack of knowledge of the distribution of many of these species hampers an analysis on affinities with the other genera and species. *Tigriagrion* is a small monotypic coenagrionid genus described from Brazil. The original description (CALVERT, 1909) was based on material from "Brazil, Chapada. We are sure that the type locality for this species refers to Chapada dos Guimarães in Mato Grosso State, central-west Brazil. Our specimens from Paraguay differed enough from CALVERT's (1909) original description for us to consider describing them as a new subspecies. However, new material kindly sent to us from Frederico Lencioni showed this species to be variable. Here we add new records for the species from central-west (Goiás), central east (Rondônia) regions, from southern Brazil (São Paulo and Minas Gerais), Paraguay, and Bolivia.We also supplement the description of CALVERT (1909), illustrate general body coloration, structure of the penis, and female caudal appendages. The original description of *T. aurantinigrum* is extensive, but Calvert's illustration of the appendages in lateral view (Plate 5, Fig. 105) show the paraproct as long as the cercus. CALVERT (1909: 196) describes the paraproct as reaching "...to the level of three-fifths of the length of the superiors....", which is confirmed in this paper. The superior appendages are divergent. The mesostigmal plates and abdominal segments 7-10 of the female were not described by CALVERT (1909). The ninth segment has a vulvar spine.The coloration in males is variable. We observed no variation in penis structure. The differences observed among the examples from Brazil and Paraguay are not enough to consider those from Paraguay a new subspecies. Character variability is common to specimens from Brazil and Paraguay. We agree with CALVERT (1909) that *Telebasis* is the nearest ally of *Tigriagrion*. BICK & BICK (1995), characterize the genus Telebasis and considers Helveciagrion the genus an amount the nebulous. According to BICK & BICK the MACHADO'S 3 taxa could be placed in Telebasis. This position is corroborated by GARRISSON (personal information). Some genera of Ischnurinae deserve a better study as the relationships among them. At present we considered Helveciagrion and Telebasis different genera.

[3749] THE SPECIES GROUPS OF NEARCTIC *PLATYPALPUS* MACQUART (DIPTERA: EMPIDOIDEA; TACHYDROMIINAE)

J.M. Cumming, Systematic Entomology Section, ECORC, Agriculture and Agri-Food Canada, Ottawa, Ontario, Canada, K1A 0C6.

The tachydromiine genus *Platypalpus* is an exceedingly speciose group of predaceous flies with a worldwide distribution. More than 100 species are known from the Nearctic Region and these can be assigned to at least six species groups. These groups are outlined and compared with the species group concepts developed for European species of the genus.
Index terms: empidoid, Empididae, Hybotidae, tachydromiine, predators

[3750] CLADISTICS AND PHYLOGENY OF SUPERFAMILY RELATIONSHIPS WITHIN HYDRACHNELLAE (ACARI, ACARIFORMES)

J. Daochao, Institute of Entomology, Guizhou University, Guiyang 550025

The Phylogenetic relationships of 9 superfamilies of Hydrachnellae (=Hydrachnidia) are studied using computer cladistic programs. The cladistic analysis were mad using 23 morphological characters and 3 biological characters. A classification scheme, which shows the phylogenetic relationships within Hydrachnellae, is proposed here for 5 groups with 9 superfamilies. Pseudohydrachnidia is the most primitive group containing one superfamily (Stygothrombioidea); Protohydrachnidia contains one superfamily (Hydovolzioidea); Euhydrachnidia consists of 2 groups Achihydrachnidia and Neohydrachnidia; the Achihydrachnidia contains three superfamilies (Hydrachnoidea, Hydraphantoidea, Eylaoidea) and Neohydrachnidia four superfamilies (Sperchontoidea, Lebertioidea, Hygrobatoidea, Arrenuroidea). The sister groups are considered as that Pseudohydrachnidia and Protohydrachnidia + Euhydrachnidia, that Protohydrachnidia and Euhydrachnidia (Achihydrachnidia + Neohydrachnidia) and that Achihydrachnidia and Neohydrachnidia. The hypothesis by other authors is reviewed.
Key words: Hydrachnellae, superfamily, cladistics, phylogeny

[3751] TOWARD A PHYLOGENY OF THE WORLD EMPIDINI (DIPTERA: EMPIDIDAE)

C. Daugeron, ESA 8043 CNRS, Laboratoire d'Entomologie, Muséum national d'Histoire naturelle, 45 rue Buffon, 75005 Paris, France, E-mail daugeron@mnhn.fr

Dance flies of the tribe Empidini (Diptera: Empididae) form a large group of about 1,200 known species and only 10 genera, two of which, *Empis* L. and *Rhamphomyia* Meigen, are worldwide and include 90% of species. Other genera (*Clinorhampha* Collin, *Empidadelpha* Collin, *Empimorpha* Coquillet, *Lamprempis* Wheeler & Melander, *Macrostomus* Wiedemann *Opeatocerata* Melander, *Sphicosa* Philippi and *Porphyrochroa* Melander) comparatively contain few species and have a limited geographical range. A subgeneric classification, based on the Palaearctic fauna, has been established for *Empis* and *Rhamphomyia* (Bezzi, 1909). However, this classification is hardly applicable to other geographical regions, for which species groups appear distinct from Palaearctic subgenera. In fact, *Empis* and *Rhamphomyia* as well as a number of their subgenera are not monophyletic in the Palaerctic region itself. Thus the world systematics of the tribe appear unnatural and out-of-date. In order to resolve the phylogenetic relationships amongst Empidini and to propose in the future a monophyletic classification of the tribe as a whole, an extensive morphological work was made within the following research framework: first, the monophyly of a series of species groups was assessed by research of autapomorphies; second these species groups were used, instead of unnatural traditional genera and subgenera, as terminal taxa in a phylogenetic analysis. The Afrotropical and Palaearctic faunas were extensively studied, whereas until now the Oriental and Neotropical faunas were partially investigated. In all, about forty monophyletic groups are presently recognised. Some of them are presented and their respective autapomorphies given. A provisional phylogenetic hypothesis of relationships of species groups is proposed and discussed.
Index terms: Empidinae, species groups, monophyly.

[3752] REVISION OF THE GENUS *METALEPTEA* BRUNNER VON WATTENWYL (ORTHOPTERA; ACRIDIDAE; HYALOPTERYGINI)

Mariano Donato & María Marta Cigliano, Departamento Científico de Entomología and Laboratorio de Sistemática y Biología Evolutiva (LASBE). Museo de La Plata. Paseo del Bosque S/ N, 1900 La Plata, Argentina. E- mail: mdonato@museo.fcnym.unlp.edu.ar

In this study *Metaleptea* is re- described based on characters from the external morphology and genitalia. The two known subspecies proposed by Rehn, J. A. G. Trans. Am. Ent. Soc. 70: 181- 234, 1944, for *M. brevicornis* (*M. b. brevicornis* and *M. b. adspersa*) are considered separate species based on characters found in the male genitalia and female subgenital plate. To analyze if these species show geographic variation in body size, measurements of morphological characteristics were made on adults collected from different localities over the species known distribution. Multivariate analyses results showed that there is no evidence of direct relationship between the body size variation and the geographic distribution of specimens, although the species are highly variable in size and color patterns.

[3753] SYSTEMATIC STUDY OF THE ARGENTINEAN SPECIES OF THE GENUS *PSEUDOCENTRON* MITCHELL (HYMENOPTERA: MEGACHILIDAE)

S.P. Durante, Dept. Cient. of Entomology. Museo de La Plata, Paseo del Bosque s/n, 1900, La Plata, Argentina. e-mail: sdurante@museo.fcnym.unlp.edu.ar

Leafcutter-bees have, among solitary bees, the greatest pollination capacity. Despite their importance in agriculture improving the yields of the cultivation, the knowledge of this group is limited in Argentina and is in need of further study. In 1934 Mitchell has proposed *Pseudocentron* as a subgenus of *Megachile*. Later, he changed its status to genus (1980) and included seven subgenus in it, four of them previously described as *Megachile* (Mitchell 1934, 1937 and 1943) and three new ones. *Pseudocentron*, with mainly neotropical distribution, gathers ninety-two species. The main goals of this papaers, within the study of the biodiversity of the genus in the Argentina are: to: redrescribe the genus, subgenus and Argentine species, including keys for their recognition; to provide new data on geographic distribution and to propose a phylogenetic hypothesis for the genus. The studied material is housed in the collections of three national and six foreign museums. Systematic tratement was carried out according to Mitchell and *Eumegachile* is considered as the out-group. Fourteen species doubtfully assigned to *Pseudocentron* have been recognized hitherto in our country. Our results rise the number up to twenty-two, distributed within the seven subgenus. A new specie, six new combinations and four new synonymies are established. The subgenus *Leptorachina* and two species of the subgenus *Pseudocentron* are first cited in Argentina. The geographic distribution of 13 species is enlarged. The new geographical data improve the knowledge of the area of distribution of the subgenus *Acentron*, *Leptorachis* and *Pseudocentron*. In Argentina, the geographic distribution of the genus corresponds to biogeographic provinces to of the Amazonian, Chacoan and Andean-Patagonian Domains (Cabrera & Willink, 1980); the southernmost site known is El Bolsón (Rio Negro). The autapomorphies supporting the hypothesis of *Pseudocentron* as a natural group are referred in females, to the mandibles and the sternum VI, and in males, to the mandibular process, the spine of coxa of the first pair of legs, the spines of the tibiae of the second pair, and the gonoforceps.
Index terms: revision, leafcutter-bees, Argentina.

[3754] CLADISTIC ANALYSIS OF *ANTITEUCHUS* DALLAS, 1851 (HETEROPTERA, PENTATOMIDAE, DISCOCEPHALINAE)

J. A. M. Fernandes, Universidade Federal do Rio Grande do Sul, Depto de Zoologia, Av. Paulo Gama s/n 90046-900, Porto Alegre, Brazil, E-mail josefern@vortex.ufrgs.br.

The genus *Antiteuchus*, which is the largest in Discocephalinae made up of 42 nominal species, was revised and a cladistic analysis showed that this genus is monophyletic. A relationship hypothesis among the species of the genera is presented here. The characters polarization was made based on the outgroup method. Species of the genera *Callostethus*, *Mecistorhinus*, *Ablaptus*, *Cataulax*, *Uncinala*, *Sympiezorhincus* and *Parantiteuchus* were used as outgroups. The analysis was made using the computer software Treegardener 2.2.1 (manager of Hennig86) that ran a data matrix with 43 terminals and 69 characters using the mh*bb* algorithm. As a result, 36 trees were obtained (155 steps, CI-65, RI-90). The consensus cladogram, originating from these trees, showed a great basal politomy. In order to resolve the low resolution of the cladogram a new analysis was made using successive weighing and consensus. The final tree with the same topology of one of the 36 initial trees (155 steps, CI-65, RI-90) was obtained. The final cladogram showed that the current classification divides the genus in paraphyletic subgenera. To resolve this problem, the synonymy of the subgenus is proposed. Six groups of monophyletic species are also proposed. The groups of species raised from the cladogram are supinatus, amplus, peruensis, tesselatus, marmoratus and mixtus. The final cladogram is shown here in parenthetic notation. ((*supinatus* (*geometricus*, *exiguus*)) ((*graziae* (*amplus* (*nebulosus* (*ruckesi*, *rufitarsus*)))) ((((*confinium*, *mimeticus*, *surinamensis*) (*pallescens*, *rideri* (*punctissimus*, *amapensis*))) (*barlletti* (*guianensis* (*cuspidatus* (*amazonicus* (*beckerae* (*peruensis*, *rolstoni*))))))) ((*tesselatus* (*paraensis*, *similis*)) (*marmoratus* (*sepulcralis* ((*nigricans*, *pictus*, *melanicus*) (*fulvescens*, *tripterus* ((*maculosus* (*panamensis* (*costaricensis*, *innocens*))) ((*melanoleucus* ((*mixtus*, *radians*) (*macraspis* (*schuhi*, *variegatus*)))))))))))).

Key words: group of species; outgroup method; successive weighing; monophyletic genus

[3755] DESCRIPTION OF THE cervus-group of *Edessa* Fabricius, 1803 (Heteroptera, Pentatomidae, Edessinae)

J. A. M. Fernandes[1] & P. H. van Doesburg[2], [1]Universidade Federal do Rio Grande do Sul, Depto de Zoologia, Av. Paulo Gama s/n 90046-900, Porto Alegre, Brazil, E-mail: josefern@vortex.ufrgs.br ; [2]Nationaal Natuurhistorisch Museum, Naturalis, Postbus 9517, 2300 RA Leiden, The Netherlands, E-mail: p.h.v.doesburg@hetnet.nl .

Revision in one work of the genus *Edessa* is almost impossible due to the high number of described (260) and undescribed (ca 300) species. Therefore, we decided to split the genus in groups that seem to be monophyletic. The cervus-group is part of this long-term project and is particularly important because it involves *Edessa cervus*, which is the type species of the genus. This group includes the known species: *E. cervus*, *E. cerastes*, *E. elaphus*, as well as three new species. This group could be easily recognised by the apices of the long cylindrical and bifurcate humeral angles (sinapomorphy for the group), hemelytrae dark, dull, with costal margin yellow, abdomen with green longitudinal bands, which include spiracles. To characterise the species, we were not able to find reliable characters on external morphology other than those of the male and female external genitalia. High similarity among them is obviously the main reason for only three described species in a group of six. Actually, almost all specimens from this complex were identified as *E. cervus*, the first described species. Many authors listed *E. cervus* in their works, most of them mentioning only the localities where specimens were collected. According to the data of the material we studied, *E. cervus* is restricted to the Guyanas, so specimens mentioned from outside this region in all probability do not belong to this species. Actually, we examined most of the material mentioned by Stål, Walker, Burmeister and Dallas and all these specimens belong to *E. elaphus* and not to *E. cervus*. These misidentifications, still very common in *Edessa*, contribute towards the present-day taxonomical "state of chaos" of the genus. These species have the following distribution: *E. cerastes* in Costa Rica and Panama; *E. cervus* in Guyana, Suriname and French Guyana; *E. elaphus* in Colombia, Venezuela, Brazil, Ecuador, Peru and Bolivia; the three new species in the Amazon region (Brazil, Ecuador and Peru).

Key words: *Edessa cervus*; *Edessa elaphus*; *Edessa cerastes*; new species

[3756] DESCRIPTION OF THE DOLICHOCERA-GROUP OF *EDESSA* FABRICIUS, 1803 (HETEROPTERA, PENTATOMIDAE, EDESSINAE)

J. A. M. Fernandes[1] & P. H. van Doesburg[2], [1]Universidade Federal do Rio Grande do Sul, Depto de Zoologia, Av. Paulo Gama s/n 90046-900, Porto Alegre, Brazil, E-mail josefern@vortex.ufrgs.br; [2]Nationaal Natuurhistorisch Museum, Naturalis, Postbus 9517, 2300 RA Leiden, The Netherlands, E-mail: p.h.v.doesburg@hetnet.nl .

Edessinae is a subfamily of the Pentatomidae, composed of four genera: *Edessa* (260 described species), *Olbia* (5 species), *Pantochlora* (1 species) and *Peromatus* (7 species). Despite the small number of genera, the classification of Edessinae remains confused mainly due to the genus *Edessa*. The large number of described and undescribed species (more than 300) and the great diversity in appearance makes a complete revision of *Edessa* impracticable. Therefore, we decided to study *Edessa* by proposing and revising groups of species, which seem to be related according to some external characters. These characters will be used in future for a cladistic study concerning the relationship between the species-groups. The ultimate goal of this long-term study is to revaluate the generic classification and, eventually, to propose a new generic classification of the Edessinae. The dolichocera-group of *Edessa* includes three South American species: *Edessa dolichocera* and two new species. *E. ductor* is considered to be a junior synonym of *E. dolichocera*. The types of *Cimex dolichocerus* and of *Edessa ductor* were studied and designated lectotypes. The dolichocera-group is characterised by the very long and sharp conical projections of the humeral angles, while the hemelytrae are concolorous with the scutellum and the pronotal disc; the abdomen is green dorsally. To describe the species, characters of external morphology such as colour, length and shape of pronotal angles, metasternal shield and genitalia of male and female were used.

Key words: *Edessa dolichocera*; *Edessa ductor*; new species

[3757] DESCRIPTION OF THE BECKERI-GROUP OF *EDESSA* FABRICIUS, 1803 (HETEROPTERA, PENTATOMIDAE, EDESSINAE)

J. A. M. Fernandes[1] & P. H. van Doesburg[2], [1]Universidade Federal do Rio Grande do Sul, Depto de Zoologia, Av. Paulo Gama s/n 90046-900, Porto Alegre, Brazil, E-mail: josefern@vortex.ufrgs.br ; [2]Nationaal Natuurhistorisch Museum, Naturalis, Postbus 9517, 2300 RA Leiden, The Netherlands, E-mail: p.h.v.doesburg@hetnet.nl .

The species belonging to *Edessa* are famous for their high diversity in size, shapes and colors. The large number of described species, around 260, covers most of these forms, but it is still possible to find different forms among the species. A good example are the three undescribed species here presented as the beckeri-group, which have a very typical shape without parallel in *Edessa*. The flat upper side of the body, the shape of the paramere and the posteriorly open pygophore characterize this group. The specimens were collected in Guyana, French Guiana and Brazil. This work is part of a long-term project that aims at a complete revision of the subfamily Edessinae.

Key words: new species, new group, Neotropical region

[3758] NOMENCLATURAL CHANGES IN EDESSINAE (HETEROPTERA, PENTATOMIDAE)

J. A. M. Fernandes[1] & P. H. van Doesburg[2], [1]Universidade Federal do Rio Grande do Sul, Depto de Zoologia, Av. Paulo Gama s/n 90046-900, Porto Alegre, Brazil, E-s/n 90046-900, Porto Alegre, Brazil, E-mail: josefern@vortex.ufrgs.br ; [2]Nationaal Natuurhistorisch Museum, Naturalis, Postbus 9517, 2300 RA Leiden, The Netherlands, E-mail: p.h.v.doesburg@hetnet.nl .

Edessinae is a subfamily of Pentatomidae composed of four genera: *Edessa*, *Olbia*, *Pantochlora* and *Peromatus*. Despite the small number of genera, the classification of Edessinae remains confused mainly due to the genus *Edessa*, which is by far the largest genus in Pentatomidae with 260 described species and more than 300 new species. Proportionally to this is the number of nomenclatural problems involving part of the species as well as some species belonging to other genera of Edessinae. Since 1803, when Fabricius proposed *Edessa*, several authors described or transferred species to *Edessa* without caring about nomenclature or zoological rules. Therefore, it is possible to find all kinds of nomenclatural mistakes in *Edessa*. When we decided to revise *Edessa* in small groups of species we realised that even in this way we will encounter nomenclatural problems, due to the high number of similar looking species, incomplete descriptions and unreliable identifications made by earlier authors. To resolve this, we decided to (re)examine as many types of *Edessa* as possible. The second author studied most of the types many years ago and the first author completed this study recently. By doing this we aim to avoid perpetuating and creating new nomenclatural mistakes. We examined 215 types of species 42 names must be considered new synonyms, 12 species reinstated, 2 new names proposed and 1 transferred to another genus of Edessinae. Around 35 types were not (yet) examined; the fate of most of them, described by French or German authors, is still uncertain. Some of them are considered lost. If in the future such types will be rediscovered, new nomenclatural changes could be expected.

Key words: *Edessa*; new synonyms; reinstated species, new names

[3759] THE GENUS *CRYPHIA HÜBNER, 1818* (INSECTA, LEPIDOPTERA, NOCTUIDAE) IN CENTRAL SPAIN

J. Fernández[1] ,L. Romera[1] & J. L. Viejo[1], [1]Dep. de Biología, Univ. Autónoma de Madrid, Cantoblanco, 28049 Madrid, Spain, E-mail-joseluis.viejo@uam.es.

This study provides data concerning the distribution of 9 species of the genus *Cryphia* (Noctuidae, Bryophilinae) found in the Community of Madrid. In 1998 we began a faunistic study of the Noctuidae, based on the systematic sampling from different vegetation formations, all of which belong to the supra-Mediterranean woodland of the Sierra de Guadarrama (holm oak, ash, gall-oak and Pyrenean oak). The material comprising the object of study were gathered by the use of portable Heath type black light traps. As a result of this fieldwork, 146 specimens were captured belonging to 6 species of the genus *Cryphia*. We obtained information about the distribution of the other 3 species from the bibliography and from diverse collections. For each species, a figure has been drawn of the male genitalia and an information archive has heen made up in which are indicated the biogeographical group to which it belongs, its distribution in the Iberian Peninsula and the Community of Madrid, the data relating to capture (if they exist), those from the revision of the specimens deposited in the collections of the Museo Nacional de Ciencias Naturales de Madrid (Madrid National Museum of Natural History) (MNCNM) and the Biology Department of the Universidad Autónoma de Madrid (UAM), and also the data from the literature review undertaken. Distribution maps for each species in the Community of Madrid have heen produced, using the UTM projection system at a resolution of 10 km squares, based on the data obtained from the captures, the specimens deposited in collections and the literature. Nomenclature and organization of species follows YELA (1997).

Index terms: Moths, Madrid, Iberian Peninsula, plant formations

[3760] CLADISTICS OF THE *ALEIODES* LINEAGE OF THE SUBFAMILY ROGADINAE (HYMENOPTERA: BRACONIDAE)

J. C. Fortier[1] & S. R. Shaw[2], [1]Dept. of Biology Wheeling Jesuit Univ., Wheeling, WV 26003 USA, [2]Dept. of Natural Resources, University of Wyoming, Laramie, WY 82071 USA

A cladistic analysis was made for 208 *Aleiodes* species. Seventy-three characters were examined. Host association data from literature and museum specimens were mapped onto the cladogram. The genus consists of 18 species-groups within three sections: basal, intermediate, and derived. Basal and intermediate species tend to be generalist feeders while derived species tend to attack noctuids exclusively. The monophyly of seven subgenera was discussed, which were subsumed under *Aleiodes*.

Index terms: *Aleiodes*, Braconidae, Cladistics, host association, Rogadinae.

[3761] ON THE GENUS *PARAMECOCEPHALA* (HETEROPTERA, PENTATOMIDAE, PENTATOMINI)

Frey-da-Silva[1], A. & J. Grazia[2], [1,2]Department of Zoology, Univ. Fed. Rio Grande do Sul, Ave. Paulo Gama, s/n, Porto Alegre, RS, 90046-900, Brazil, E-mail: jocelia@ufgrs.br

Paramecocephala, monotipic, and *P. foveata*, were described based in one male specimen from Belo Horizonte, Minas Gerais, Brazil. It is close related to *Mecocephala* Dallas, and *Tibraca* Stal. In a previous analysis (not published) the monophyly of the group *Mecocephala*, which included both mentioned genera plus *Glyphepomis* Berg, *Hypatropis* Bergroth, *Paratibraca* Campos & Grazia, *Hypanthracos* Grazia & Campos, *Parahypatropis* Grazia & Fernandes, *Amauromelpia* Fernandes & Grazia, *Luridocimex* Grazia, Fernandes & Schwertner, and *Stysiana* Grazia, Fernandes & Schwertner, was corroborated. *Paramecocephala* was not included in this group. In the present paper the genus is expanded to contain *Mecocephala uruguayensis* Pirán, *Mecocephala rubripes* Berg, *Mecocephala fusca* (Haglund), and 10 new species. Measurements of 18 parameters were performed under a stereomicroscope with a graduated eyepiece. The morphology of the external and internal genitalia of both sexes was used to characterize the species. To study the internal genitalia, the specimens were cleared in KOH, stained with Congo red, and stored in glycerin. The illustrations were made with the help of a drawing tube attached on the stereomicroscope.

Index terms: taxonomy, morphology of genitalia, stink bugs, neotropical

[3762] INVESTIGATION OF THE VALIDITY OF SPECIES STATUS OF *TOMICUS DESTRUENS* (COLEOPTERA, SCOLYTIDAE) USING RIBOSOMAL DNA

J. Galián, & D. Gallego, Department of Animal Biology, Faculty of Veterinary, University of Murcia, Apdo. 4021, 30071 Murcia, Spain, E-mail jgalian@fcu.um.es.

The bark beetles species of the genus *Tomicus* are some of the main pests of European forests. The genus includes 6 species of which 3 are present in the Iberian Peninsula: *T. destruens, T. piniperda, T. minor*. The species pair *T. destruens* and *T. piniperda* are morphologically indistinguishable, although they show differences in terms of reproductive behaviour. Both species have been considered conspecific by some authors. The problem about the status of *T. destruens* and *T. piniperda* as separate species is a question of biological and economic importance. Molecular tools can solve systematic problems and can facilitate the identification of sibling species. In this paper we characterise molecular markers in the ribosomal DNA, that allow to test the status of *T. destruens* as a species distinct from *T. piniperda*, and develop a quick test for identification. The internal transcribed spacers (ITS1 and ITS2) of the rDNA of both species have been analysed by PCR (polymerase chain reaction), restriction enzymes and sequencing. These regions are highly variable and different species not only have different sequence but also they often show differences in length. We analysed individuals of *T. destruens* from the region of Murcia, SE Spain, where this species has caused great damage in the pine forests, and individuals of *T. piniperda* from different Spanish and Swedish localities. The ITS1 region differs in about 100 bp between both species (1600 bp for *T. destruens* and 1700 bp for *T. piniperda*). The ITS2 region has the same length in both species, although there are differences in base sequence. We determined the sequence in both species and localised the target for several restriction enzymes that produce a different restriction pattern. These differences in ITS1 and ITS2 are consistent in all individual analysed. These results suggest that *T. destruens* and *T. piniperda* are valid species. PCR amplification of the ITS1 region constitutes a reliable test for quick species identification. PCR amplification of the ITS2 region and subsequent restriction tests constitute additional corroboration data for identification of these sibling species.
Index terms: Coleoptera, Scolytidae, *Tomicus*, rDNA, ITS1, ITS2

[3763] REVISION OF *TAUROCERUS* AMYOT & SERVILLE, 1843 (HETEROPTERA, PENTATOMIDAE, PENTATOMINI)

J. Grazia[1] & A. Barcellos[2], [1,2] Dept. of Zoology, Univ. Fed. Rio Grande do Sul, Ave. Paulo Gama, s/n, Porto Alegre, RS, 90046-900, Brazil;[2] e-mails: jocelia@vortex.ufrgs.br/ alinebar@vortex.ufrgs.br.

Taurocerus, with three nominal species, is an exclusively Neotropical genus, distributed from Mexico to Central Brazil. *Taurocerus* was described to include *T. edessoides*, based on a specimen from Brazil. The genus is included among the Pentatomini genera characterized by the presence of a tubercle at the base of abdominal venter, apposed to the posterior margin of metasternal carena. The male genitalia, particularly the aedeagus, presents similarities with that of *Arvelius*. In this paper, *Taurocerus* is revised, based on morphological characters, especially on male and female genitalia. The relationships between *Taurocerus* and other Pentatomini genera are presented and commented.
Index terms: .stink bugs, morphology of genitalia, taxonomy, neotropical.

[3764] CLADISTIC ANALYSIS OF GENUS *SERDIA* (HETEROPTERA: PENTATOMIDAE: PENTATOMINI)

J. Grazia[1,2], & N. D. F. de Fortes[1], [1]Dept. Zoology, Univ. Fed. Rio Grande do Sul, Ave. Paulo Gama, s/n, Porto Alegre, RS, Brazil, 90046-900, [2]E-mail: jocelia@ufgrs.br.

The neotropical genus *Serdia* Stal originally including 13 species was reviewed three times. At the most recent revision five new species were added and the genus was redefined. The present parer analyzes the relationships among the species. A cladistic analisys was performed using 40 characters; 21 taxa; and the genera *Tibilis* Stal, *Neotibilis* Grazia & Barcellos and *Similliserdia* Fortes & Grazia as outgroup. To carry on the analysis the software Hennig86 as well as the program Tree Gardner and command ie* were used. The results show only one cladogram with 83 steps, index of consistency 51 and index of retention 75. The monophily of *Serdia* is supported by four synapomorphies: darkened margins of the scutellum apex, males with the inner wall of genital cup thicker and with brim-shaped processes, females with thickenning of the vaginal intima arising at posterior half of gonapofises 9 and projected ventrally.
Index Terms: Phylogenetic analysis, morphology of genitalia, neotropical region

[3765] NEW TAXA AND NOTES ON NEOTROPICAL CERAMBYCIDAE (COLEOPTERA)

M. H. M. Galileo, Museu de Ciências Naturais, Fundação Zoobotânica do Rio Grande do Sul, P. O. Box 1188, Porto Alegre, RS, 90001-970, Brazil, E-mail galileo@pampa.tche.br.

New taxa described - Cerambycinae: Ibidionini, *Cecaibidion* gen. n., type species, *C. bivittatus* sp. n. from Panama; Acangassuini trib. n., *Acangassu* gen. n., type species, *A. diminuta* sp. n. from Brazil (Rio de Janeiro); Necydalopsini: *Eucharassus flavotibiale* sp. n. from Colombia (Valle) and *E. confusus* sp. n. from Venezuela (Distrito Federal). Lamiinae: Onciderini, *Iaquira* gen. n., type species, *I. viridis* sp. n. from Brazil (Espírito Santo); Phacellini, *Phacellus plurimaculatus* sp. n. from Brazil (Amazonas). Notes on *Phacellus fulguratus* Monné, 1979 and a key to the species of *Eucharassus* are added.
Index terms: Acangassuini; Ibidionini; Necydalopsini; Onciderini; Phacellini

[3766] PHALLIC STRUCTURE, BIOACUSTIC AND CHROMOSOMES OF THE CRICKET *UROGRYLLUS TOLEDOPIZAI*

P. C. García & A. Mesa, Dept. de Biologia, Instituto de Biociências, Univ. Estadual Paulista (UNESP), Av. 24A 1515, 13506900, Rio Claro, SP, BRAZIL. E-mail: alejomesa@linkway.com.br

In the present paper information is provided on the morphology of the phallic structure and the *pars stridens* of the species *Urogryllus toledopizai*. Meiotic and mitotic chromosomes are also studied as well as the song structure emitted by the males and the consequent mating behavior of male and female. Disagreements with the results published by other authors are discussed.
Index terms: Gryllidae, cytogenetic, calling song.

[3767] MORPHOLOGY, BIOACUSTIC AND CYTOGENETIC IN 4 SPECIES OF *ANUROGRYLLUS* (ORTHOPTERA, GRYLLIDAE)

P. C. García, S. Kasahara & A. Mesa, Dept. de Biologia, Instituto de Biociências, Univ. Estadual Paulista (UNESP), Av. 24A 1515, 13506900, Rio Claro, SP, BRAZIL. E-mail: alejomesa@linkway.com.br. Supported by CAPES and FAPESP.

Morphological, bioacustic and cytogenetic studies were carried out in 174 specimens of the cricket genus *Anurogryllus* collected in six different localities of the São Paulo State. The following morphological structures were analyzed: female and male genitalia, the *pars stridens* teeth, the general body color and the color pattern of several body regions in males. The kind of song that received most attention was the calling song because it enclose species-specific information but also courtship and agressivity songs as well courtship and mating behaviors were studied. Meiotic and mitotic chromosomes were analyzed with standard and differential staining techniques as C-banding, Ag-NOR and, in some cases, BrdU incorporation followed by FPG staining. The majority of the morphological structures did not provide solid criteria to group the specimens, but only circunstancial evidences based in size and color differences that allowed to accomplish a preliminar distribution of the specimens in four different groups. The calling song analysis was decisive to identify *Anurogryllus* sp1 because the song emission in this species is discontinuous and, for this reason, is different from that presented by all the remaining known species of the genus. The calling song structure also allowed to separate two species from a single locality that were named *Anurogryllus* sp2 (univoltine) and *Anurogryllus* sp3 (bivoltine). *Anurogryllus* sp4 can not be distinguished from *Anurogryllus* sp2 because both of them show similar calling songs. The standard chromosome analysis showed that *Anurogryllus* sp3 has a characteristic karyotype, while the remaining species have differences that, without a preliminar grouping based on morphology and bioacustic could be interpreted as intraspecific variations. Regarding to differential staining techniques, the Ag-NOR did not provided useful information for group discrimination. The C-band however showed some differences that allowed to separate *Anurogryllus* sp1 and *Anurogryllus* sp3 from *Anurogryllus* sp2 and *Anurogryllus* sp4. Being in mind the problem of *Anurogryllus* sp4 that has a body size similar to *Anurogryllus* sp3, variable body color and chromosomes similar to *Anurogryllus* sp2, a multivariate statistic test was carried out with morphological and song characteristics in order to quantify the differences, especially between *Anurogryllus* sp2 and *Anurogryllus* sp4. The results confirmed that it is possible to separate the specimens of *Anurogryllus* here studied in four different species. The characteristics of each of them were compared with the remaining already described *Anurogryllus* species, confirming the existence of four new species in the genus.
Index terms: cricket, song, chromosome, genitalia, *pars stridens*

[3768] PHENOLOGY OF A POTENTIALLY MULTIVOLTINE BUTTERFLY, *COENONYMPHA PAMPHILUS* IN A MEDITERRANEAN ENVIRONMENT

E. García-Barros[1], Dept. Biology, Univ. Autónoma de Madrid, 28049 Madrid, Spain, E-mail garcia.barros@uam.es.

The length of the period when temperature is favourable for plant development increases from North to South in Europe. For insects with a variable number of broods that occur along a wide latitudinal gradient in Western Europe such as the small heath butterfly *Coenonympha pamphilus*, an increase in the number of generations per year is expected to occur along this gradient. However, summer draught becomes a limiting factor in the southernmost part of its geographic range. The larvae of this species feed on grasses, and the adults are found in a more or less continuous way between April and September in the central part of the Iberian Peninsula, even when the lack of rainfall during mid and late summer represent adverse conditions for larval growth. This study attempted to determine the phenological behaviour of *C. pamphilus*, using a combination of rearing experiments carried out under natural and controlled conditions. The results show that: 1) Adult abundance follows a roughly bimodal curve, with a sub-minimum in the dry midsummer period. 2) The larvae is the hibernating stage. Larval diapause seems to occur at any larval size before the final instar, and is induced by photoperiods between 14:10 and 15:9 L:D. Larval growth rates seem to be determined by photoperiod. 3) No summer diapause was detected in the egg, larval or pupal stages. 4) The newly hatched larvae are able to withstand starvation for remarkable periods of time. In addition, there is some evidence that adult females of the summer morph are able to delay oviposition. These facts may explain the frequency distribution of adults along the year, which results from: A) A spring emergence of adults that hibernated as larvae, B) One or more late spring or summer emergence/s of adults that represent the descent of the spring emergers, and C) A summer/late summer populations consisting of a mixture of dominating early/mid summer adults together with a small proportion of late emergers. The potentially long season is thus constrained by two both summer draught and winter conditions, which probably determines a conflict between the advantages and drawbacks of multivoltinism.
Index terms: Lepidoptera, Satyrinae, life-history, climate, diapause

[3769] MOLECULAR PHILOGENY OF THE GENUS *CYRTONUS* (COLEOPTERA: CHRYSOMELIDAE)

I. Garneria, C. Juan & E. Petitpierre, Lab. Genètica, Dept. Biologia, UIB, 07071 Palma de Mallorca (Spain). e-mail: dbaigp4@clust.uib.es.

The genus *Cyrtonus* comprises some 40 species mainly inhabiting the Iberian Peninsula, three of which can also be found in France. Furthermore, one species lives in Morocco and another on the Balearic Islands. There is not a phylogenetic hypothesis available for this genus. The objective of this research is to elucidate the phylogenetic relationships within the genus *Cyrtonus*. A fragment of 509 bp of mitochondrial 16S rDNA was sequenced in 14 species. Two species were used as outgroups, one of *Chrysolina* and another of*Timarcha*. Phylogenetic trees were constructed using methods of maximum parsimony and maximum likelihood. The results were compared with the chromosomal data available for 11 species. In general, the chromosomal number is congruent with the phylogenetic tree except for *C. cylindricus* and *C. contractus*, both with 2n = 28 chromosomes but related to taxa with 2n = 40. Thus, the diploid number seems to have evolved from 28 to 40 chromosomes.
Index terms: 16S rDNA

[3770] AN ORIGINAL FRESHWATER INSECT COMMUNITY ON FRENCH GUYANA INSELBERGS : INCLINED WET ROCK

R. Garrouste[1,2], [1]Muséum National d'Histoire Naturelle (MNHN), Antenne de Guyane c/o IRD BP 165 F-97323 Cayenne cedex, French Guyana, E-mail : garroust@mnhn.fr ; [2]MNHN Laboratoire d'Ecologie, 4, avenue du Petit-Château F-91800 Brunoy, France.

Inselbergs are very common in French Guyana (FG), as well as rocky outcrops, and host a mosaic of characteristic vegetation types with floristic singularities ("savane roche"). On an average altitude granitic inselbergs in the center of FG, (Le Mont Chauve), studied by a pluridisciplary team (faunistic and floristic surveys) specialy dropped by helicopter, we describe, as first results (during the rainy season), an original rheocrene community, on permanent and periodicaly inclined wet rock, with emphasis on Heteroptera community and "preys" of main aquatic plants, carnivorous Utricularia sp. (Lentibulariaceae). Functional hypothesis and adaptation to drastic thermal and hydric conditions are discussed.
Index terms : aquatic Heteroptera, rheocrene,

[3771] BIONOMICS OF THE GUAVA COTTONY SCALE, *Capulinia* sp. NEAR *jaboticabae* (HEMIPTERA: ERIOCOCCIDAE) ON *Psidium* SPECIES

F. Geraud-Pouey [(1)] y D.T. Chirinos [(1)], Unidad Técnica Fitosanitaria, Facultad de Agronomía, La Universidad del Zulia Apartado 15205, Maracaibo 4005, Zulia, Venezuela. Telefax (58 61) 597113. E-mail: fgeraudp@hotmail.com.

The guava cottony scale, *Capulinia* sp. near *jaboticabae* (Hemiptera: Eriococcidae), is apparently a new species to science or at least on guava (*Psidium guajava*) were it became the most destructive pest in Venezuela since its appearance in 1993. During June-October 1999 the range of host plants of this insect was approached evaluating demographic statistics on two guava local selections and two other species in the same genus, "cas", *P. friedichsthalianum* and "guayabito de cerro", *P. guineense*. Survival to adulthood of *Capulinia* sp. resulted on *P. guajava* "Criolla Roja" (90.60%) > *P. guajava* "Selección 12" (63.45%) > *P. friedichsthalianum* (3.76%) > *P. guineense* (0%) ($P<0.05$). The lower survival on "Selección 12" compared to "Criolla Roja" was associated with the scarcity of bark exfoliations on the former. Crawlers in this scale insect show a strong preference for such exfoliations as protected sites under which they set to start feeding and continue development. The proportion of males as well as the duration of development resulted higher and the fertility as well as demographic statistics were lower on *P. friedichsthalianum* compared to both selections of *P. guajava*. The lengthening of development of first instar nymph and the high mortality after crawler setting on *P. friedichsthalianum* and *P. guineense* could be associated with secondary plant compounds without disregarding nutritional effects. The results obtained on these two species suggest they are far separated from the host plants on which the insect evolved. The high survival and fertility (2639.80±161.43 eggs/female) of *Capulinia* sp. on *P. guajava* "Criolla Roja" produced demographic statistics showing that in a generation time (T) of 45.37 days, the population can multiply 1090.81 times (R_o), representing an instantaneous contribution of 0.20 individuals per individual per day (r_m). These statistics explain the high infestations occurred when the insect colonized new areas in the absence of efficient natural enemies and partially supports the importance the insect still has as guava pest in Venezuela. The physical effect of bark exfoliations as well as biochemical features of host plants could constitute sources of resistance that could be combined with the action of natural enemies in search of lowering incidence and damages by *Capulinia* sp. within an Integrated Pest Management framework.
Key words: Life tables, fertility table, Coccoidea, host plants

[3772] A NEW GENUS OF ONCIDERINI (COLEOPTERA, CERAMBYCIDAE) FROM PERU

J. A. Giorgi, Dept. de Zoologia, Univ. de São Paulo, São Paulo, SP, Brazil; Dept. de Entomologia, Museu Nacional, Quinta da Boavista, São Cristovão, Cep 20940-040, Rio de Janeiro, RJ, Brazil, giorgi@acd.ufrj.br

The examination of the Onciderini deposited at the Cerambycidae collection of the Museu Nacional (MNRJ) gave me the opportunity to describe a new genus by means of one male specimen collected at Sani Beni, Department of Junin, Peru. The new genus shares the swollen condition of the third antennal segment, rather elliptical in outline, in males, with the Onciderini genera *Eudesmus* Audinet-Serville, 1835, *Lachaerus* Thomson, 1868, *Psyllotoxus* Thomson, 1868, *Clavidesmus* Dillon & Dillon, 1945 and a few species of *Oncideres* Lepeletier & Audinet-Serville, 1830. The presence of transverse front, straightened antennal third segment, lack of tubercle on the pronotal disk, cylindrical and robust body shape, and shortness of antennae, would place this genus together with *Clavidesmus* in the key proposed by Dillon & Dillon (1945). The new genus is easily differentiated from *Clavidesmus* by the combination of the following conditions: 1) lower ocular lobes not removed from frontal margin; 2) 3rd antennal segment slender at base; 3) shortness of the 4th antennal segment, approximately 1/2 of 3rd segment length; 4) absence of the prothoracic lateral tubercle; 5) pronotal disk transversely corrugated; 6) procoxae armed with a well develop tubercle; 7) profemora slightly clubbed from base, almost completely rugose. *Clavidesmus* exhibit: 1) lower ocular lobes strongly removed from frontal margin; 2) 3rd antennal segment swollen at base; 3) 4th antennal segment, approximately 2/3 of 3rd segment length; 4) distinct prothoracic lateral tubercle; 5) pronotal disk smooth; 6) procoxae unarmed; 7) profemora strongly clubbed from basal 1/3, with rugosities restricted to basal 1/3.
Index terms: Sistematics; Cerambycidae; Onciderini.

[3773] TRANFERENCE OF TWO SPECIES FROM *CLAVIDESMUS* TO *LACHAERUS* (COLEOPTERA, CERAMBYCIDAE, LAMIINAE, ONCIDERINI)

J. A. Giorgi, Dept. de Zoologia, Univ. de São Paulo, São Paulo, SP, Brazil; Dept. de Entomologia, Museu Nacional, Quinta da Boavista, São Cristovão, Cep 20940-040, Rio de Janeiro, RJ, Brazil, giorgi@acd.ufrj.br

Clavidesmus was proposed by DILLON & DILLON (1945) for *Eudesmus heterocerus* and *E. metallicus*. Nowadays, this South American genus is composed of seven species, six of them occurring in Brazil and one another in Colombia. Based on external characters, Giorgi (1998) showed that *Clavidesmus* comprise two groups of species: *C. chicae* Giorgi, 1998, *C. heterocerus* (Buquet, 1852), *C. indistinctus* Dillon & Dillon, 1952 and *C. metallicus* (Thomson, 1868); *C. monnei* Giorgi 1998, and *C. rubigineus* Dillon & Dillon, 1949. The taxonomic position of *C. rubigineus* and *C. monnei* seemed questionable considering that the characters pointed out by Giorgi (*op. cit*) for justifying this cluster also occur in *Lachaerus* Thomson, 1868, a monobasic genus. For that reason, it was carried out a comparative study between *Clavidesmus* and *Lachaerus* species in which the endosternites, wing venations and male genitalia of the type-species of these two genus and *C. rubigineus* were analysed. This study demonstrated that *C. rubigineus* and *C. monnei* share a greater number of features with *Lachaerus* than with *Clavidesmus*. Based on those evidence we propose the transference of these species to *Lachaerus*.
Index terms: Sistematics; Cerambycidae; Onciderini; Clavidesmus; Lachaerus.

[3774] PHYLOGENY AND EVOLUTION OF LEIODIDAE (COLEOPTERA) - INTRODUCTION TO THE SYMPOSIUM

P. Gnaspini[1] & S. B. Peck[2], [1]Depto Zoologia, I. Biociências Univ. S. Paulo, Cx.P. 11461, 05422-970 São Paulo - SP, Brazil. E-mail: gnaspini@ib.usp.br; [2]Dept Biology, College Nat. Sciences, Carleton Univ., 1125 Colonel By Drive, Ottawa, Ontario, K1S 5B6, Canada. E-mail: StewartPeck@pigeon.carleton.ca.

Leiodidae (s.l.) has been a rather neglected family of beetles. In the last decade, several important papers have been published with descriptions of new species and preliminary phylogenetic analyses. These papers focused mainly on cave and leaf litter species, mainly from the Oriental and Neotropical regions, where our knowledge is extremelly incomplete. These advances led to the convening of a symposium on Leiodidae which was held at the ICE four years ago. Since then, new discoveries have been made and the present symposium was thought to be needed. New data from the Neotropical, Oriental and Australian regions have brought knowledge of "strange" and "unexpected" new species and genera which are contributing to a better understanding of the phylogeny of the group. Among Leiodidae, the Cholevinae has been studied more intensively, especially because of their cavernicolous radiation. In the present symposium, these new taxa and their contribution to phylogenetic reconstructions (mollecular and morphological) is discussed.

[3775] BATFLIES (DIPTERA: STREBLIDAE AND NYCTERIBIIDAE) OF PARANÁ STATE, BRAZIL

G. Graciolli & C. J. B. de Carvalho, Curso de Pós-graduação em Entomologia, Depto. de Zoologia, Universidade Federal do Paraná. C. P. 19020, CEP: 81531-990. Curitiba, Paraná, Brasil. Laboratório de Biodiversidade e Biogeografia de Diptera.

A survey of batflies (Diptera: Streblidae and Nycteribiidae) was carried out in Paraná State, Brazil during 1998 and 1999. Twenty-tree species were recorded, in 10 genera of Streblidae and seven species in one genus of Nycteribiidae. Two species of streblid batflies, *Paraeuctenodes longipes* and *Metelasmus pseudopterus*, that have not been collected in Paraná were included because have been recorded in Rio Grande do Sul and São Paulo States and probably will be collected in the next surveys. Two species are new records to Brazil: *Trichobius jubatus* and *Basilia ortizi*; and one new species is described: *Basilia lindolphoi* sp. n.. Beyond one, twenty-two species are new records for Paraná State: *Trichobius joblingi*, *Trichobius tiptoni*, *Trichobius furmani*, *Trichobius longipes*, *Paratrichobius longicrus*, *Megistopoda aranea*, *Megistopoda proxima*, *Aspidoptera falcata*, *Aspidoptera phyllostomatis*, *Exastinion clovisi*, *Noctiliostrebla aitkeni*, *Paradyschiria fusca*; *Paradyschiria parvula*, *Strebla chrotopteri*, *Strebla diaemi*, *Strebla guajiro*, *Strebla mirabilis*, *Paraeuctenodes similis*, *Anastrebla caudiferae*, *Anastrebla modestini*, *Basilia carteri*, and *Basilia juquiensis*. Occurrences of *Trichobius dugesioides dugesioides* and *Strebla mirabilis* on phyllostomid bat *Mimon bennettii* and *Paratrichobius longicrus* on phyllostomid bat *Pygoderma bilabiatum* were observed for the first time. The male of *Basilia juquiensis* is characterized. Pictorial keys to species are presented; gonopods of streblid batflies and female abdomen of *Basilia* are illustrated.
Index terms: ectoprarasites, *Basilia*, streblid batfly, pictorial key, bats

[3776] COCCOIDEA AFFECTING ORNAMENTAL PLANTS IN ARGENTINA

M.C. Granara de Willink[1], [1]Consejo Nacional de Investigaciones Científicas y Técnicas (CONICET), Fundación Miguel Lillo e Instituto Superior de Entomología (INSUE), Facultad de Ciencias Naturales y Museo, Universidad Nacional de Tucumán, Miguel Lillo 205, San Miguel de Tucumán, (4000) Tucumán, Argentina. E-mail: ewillink@arnet.com.ar.

Many native and exotic plant species are cultivated in homes and cities, where they provide shade and appeal to our aesthetic sensibilities. Almost no research has been done on the Coccoidea associated with ornamentals in the Neotropics, although scale insects seem specially well adapted for survival in urban ecosystems. Indeed, the harsh natural selective pressures, such as air and water pollution, that prevail in the cities may adversely affect plant development and, at the same time, promote abnormally rapid increase of herbivorous insect populations, destroying the aesthetic value of the plants which are attacked. More importantly, many agricultural pest species seem to find a natural reservoir in the ornamental plants of urban green spaces, most of which are not subject to phytosanitary control. The objective of this research is to provide information about the some scale insect families which attack ornamental plants in Argentina. This work was accomplished by examining scale insects in argentine collections, as well as by studying new material collected in the field, or sent in for identification by colleagues throughout the country. These studies were carried out under research projects supported by the Instituto Superior de Entomología and by the Fundación Antorchas. Microscopic preparations were made of specimens to be examined, which were cleared, stained, dehydrated, and mounted on slides in Canadian Balsam. More than 32 species of Coccoidea were identified, belonging to the following 6 families, and 16 genera: 7 species of Pseudococcidae in the genera *Pseudococcus, Planococcus, Ferrisia* and *Dysmicoccus*; 13 species of Coccidae in the genera *Akermes, Ceroplastes, Coccus, Eucalymnatus, Protopulvinaria, Parasaissetia, Parthenolecanium* and *Saissetia*; as well as species of Margarodidae in the genera *Icerya*, Eriococcidae (*Acanthococcus*), Asterolecaniidae (*Asterolecanium*), and Lecanodiaspididae (*Lecanodiaspis*). About 60 species of ornamental plants in many different families were found to be affected. A list of the host plants along with the scales that attack them is given.
Index terms: Scale insects, host plants, ornamentals

[3777] DERMAPTERAN LIFE HISTORY EVOLUTION AND PHYLOGENY WITH SPECIAL REFERENCE TO THE FORFICULIDAE FAMILY

S. Guillet & M. Vancassel, Univ. Rennes1, UMR CNRS 6553, Bat.14, Campus de Beaulieu, 35043 Rennes, France, E-mail: michel.vancassel@univ-rennes1.fr.

The monophyletic order of Dermaptera displays a great diversity of life histories from iteroparity to strict semelparity. The climatic criterions allow a general ordering of these life histories from iteroparous-tropical species to semelparous-cold adapted species. This general trend of evolution is confirmed and several of its particular aspects are highlighted with a molecular phylogeny based on the mitochondrial 16S gene partial sequence.
Index terms: iteroparity, semelparity, ARN 16S.

[3778] A TAXONOMIC STUDY ON SUBFAMILY MYCOMYINAE FROM CHINA (DIPTERA: MYCETOPHILIDAE)

W. Hong, Zhejiang Forestry College, Lin'an 311300, P. R. China

This paper deals with the taxonomy on subfamily Mycomyinae from China. A total of 66 species belonging to 3 genera are recorded. These species distributed 16 Provinces of China, among which 20 species distributed at north of the Yangtze River, with a percentage of 30.3%; 38 species at south of the Yangtze River, with 57.6% and 8 species step the Yangtze River, with 12.1%. Among 3 genera, genus *Mycomya* is a dominant genus, possess 41 species, and cover 62.1% of the total Mycomyinae fauna from China. *Vecella* is endemic to China, with only 1 species. *Neoempheria* possess 24 species, cover 36.4% of the total Mycomyinae from China. In *Mycomya*, 15 species distributed at north of the Yangtze River, with a percentage of 36.6%; 21 species at south of the Yangtze River, with 51.2%; 5 species step the Yangtze River, with12.2%. *Vecella* only distributed at south of the Yangtze River. In *Neoempheria*, 5 species distributed at north of the Yangtze River, with a percentage of 20.8%; 16 species at south of the Yangtze River, with 66.7%; 3 species step the Yangtze River, with12.5%. This article has classified all Mycomyinae species of China into 4 faunistic categories: 1) Oriental components; 2) Palaearctic components; 3) Eurytopic components; 4) East Asia components (including levels of China distribution and China-Japan distribution). As a whole, the Oriental components possess 1 species and cover 1.5% of the total Mycomyinae fauna of China, where Palaearctic components has 12 species and occupy 18.2%, Eurytopic components 2 species and 3.0%, and East Asia components 51 species and 77.3% (all species belonging to China distribution, there is no China-Japan distribution species). The East Asia components form the main part of the Mycomyinae fauna of China. Since the dominant components determine the characteristics of a fauna, the Mycomyinae fauna of China is therefore an East Asia fauna. he characteristic of the geographical distribution of Mycomyinae from China is: some of the species are distributed from Europe to southeastern China; narrow distribution in many species explains this subfamily splits violent in China.

Key words: Mycomyinae, taxonomy, China

[3779] CHARACTER EVALUATION AND PHYCITINE PHYLOGENY (LEPIDOPTERA, PYRALIDAE)

M. Horak, CSIRO Entomolgy, GPOBox 1700, Canberra, ACT 2601, Australia.

The Phycitinae are a large pyralid subfamily occurring worldwide and containing many species of economic importance. However, their phylogeny and consequently their higher classification is still little understood. In contrast to some other groups the problem seems to be a confusing wealth of characters and their distribution rather than lack of morphological information. Tracking of character transformation series within demonstrably monophyletic phycitine subgroups suggests that the implicit assumption about phycitine character evolution from simple to complex underlying much phycitine classification is a fallacy. As a working hypothesis derived from studies of the Australian/Oriental fauna, a phycitine groundplan including at least some of the secondary sexual characters considered typical of 'higher phycitines' is suggested as a departure point for testing and debate.

Index terms: Phycitinae, transformation series, secondary sexual characters

[3780] BEHAVIOURAL AND BIOGEOGRAPHICAL IMPLICATIONS OF *AGAPOSTEMON* PHYLOGENY (HYMENOPTERA: HALICTIDAE)

J. Janjic[1,2], L. Packer[1], [1]Department of Biology, York Univ., 4700 Keele Street, Toronto, Ontario, Canada, M3J 1P3. [2]E-mail: beegirl@yorku.ca.

The evolution of the sweat bee genus *Agapostemon* is of interest for both behavioural and biogeographical reasons. It exhibits both communal and solitary behaviours, and is believed to have originated in South America, and is currently found throughout North, Central, and South America as well as on the Caribbean islands. Behavioural and biogeographical studied both require a species level phylogeny of *Agapostemon*. We present the results of a morphology-based phylogenetic analysis of the 43 *Agapostemon* species, with 10 additional taxa from the Agapostemonine group of genera used as outgroups. Conclusion on behavioural evolution and biogeography within *Agapostemon* will be presented and compared to similar studies of other taxa.

Index terms: New World, cladistics, morphology, evolution, sweat bee

[3781] PHYLOGENETIC ANALYSIS OF CHARACTERS OF THE MALE AND FEMALE REPRODUCTIVE SYSTEMS OF SOME LAND BUGS (HEMIPTERA: HETEROPTERA)

M. Javahery, Lyman Entomological Museum and Research Laboratory, Macdonald Campus of McGill University, PO Box 140, 21111 Lakeshore, Quebec, Canada H9X 3V9

The heteropteran infraorders of Pentatomomorpha and Cimicomorpha are fascinating groups of land bugs to study. There is a vast literature available on their reproductive morphology and its bearing on the phylogenetic classification. A number of characters studied by Heteropterists' in the superfamilies were based on the structure of the reproductive systems, particularly of the male genitalia (Pruthi 1925), spermathecha (Pendergrast 1957), and the reproductive systems of both sexes (Leston, Pendergrast and Southwood 1954; Cobben 1978; Schaefer 1993; Schuh and Slater 1995). However, most of the examples examined were dried museum materials boiled in 10 percent potassium hydroxide solution. In the present studies, all examples were from dissection of fresh materials of both male and female reproductive systems under 50 percent alcohol. An extensive collection of data on a number of characters of the reproductive systems of both sexes has been investigated from 65 species of 34 genera, and 16 superfamilies of the Nearctic and Palearctic region. These materials were from Acanthosomatidae, Alydidae, Aradidae, Cydnidae, Coreidae, Lygaeidae, Pentatomidae, Pyrrhocoridae, Rhopalidae, Scutelleridae, and Thyreocoridae (Pentatomomorpha), as well as, Miridae, Nabidae, Phymatidae, Reduviidae and Tingidae (Cimicomorpha). A comparative study of male and female reproductive characters indicate different values, within or between examples, which separate these bugs at the family, genera, and even closely related species. The male aedeagus and paramers, the female ovipositor structures (one spermatheca, or 2 pseuspermatheca), and to a lesser extent the number of ovarioles in each ovary (from 3 in Phymatidae to 8 in Reduviidae, and 7, a rather common number in most Pentatomoidea) were investigated. The data collected is a valuable resource for tracing the evolution and the phylogeny of the two groups, and to provide information within species, genera, families and comparative data about outgroups, to other researchers.

Key words: Pentamomorpha, Cimicomorpha, Phylogeny.

[3782] SPECIATION BY REINFORCEMENT OF A SHIFT IN MIMICRY

C. D. Jiggins, University College London, The Galton Laboratory, 4 Stephenson Way, London NW1 2HE c.jiggins@ucl.ac.uk.

In two sympatric sister species, *Heliconius melpomene* and *Heliconius cydno*, there is evidence that speciation has resulted from a shift in Müllerian mimicry. Changes in mimicry between these species are associated with a habitat shift and males use mimetic colour patterns directly to find mates. Thus a change in mimicry can cause strong pre-mating isolation between incipient species. Hybrid butterflies also have intermediate maladaptive colour patterns which likely causes strong disruptive selection. This is therefore a good example of pleiotropy between an ecologically selected trait and mate choice between species. In addition these species show female hybrid sterility, following 'Haldane's Rule'. Speciation driven by changes in mimicry could occur in a variety of geographic contexts, and may explain the higher diversity of mimetic versus non-mimetic Heliconiine butterflies.
Index terms: *Heliconius*, biodiversity, mate choice

[3783] THE POSITION OF THE TIPULOIDEA IN THE LOWER DIPTERA

H. de Jong, Zoölogisch Museum Amsterdam, Afdeling Entomologie, Plantage, Middenlaan 64, 1018 DH Amsterdam, The Netherlands, E-mail: hjong@bio.uva.nl.

Recent publications discussing the basal phylogeny of the lower Diptera show considerable incongruence when it comes to the phylogenetic relationships of the larger clades. Conflicting ideas are brought forward regarding the Tipuloidea, which are either considered one of the most primitive superfamilies of the order or are placed in a derived position close to the Brachycera. The wing venation of the tipuloid family Pediciidae differs from the wing venation of the majority of recent Diptera by showing numerous plesiomorphic similarities with the oldest known fossil Diptera. Pediciidae probably represent an old clade of the Tipuloidea and may be one of the oldest extant lineages of the Diptera. Analysis of the species-level and genus-level phylogeny of the Pediciidae eventually will give us a better understanding of the phylogeny of the Tipuloidea, of the position of the Tipuloidea within the lower Diptera, and of the relationships of the larger clades of the lower Diptera.
Index terms: Phylogeny, Pediciidae, Nematocera

[3784] A NEW GENUS OF ANISOCERINI (CERAMBYCIDAE, LAMIINAE)

C.E.A. Julio[1,2], [1]Museu Nacional/UFRJ, Dept. of Entomology, Quinta da Boa Vista, 20940-040, Rio de Janeiro, RJ, BRASIL; [2]Universidade Estadual Paulista–UNESP/Botucatu. (FAPESP fellow, grant 98/10692-5).

A new genus of Anisocerini from Amazonas State is described. The examination of the Anisocerini material deposited at the Cerambycidae collection of the Museu Nacional – Universidade Federal do Rio de Janeiro, gave the opportunity to describe a new genus of Anisocerini based on two specimens collected at Tabatinga, Amazonas State, Brasil. The new genus resembles *Caciomorpha* in a number of characters. It is characterised by the combination of the following conditions: antennal tubercles strongly projected; antennae 11-segmented, filiform, elongated, twice as long as the body; antennal segments cilindrical; scape elongated, feebly clavate; segment III twice as long as scape, scarcely longer than IV; segments V–XI gradually shorter; prothorax wider than long, sides with a moderate tubercle behind middle; pronotum with two anterior gibbosities moderately proeminent; mesosternal process feebly impressed at middle; elytra sparsely granulated from base to middle, with a basocentral granulated gibbosity, from middle to apex lacking tubercles or gibbosities. Differs from *Caciomorpha* by lacking antennal tufts or intumescences; antennal tubercles strongly projected; elongated and feebly clavate scape; moderated tubercles at prothorax sides and pronotum lacks central gibbosity. In *Caciomorpha*: apex of antennal segment III with tufted intumescence; antennal tubercles weakly projected; scape thickened, piriform, feebly impressed at base of the dorsal side; prothorax sides with a proeminent tubercle at middle and pronotum with three gibbosities, two lateroanterior proeminent and a central one weakly conspicuous.
Index terms: Coleoptera, descriptions, taxonomy.

[3785] A PHYLOGENETIC STUDY IN THE CAVE CRICKET GENUS *TROGLOPHILUS* (ORTHOPTERA, RAPHIDOPHORIDAE): COMBINING ALLOZYMIC AND MITOCHONDRIAL DNA SEQUENCE VARIATION DATA

V. Ketmaier[1], M. Cobolli[1], E. De Matthaeis[1] & M. Rampini[1], [1]Dept. of Animal and Human Biology, Univ. of Rome "La Sapienza", V.le dell'Università 32, I-00185, Rome, ITALY, E-mail: ketmaier@axrma.uniroma1.it.

The cave cricket species belonging to the genus *Troglophilus* (Orthoptera, Raphidophoridae) are discontinuously distributed in the Mediterranean area, such a pattern is believed to be the result of past dispersal events followed by a quite recent adaptation to cave life. According to classic biogeographical hypotheses the genus *Troglophilus* is supposed to arise in the Aegean area at the beginning of the Tertiary. Subsequently it could have spread toward east and west, exploiting the emerged connections between the Aegean, South Italian and Balkan areas as well as the connections between the Aegean and Anatolian areas. The interest in studying patterns of genetic variation in these organisms resides on their potential use as a good biological marker of palaeogeographical events occurred in these areas. The levels of genetic differentiation and evolutionary relationships among several cave populations from the Anatolian peninsula, Rhodos, Crete, Santorini, Slovenia and Italy were investigated by means of two methods: allozyme electrophoresis of 19 enzymatic loci and analysis of sequence variation of mitochondrial DNA (mtDNA) fragments of 12s (380 bp) and 16s (550 bp) ribosomal RNA genes and cytochrome oxidase I (COI; 370 bp) protein coding gene. *Dolichopoda geniculata*, *D. paraskevi* and *Hadenoecus subterraneus* (Orthoptera, Raphidophoridae) were used as outgroups. Multiple methods of tree reconstruction procedures were used (maximum- likelihood (ML), neighbor-joining (NJ) and maximum-parsimony (MP)). The analysis of allozyme polymorphisms of Anatolian populations allowed us to recognise 4 well distinct forms ($0.83 \geq D_{Nei} \geq 0.45$) including the nominal species *T.adamovici* and *T.gajaci* plus two other newly discovered species. Interesting is the syntopic co-presence of the latter two species with the more widespread *T.adamovici*. The population from Santorini, previously attributed to the Cretan species *T. spinulosus*, resulted genetically differentiated and probably represents an other new species. Results from the two molecular data sets are compared in order to discuss merits and limits of the two techniques in tracing reliable phylogenies. A tentative calibration of both allozymes and mtDNA rates is proposed with the aim to place in time the beginning of independence evolution of the study populations and species. As a whole, the pattern of phylogenetic relationships is in agreement with the palaeogeographical model available for the West- Mediterranean area.
Index terms: *Troglophilus*, molecular systematics, cave environment.

[3786] THE SPIDER FAUNA OF NAMHAIDO ISLAND, KOREA

J. P. Kim, Dept. of Applied Biology, College of Life Resource Science, Dongguk Univ., #26, 3-ga, Pil-dong, Chung-gu, Seoul 100-715 and The Arachnological Inst. of Korea, Seoul 133-040, Korea; E-mail kjpil@dgu.ac.kr

The spider fauna of Namhaido Island was investigated from 21 to 25 Aug 1998. As a result, 81 species of 43 genera under 15 families were collected. Identified spiders are composed of 25 palaearctic species (30.8%), 23 palaearctic and oriental species (28.4%), 5 holarctic species(6.1%), 2 oriental species(2.4%) and 3 cosmopolitan species (3.7%). Araneid, salticid and theridiid spiders were dominant among the spiders. Common species with Japan and China were 56(69.1%) and 55(67.1%) species, respectively.
Index terms: Spider fauna, Namhaido Island, Korea.

[3787] THE SPIDER FAUNA OF ISLAND ANMYUN-DO, KOREA

J. P. Kim[1], Dept. of Applied Biology, College of Life Resource Science, Dongguk Univ., #26, 3-ga, Pil-dong, Chung-gu, Seoul 100-715 and The Arachnological Inst. of Korea, Seoul 133-040, Korea; E-mail kjpil@dgu.ac.kr.

For the purpose of surveying the distribution of Korean spiders, spider fauna of Island Anmyun-do was investigated by hand search, pitfall trap and sweeping methods from 21st to 25th August 1999. As a result the collecting list of the Island are reported and compared to other faunas of Islands in Korea.
Index terms: Spider fauna, Island Anmyun-do, Korea.

[3788] OVERCOMING THE TAXONOMIC IMPEDIMENT TO SUSTAINABLE DEVELOPMENT - BIONET-INTERNATIONAL, THE GLOBAL NETWORK FOR TAXONOMY

N. King, bionet-international, Bakeham Lane Egham, Surrey TW20 9TY, UK, bionet@cabi.org; n.king@cabi.org

bionet-international is a global network for capacity building in biosystematics for sustainable development. The network is comprised of a number of inter-linked regional loops (Locally Organised and Operated Partnerships) of developing country institutions, supported by a consortium of developed country institutions. Its purpose, through South-South cooperation and North-South partnerships for institutional strengthening and human resource development, is to enable developing countries to achieve self-reliance in taxonomy to support regional and national programmes for eradication of poverty via sustainable agricultural development and use of natural resources, and conservation of biodiversity (including implementation of the Convention on Biological Diversity). The networks' success is attributable to two key components. The first is local ownership of the process, including governmental endorsement of the need for such a capacity building network whereby needs are identified and prioritised by member countries themselves. The second is a tried and tested mechanism whereby a lack of individual country capacity is overcome by pooling, optimising and sharing regional capacity on a reciprocal basis between member countries. It provides a very useful model for other capacity building initiatives in developing countries, as well as for North-South and South-South collaborative partnerships for capacity building.
Key words: capacity building, networks, south-south, north-south, partnerships, biosystematics, taxonomy.

[3789] MOLECULAR PHYLOGENY OF THE JAPANESE AND NEW ZEALAND MICROPTERIGIDAE (LEPIDOPTERA) BASED ON MITOCHONDRIAL GENE SEQUENCES

Y. Kobayashi[1], H. Suzuki[1], S. Hashimoto[2] & G. W. Gibbs[3], [1]Dept. Natural History, Graduate School of Science, Tokyo Metropolitan Univ., Minami-Ohsawa 1-1, Hachioji-shi, Tokyo 192-0397, Japan, E-mail kobayashi-yukimasa@c.metro-u.ac.jp; [2]Zool. Lab. Meijo Univ., Tempaku-ku, Nagoya 468, Japan; [3]School. Biol. Sci., Victoria Univ., Private Bag, Wellington, New Zealand.

As the Micropterigidae are presumed to be the first diverged lepidopteran lineage, knowing their interrelationships is very important in discussing the origin, past dispersal, and early evolutionary process of Lepidoptera. The family, which is composed of about 120 species, has been tentatively divided into 2 subgroups, i.e. the *Micropterix*-group (*Micropterix* only) and the *Sabatinca*-group comprising all other genera, but the relationships between them are obscure and the monophyly of the latter group has often been questioned. Both Japan and New Zealand are relatively rich in the micropterigid fauna: In Japan, both *Micropterix*-group (*Micropterix aureatella* only) and *Sabatinca*-one (2 *Paramartyria*, 7 *Neomicropteryx*, and 4 undescribed species) are known. On the other hand, in New Zealand, only *Sabatinca s.lat.* species (about 15) are distributed, but morphologically they are thought to be composed of 4 somewhat discrete lineages, i.e. the Australian species group, *Sabatinca s.s.* group, and subgenera *Palaeomicra* and *Micropardalis* endemic to New Zealand. We investigated the phylogenetic relationships among all the Japanese and 5 New Zealand micropterigid species (*Sabatinca zonodoxa*, *S. demissa*. *S. calliarcha*, *Palaeomicra chalcophanes*, and *Micropardalis doroxena*) representing above 4 lineages using nucleotide sequences of the ND5 gene and 16S ribosomal RNA gene obtained from mitochondrial DNA. Our result showed that these species are divided into 3 main lineages; *Micropterix* + (*Paramartyria* + *Neomicroteryx*-group including undescribed species), *Sabatinca demissa* + (*S. calliarcha* + (*P. chalchophanes* + *M. doroxena*)), and *Sabatinca zonodoxa* only (Australian species group). Monophyly of the former 2 lineages was supported by high bootstrap values of 88 and 100%, respectively, but the branching order of these 3 lineages could not be determined, because of their low bootstrap values. Therefore the possibility of the monophyly of not only so-called *Sabatinca*-group but also *Sabatinca s.lat.* is almost completely denied. The result also strongly suggests that only the northern hemispherical *Sabatinca*-group as a whole is the sister group of *Micropterix*. Based on these data some new interpretaions of the past dispersal and evolution of the Micropterigidae will be given.
Index terms: *Micropterix*, *Sabatinca*, ND5, 16S ribosomal RNA.

[3790] ON THE GENERA OF THE ORIENTAL AND AUSTRALIAN CONODERINAE (ZYGOPINAE AUCTT) (COLEOPTERA: CURCULIONIDAE)

H. Kojima[1] Kojima[1] & C. H. C. Lyal[2], [1] Faculty of Agriculture, Kyushu Univ., Fukuoka, 812-8581 JPN; [2] Dept. of Entomology, The Natural History Museum, London, SW7 5BD, UK.

The subfamily Conoderinae (until recently known as Zygopinae (Alonso-Zarazaga & Lyal, 1999)) is one of the most peculiar and interesting groups among weevils. The beetles are characterised by their very large eyes, occupying most of the head and, in some tropical groups, quick movements similar to certain flies (Hespenheide, 1973). Their unique morphological and behavioural features have fascinated weevil systematists, and taxonomic studies have been conducted for many years (Pascoe, 1871; Heller, 1893-95 etc). However, there is still no stable classification. In this study, the Oriental and Australian genera of Conoderinae are revised systematically and new system is proposed as follows: 1, *Agametis* and *Ganyopis* are removed from Mecopini and may merit description of a new tribe. They seem to have some affinity with the New World tribe Zygopini. 2, A new genus of the tribe Peleropodini, which has so far been known only from Africa, is recorded from the Oriental Region for the first time. 3, The tribe Othippini is shown to be heterogenous. Its type genus and allies are very close to *Coryssopus* and the tribe is sunk as synonym of Coryssopodini, which is also known only from Africa. However, Coryssopodini possibly should be sunk as a synonym of Sphadasmini; the relationships of these two tribes needs more investigation. 4, A new tribe is proposed for the Oriental taxa *Brimoda*, *Rimboda* and their allies. The monophyly of this subfamily has not yet been confirmed, but the Austral tribe Arachnopodini and some Indo-Austral genera with a shiny rhomboidal form, such as *Panigena*, *Pseniclea* and their allies previously assigned in the tribe Othippini, should be placed elsewhere.

Index terms: Zygopinae, Conoderinae, Curculionidae, systematics, Oriental and Austral Regions

[3791] A PHYLOGENETIC ANALYSIS OF BRAZILIAN SOFT SCALE INSECTS

T. Kondo & M.L. Williams, Dept. of Entomology/Plant Pathology, Auburn Univ., School of Agriculture, 301 Funchess Hall, Auburn, AL 36849-5413, USA, E-mail: tkondo@acesag.auburn.edu

The soft scale insect fauna of Brazil with 158 species so far described is very interesting. It does not only include various monotypic genera such as *Anopulvinaria*, *Edwallia*, *Eutaxia*, and *Pulvinella*, but also species rich genera such as *Ceroplastes* (28%), *Mesolecanium* (10%), *Pulvinaria* (9%), *Saissetia* (8%), *Eucalymnatus* (7%) and *Neolecanium* (3%). In this type of faunal composition, phylogenetic analyses using parsimony is very useful, since it allows us to test the monophyly of the group and their phylogenetic relations. Members of the genus *Akermes*, *Coccus*, *Saissetia*, and *Ceroplastes* are found in different geographical regions, and serve as interesting material for testing evolutionary theories. How closely related are congeneric members of different locations? Are they really congeneric? What is unique about the Brazilian coccid fauna? These are some interesting questions that will be discussed. The soft scale insects of the subfamily Myzolecaniinae, which is well represented in Brazil has long been treated as a monophyletic group, however our studies indicate that the subfamily is rather polyphyletic. The Myzolecaniinae is composed of soft scales that are closely associated with symbiotic ants, such as *Azteca* spp., *Crematogaster* spp., and *Myrmelachista* spp. Reduction and secondary loss of important diagnostic characters in the adult female (the stage commonly used in scale insect taxonomy) have evolved as an adaptation to such a symbiotic relation, and resulted in the convergence of characters among unrelated taxa. Our studies using characters of first instar nymphs (crawlers) suggest that the subfamily is composed of at least three taxonomic groups. Specimens were borrowed from the Museu Zoologico (San Paulo), the Instituto Biologico (San Paulo), the Museum National d' Histoire Naturelle (Paris), the United States National Museum and the Auburn Coccoidea collection. Morphological characters of adult females and first instar nymphs were used, and parsimony analyses and character state data were analyzed by the computer programs PAUP (Swofford, 1999) and MacClade (Maddison & Maddison, 1992).

Index terms: Coccidae, Myzolecaniinae, scale insects, phylogenetic systematics

[3792] BIOSYSTEMATICS OF SOME SPECIES OF *AGROTIS OCHSENHEIMER* (NOCTUINAE: NOCTUIDAE: LEPIDOPTERA) FROM NORTH INDIA

R. Kumar, Sucheta & K.S.Khokhar, Department of Entomology, CCS Haryana Agricultural University, Hisar – 125 004, India

The species belonging to genus *Agrotis ochsenheimer* attack a wide variety of crop and distributed throughout India. Amongst a few dominating species throughout India, *A.flammatra* (Schiffermuller) and *A.ipsilon* (Rottenburg) attained their peak twice in a year i.e. during March-April and Sept-October on the basis of light trap in North India while *A.spinifera* (Hubner) attained peak only in October. The larval characteristics viz. number of stripe, number & position of prolegs and number & type of crochets were studied for their easy identification at field level. Besides, chaetotaxy of cephalic, thoracic and abdominal regions was studied for more academic and taxonomic basis. Characteristics of eyes, antenna, labial palpi, structure of tibiae, wing venation of adults, morphometric analysis in addition to male and female genitalia were studied and illustrated. Key to the species was framed considering the important characters of identification of adults.

[3793] INSECT EXTINCTION AT THE END OF THE CRETACEOUS

C.C. Labandeira[1,2], K.R. Johnson[3] & P. Lang[4], [1]Department of Paleobiology, National Museum of Natural History, Smithsonian Institution, Washington, DC, USA 20560, e-mail: *labandeira.conrad@nmnh.si.edu*; [2]Department of Entomology, University of Maryland, College Park, MD, USA 20742; [3]Department of Earth Sciences, Denver Museum of Natural History, Denver, CO 80205; [4]Geology Department, University of London, Egham, TW20 0EX, UK

Recent studies provide no evidence for an insect mass extinction at the boundary between the Cretaceous and Tertiary (K/T) Periods. These studies were based on global, family-level compilations of body-fossil data that indicated no deviation from background rates of extinction. By contrast recent palynological and megafloral evidence demonstrate a significant extinction of plant taxa at the K/T boundary. To test these opposite conclusions, we examined insect-mediated plant damage on 7,630 leaves in a succession of 78 floras from the Williston Basin of southwestern North Dakota, spanning a 2.0 million year interval of the latest Maastrichtian Hell Creek Formation and earliest Fort Union Formation. This interval encompasses four megafloral zones constrained by magnetostratigraphy, vertebrate biostratigraphy, and a laterally extensive K/T boundary defined by palynomorph coincidence with iridium and shocked quartz anomalies. All characterizable leaf hosts from these floras were assigned to morphotypes and/or Linnean identifications, providing explicit recognition of plant hosts. We identified 49 objective types of insect damage, representing insect herbivory from four functional feeding groups: external feeders, leaf miners, gallers, and piercer-and-suckers. For external feeders we recognized the subcategories of margin feeding, hole feeding, skeletonization (including leaf rolling), surface feeding, and bud feeding. For the preboundary Hell Creek flora 48 types of damage were identified, including several conspicuous examples host specialization. Highly-stereotyped, and host-specific damage on extinct taxa included a coccid scale attacking the primary veins of *Erlingdorfia* (Platanaceae) and a serpentine lepidopteran leaf mine on *Marmarthia* (Lauraceae). The most intriguing association is an undetermined hole-feeder on a species of Cannabinaceae, with affinities to *Cannabis*. This plant host contains abundant resiniferous glands indicating possible use of secondary compounds as an antiherbivore defense. For the postboundary Fort Union flora 18 types of damage were identified, albeit all but one occurred in preceding Hell Creek strata. The frequency of occurrence of Paleocene damage was significantly lower, and associations were more generalized, typically lacking host specificity. These data show that at regional scales insect herbivory suffered dramatically during the K/T boundary, with no rapid recovery. In western North America levels of herbivore diversity remained depressed until pronounced vegetational shifts during the Early Cenozoic Thermal Maximum, of latest Paleocene to early Eocene age.

Key words: Cretaceous/Tertiary extinction, plant-insect associations, Hell Creek

[3794] INVESTIGATION OF THE VALIDITY OF SPECIES STATUS OF *IXODES DIDELPHIDIS* (ACARI: IXODIDAE) USING THE SECOND INTERNAL TRANSCRIBED SPACER (ITS2) OF RIBOSOMAL DNA

M. B. Labruna[1], M. T. Marrelli[2], M. B. Heinemann[1], A. F. Bueno[1], A. Cortez[1], R. M. Soares[1], S. M. Sakamoto[1], L. J. Richtzenhain[1], O. Marinotti[2] & T. T. S. Schumaker[2], [1]Dept. Med. Vet. Preventiva e Saúde Animal, Faculdade de Medicina Veterinária e Zootecnia, Univer. de São Paulo, Av. Prof. Orlando Marques de Paiva, 87- São Paulo, SP, Brazil, 05508-000. [2]Depto. de Parasitologia, Inst. de Ciências Biomédicas, Univer. de São Paulo, Av. Prof. Lineu Prestes, 1374, São Paulo, SP, 05508-900, E-mail: ttsschum@icb.usp.br,

Although *Ixodes* ticks have been reported to be involved in the transmission of zoonosis agents, the taxonomic status of several species of this genus remains to be clarified. *Ixodes didelphidis*, for instances, has been considered a synonym of *I. loricatus* by several authors, despite morphologic differences in the spiracular plates of adults can be detected. In fact, the morphological description of *I. didelphidis* immatures have not been recorded yet. Several methods such polythene chromosome analysis, isoenzymes electrophoresis and DNA sequence analysis have been used to distinguish morphologically identical species. Among DNA sequence analysis, the ribosomal DNA (rDNA) has been usefull to address taxonomic questions. The rDNA genes are usually arranged in tandemly repeated units, being present in many copies what makes them excellent targets for the development of molecular systematic and the study of evolutionary relationships among the organisms. The ITS regions evolve faster than the coding sequences and they have been of utility for the development of diagnostic tools for the identification of several mosquitoes and ticks. To evaluate the species status of *I. didelphidis* we sequenced the second internal transcribed spacers (ITS2) of the rDNA of ticks from three Brazilian populations. These ticks were collected from opossums trapped in the states of Minas Gerais, São Paulo and Rio de Janeiro, and were reared in laboratory to establish three independent colonies labeled as BMG, CSP, and TRJ, respectively. According to the classic taxonomic key of Aragão and Fonseca (Mem. Inst. Oswaldo Cruz Rio J., 59: 115, 1961), the BMG and CSP ticks could be identified as the putative species *I. didelphidis* and the TRJ ones as *I. loricatus*. The ITS2 of captured ticks were amplified using polymerase chain reaction with conserved primers of 5.8S and 28S regions and cloned in pGEM T plasmids. The amplified DNA fragments were sequenced and the results showed that *I. didelphidis* and *I. loricatus* present divergences in their sequences of ITS2. Although these findings suggest the validity of two distinct species (*I. didelphidis* and *I. loricatus*), this study must be extended to other populations of both species.

Index terms: *Ixodes loricatus*, *Ixodes didelphidis*, rDNA, ITS2

[3795] CONFIRMING A NEW STATUS FOR *ODONTOPUS BREVIROSTRIS* (COLEOPTERA: CURCULIONIDAE) VERSUS *ANNONA MURICATA* (ANONACEAE)

I. M. de M. Lima[1], E. E. P. de Lemos[2] & G. H. Rosado-Neto[3], [1]Dep. of Zoology, Univ. Fed. de Alagoas, Pça. Afrânio Jorge s/n Centro, 57010-020, Maceió – Alagoas, Brazil. E-mail iralima@dialnet.com.br; [2]Dept. de Fitotectnia e Fitossanidade, Univ. Fed. de Alagoas; [2]Dep. of Zoology, Univ. Fed. do Paraná, Caixa Postal 19020, 81531-990. Curitiba-Paraná,. E-mail ghrosado@bio.ufpr.br.

Odontopus brevirostris – syn. *Prionomerus brevirostris* Hustache, 1936; *Meroprion anonicola* Bondar, 1939 and *Prionomerus anonicola* (Bondar, 1939) –, has been registered as an associated insect among different species of *Annona* (*A. cherimola, A. glabra, A. muricata,* and *A. squamosa*) in Brazil (States of Bahia, Santa Catarina, Mato Grosso, Paraná, Alagoas and Pernambuco). No important insects have been recorded attacking the leaves of *Annona*. Since 1991, various damaged *Annona* plants have been observed in back gardens in Alagoas. The leaf miners larvae fed only on the mesophyll destroying more than a half of the leaf-blade. The adults perforated young leaves causing several small round orifices. However, the increasing population of the plants in the last ten years has changed the *status* of this insect. In 1999, this insect was found attacking all plants of a 5 hectares soursop orchard located in Arapiraca (in Alagoas, 9°46'51''S, 36°33'57''W). Its high population in the orchard lead to a new behavior: besides the soft young leaves, the adults have also attacked mature leaves, sepals and petals of flowers and small fruits. This attack caused a vertiginous abscission of leaves, flowers and young fruits, causing severe losses. The high level of damage and stress of the plants may have induced a rise in their respiration rate and so in their ethylene production. Ethylene is a known plant-aging hormone that is associated to leaf abscission. This physiological phenomenon is common in plants submitted to various physical (drought, heat, shilling) or biological stress (infection by fungus like *Colletotrichum gloeosporioides*, insects etc). The cause of this environmental disturbance is yet to be established. However, it was probably related to the high plant population combined to the frequent use of insecticides to prevent the attack of fruit borers: *Cerconota anonella* (Lepidoptera) and *Bephratelloides pomorum* (Hymenoptera), until now the main limiting pests for this crop. This report is an example of environmental impact caused by insecticide abuse: an apparently non-important insect can change its role in an agroecosystem becoming a key-pest. Specimens of adults and immature forms were deposited at Entomological Collections (Dep. of Zoology, Unv. Fed. do Paraná and Dep. of Zoology, Univ. Fed. de Alagoas).

Index terms: Abscission, ethylene, insecticide, environmental disturbance

[3796] FIRST RECORD OF A BUPRESTIDAE (COLEOPTERA) SPECIES IN ASSOCIATION WITH *ANNONA MURICATA* (ANONACEAE) IN BRAZIL

I. M. de M. Lima[1], E. E. P. de Lemos[2] & L. M. de Almeida[3], [1]Dept. of Zoology, Univ. Fed. de Alagoas, Pça Afrânio Jorge s/n Centro, 57010-020, Maceió – Alagoas, Brazil. E-mail iralima@dialnet.com.br; [2]Dept. de Fitotecnia e Fitossanidade da Univ. Fed. de Alagoas. E-mail: eurico@dialnet.com.br; [3]Dept. de Zoologia da Univ. Fed. Do Paraná. E-mail: lalmeida@bio.ufpr.br.

Annona muricata L. (soursop, guanábana, graviola) is a fruit tree native from Central and South America that has now been cultivated in many tropical countries. Its special flavor shows a great potential for the fresh or processed fruit (pulp, nectar, juice or ice cream) market. In Brazil, the demand for these fruits has significantly increased over the last few years and the commercial plantations of soursop are in fast expansion in coastal and semi-arid zones of Northeast. Most of the orchards use unappropriated technologies that facilitate the competition among plants for space, light and nutrients, therefore creating a favorable environment to develop pests and diseases. The aim of this work was to record a new soursop pest detected in 1999 by growers in an orchard located in Arapiraca, State of Alagoas, in semiarid region of Northeast (9°46'S, 36°33'W). This is the first time that a great amount of adults of *Psiloptera roseocarinata* Thomson, 1878 (Coleoptera: Buprestidae: Chalcophorini) were collected feeding on soursop leaves. No larvae or pupae were available in the samples sent to identification. The larvae are thought to be stem borers that usually reduce drastically the fruit production. If this association could be confirmed, this insect must be better studied to set forward a strategy of control. The captured adults were deposited at the entomological gallery Padre Jesus Santiago Moure of the Universidade Federal do Paraná. The relationship between a phytophagous insect and its host-plant vary from a simple association to great economic losses by affecting the production and quality of the fruits. Nevertheless, this status may change due environmental instability. Considering the possibility of an associated species became a pest, it is very important to record all the insects that are found feeding on each part of a soursop tree to further technical decisions.

Index terms: Chalcophorini, *Psiloptera roseocarinata*, phytophagous, *Annona*

[3797] FIRST CITE OF *AUSTRELMIS PERUANA* FOR ARGENTINA, WITH A REDESCRIPTION OF THE SPECIES

M. V. Manzo, Fac. Ciencias Naturales, Univ. Nacional de Tucumán, Miguel Lillo 205 (4000), Argentina, E-mail vmanzo@csnat.unt.edu.ar

The family Elmidae is comopolitan distribution. The elmid beetles are called " riffle beetle" because of their preference for riffles in clear, cold, fast flowing streams with a high oxygen content. Because adults are often very abundant in such habitats, their significance as indicators of water quality has increased. For this purpose their identification is essential. The neotropical genus *Austrelmis* includes 17 species , none of them recorded for Argentina. *Austrelmis peruana* is cited for the first time for five argentine provinces. The species is redescribed, and new data on its biology are included. Index terms: beetle, Austrelmis, "riffle beetle".

[3798] PHYLOGENETIC USEFULNESS OF THE ELONGATION FACTOR-1α (EF-1α) IN DITRYSIA GROUP (INSECTA: LEPIDOPTERA)

R.A. Di Marc [1, 2], S. L. Bonato [1, 3] & E.Corseuil [1, 4], [1] PPG-Biociências PUCRS, Av. Ipiranga, 6681, Caixa Postal 1429, CEP 90619-900, Porto Alegre, RS, Brasil; [2] Depto. Biologia, CCNE, UFSM, Camobi, Santa Maria, RS, Brasil. E-mail: ram13@zaz.com.br. [3] E-mail: sbonato@pucrs.br. [4] E-mail: corseuil@pucrs.br.

The molecular data have been giving a new perspective for a series of systematic subjects. Even so, the lack of an exact interpretation starting from the information of nuclear genes, in several systematic levels, is a problem for the molecular systematic. It was demonstrated that the gene EF-1α presents suitable characteristics to be used in phylogenetic analysis, with substitution patterns and a source of potential homoplasy, evaluated through comparison with phylogenies derived independently and based on morphology. In this study its use is examined in the insects tree construction of the Ditrysia group, that includes 98% of the lepidopterous, with base in species sequences allocated in the NCBI database. There were 139 sequences sampled, distributed in the families Papilionidae, Saturniidae, Noctuidae, Notodontidae, Arctiidae Lymantriidae, available in GENEBANK. The sequences were aligned with "Clustal X" program, version 1. 64b. To estimate and analyse the nucleotide frequencies, number of transitions or transversions and number of synonymous or non-synonymous substitutions, it was used "Analysis of Data in Molecular Biology and Evolution" program (DAMBE), version 3.0. The trees were performed using neighbor-joining, under Kimura 2-parameter distance. For such, it was used TREECON program, version 1.1. The insertions and deletions were discarded from analysis. Of all families investigated, Papilionidae and Saturniidae form very defined monofiletic groups, with "bootstrapping indexes" of 100%. Noctuidae with the lowest indexes and larger species number analyzed appears subdivided in two groups. A larger group, with a larger subfamilies number, and other with Arctiidae and Lymantriidae, that do not form very defined groups. The incongruities observed in Noctuoidea, probably, can be associated to erroneous interpretations of the morphologic classification, because in Papilionidae and Saturniidae the gene produces quite different clados. The molecular data based on the gene EF-1α produce trees that do not support the monophily either for the largest family or the other ones, in Noctuoidea, suggesting that they form a grado. Therefore, the analysis of the gene EF-1α shows conditions to be used in wider systematic analysis, with great number of species and in different levels.

Index terms: Molecular Systematic, Noctuoidea, Papilionidae, Saturniidae.

[3799] ANALYSIS CLADISTIC OF THE TRIBE RHOPALOPHORINI (COLEOPTERA, CERAMBYCINAE)

M. I. Marques[1] & D. S. Napp[2], [1]Dept.of Biology and Zoology, Univ. Federal of Mato Grosso, Ave. Fernando Correa da Costa s/n, 78060-900, Cuiabá, MT, Brazil, E-mail m.marque@zaz.com.br; [2]Dept. of Zoology and Center of Identification of fitofags Insects, Univ. Federal of Paraná, P.O. Box 19020, Curitiba, PR, Brazil, E-mail: napp@ufpr.bio.br.

This work consists of the phylogenetic analysis of the american genera of the Rhopalophorini tribe, based upon the morphology study of the species-type and/or congeneric. The analyses, processed through the PAUP v2.4.1 software, have demonstrated that the similarities between *Ozodes, Neozodes, Lissozodes* and *Elaphopsis* and the rest of the Rhopalophorini are archaemorfies. The exclusion of *Ozodes* and *Lissozodes* from Rhopalophorini is corroborated, and being *Neozodes* an *Ozodes* sister-group, it is temporarily included in Necydalopsini, in the same way as *Elaphopsis* is included in Ibidionini. Rhopalophorini, as defined in this work, is a monophyletic group and in the Americas it is formed by the following genera: *Argyrodines; Parozodes; Cycnoderus; Ischionodonta; Rhopalina; Disaulax; Cosmisoma; Closteropus; Gurubira; Rhopalophora; Coremia; Dirocoremia; Thalusia; Lathusia; Merocoremia; Rhopalophorella and Muxbalia*. The data about *Rhopalophorella and Muxbalia*, available until now, refer only to the external morphology and are therefore insufficient to enlighten a possible relationship with any other Rhopalophorini genus which may be better defined in a study of the internal morphology. *Parozodes + Argyrodines* constitute the basal group in the tribe, although their maintenance in Rhopalophorini should be re-evaluated at the time of a more extended analysis of the Cerambycinae tribes. The cladogram topology indicates the constitution of two large monophyletic groups. The first one is formed by *Ischionodonta + Disaulax + Cosmisoma + Closteropus + Gurubira* and the second one by *Rhopalophora + Coremia + Dirocoremia + Thalusia + Lathusia + Merocoremia*. The relationships between Rhopalina and any one of these groups were undefined and need to be better investigated. The relationship of *Rhopalophora* with *Coremia*+ genera as well as the inclusion of this group in the tribe and its monophyletism are corroborated. Based upon the cladogram analyses, a proposal of classification to the american genera of Rhopalophorini is made.

Index Terms: Coleoptera, Cerambycidae, Cerambycinae, Rhopalophorini, Cladistic.

[3800] PHYLOGENY OF ENALLAGMA (ODONATA: COENAGRIONIDAE) AND RELATED GENERA

M. L. May, Dept. of Entomology, Rutgers Univ., 93 Lipman Drive, New Brunswick, NJ 08901-8524, U.S.A., E-mail may@aesop.rutgers.edu.

The genus *Enallagma*, as presently understood (e.g., Bridges, 1994), occupies two disjunct centers of diversity, one in eastern North America and the other in subsaharan Africa, with a scattering of species in the Neotropical, Palaearctic and Oriental regions. The strong concentration of species in two areas widely separated in distance and geologic time suggests the independent evolution of two clades in these regions, but no generally acceptable characters have been proposed to distinguish them. Moreover, appropriate synapomorphies have not been recognized to distinguish the genus as a whole unambiguously. My main purpose here is to identify such apomorphies and to use these to analyze relationships of Nearctic and African *Enallagma* among themselves and with other coenagrionid genera. A cladistic analysis, based on morphological characters and including most species currently assigned to *Enallagma*, supports the hypothesis that the North American assemblage, including their close Palaearctic, Antillean and Central American relatives, is monophyletic. Within this clade are two major subdivisions that may each deserve generic status. The African species, however, are distributed in at least three separate clades that differ among themselves and are probably only distantly related to the North American clade.

Index terms: biogeography, damselflies, taxonomy

[3801] WING VENATION IN THE LEAFHOPPER SUBFAMILY CICADELLINAE (HEMIPTERA: AUCHENORRHYNCHA: CICADELLIDAE)

G. Mejdalani, Dept. de Entomologia, Museu Nacional, Univ. Federal do Rio de Janeiro, Quinta da Boa Vista, São Cristóvão, 20940-040, Rio de Janeiro, RJ, Brasil. E-mail: mejdalan@acd.ufrj.br.

The subfamily Cicadellinae sensu Young, 1968 (tribes Cicadellini and Proconiini) is a diverse, cosmopolitan group of leafhoppers including approximately 300 known genera and 2000 known species. As in other subfamilies of Cicadellidae, the homologies of the veins of the fore- and hindwings of the Cicadellinae are not clearly understood when their wings are compared with those of other insect groups. In this study, the venation and axillary sclerites of the Cicadellinae were described and analyzed in detail. Comparisons with other auchenorrhynchan groups (Cicadomorpha and Fulgoromorpha) were also carried out. Ten species of Cicadellinae were studied, five in the Cicadellini (*Versigonalia ruficauda, Amblyscartidia albofasciata, Tettisama quinquemaculata, Macugonalia leucomelas*, and *Diedrocephala variegata*) and five in the Proconiini (*Tretogonia cribrata, Ciccus adspersus, Homoscarta superciliaris, Ichthyobelus* sp., and *Rhaphirrhinus phosphoreus*). These species present the following important veinal characteristics: forewings: (1) a strong costal vein is present, formed by a fusion between precosta (PC), costa anterior (CA), and costa posterior (CP); (2) vestiges of subcosta posterior (ScP) and media (M) occur in the wing base; (3) a vein formed by a fusion between anal (A) and jugal (J) veins is observed along the inner margin of clavus; hindwings: (1) PC, CA, and CP are also fused, being the occurrence of PC inferred by the presence of the wing coupling lobe, which represents the terminal portion of this vein; (2) jugal anterior (JA) is fused to anal posterior (AP"); (3) jugal posterior (JP) occurs as a small rudiment at the wing base. These characteristics are in full agreement with the observations of Dworakowska (1988) on the fore- and hindwings of the Cicadellidae and other auchenorrhynchan groups. The presence of PC and J corroborates Kukalová-Peck's (1983) model of the primitive pterygote venation. This model provides an adequate explanation for the veinal features observed in the wings of the above-mentioned leafhoppers. In the axillary region of the forewings, a row of three sclerites is present between the notum and the anal (AB) and jugal (JB) basivenalia. The position of this row suggests that its sclerites result from fusions between the primitively independent anal (A) and jugal (J) rows of sclerites. Accordingly, using Kukalová-Peck's (1983) terminology, the three sclerites were termed (from the notum to the wing) the AJ proxalare, AJ axalare, and AJ fulcalare.

Index terms: Cicadellini, Proconiini, morphology, homologies, wing veins

[3802] REVISION AND TRANSFER TO HETEROPSININ OF THE GENUS *EUPEMPELUS* BATES (COLEOPTERA, CERAMBYCIDAE)

J. R. M. Mermudes[1] & D. S. Napp[1], [1] Departamento de Zoologia, Universidade Federal do Paraná, Caixa Postal, 19020, Curitiba - PR, 81531-990, Brazil. E-mail: mermudes@bio.ufpr.br.

The genus *Eupempelus* was proposed by Bates based on a single species, *E. olivaceus*, described from Tefé, Amazonas, Brazil. The genus was assigned to Cleomenini and since the original description it has never been studied. A recent morphological comparative study at the Neotropical genera of Cleomenini together with other non-Neotropical genera, including *Cleomenes*, type genus of the tribe, showes that *Eupempelus* do not belong to Cleomenini. Among the Neotropical Cerambycinae tribes with finely faceted eyes, *Eupempelus* presents several structural features which are proper at the Heteropsini, the reason why it is here transferred to this tribe. The following characters present by *Eupempelus* and the majority of the South American genera of Heteropsini warrant the present transferrence: 1) apical segment of palps short and expand apically; 2) antennae filiform, with the 3rd segment longer than the following; 3) prothorax sexually dimorphic; 4) anterior coxal cavities angulate at sides, open behind; 5) femora linear, not carenate; 6) elytra not carinate laterally, with the epipleura decliveous neither carinate nor asperate; 7) mesosternum with the intercoxal process notched medially at apex; 8) abdomen not oval, the first urosternite transverse, as long as the second, with the intercoxal process narrow and acuminate. Two new species are described to the genus, thus *Eupempelus* now includes three species which are illustred and keyed. The specimens studied were provided by the following institutions: Departamento de Zoologia, Universidade Federal do Paraná, Curitiba; Muséum National d'Histoire Naturelle, Paris; and Museu Nacional, Universidade Federal do Rio de Janeiro, Rio de Janeiro.

Index terms: Cerambycinae, Cleomenini, Taxonomy, new species

[3803] A NEW SPECIES OF THE GENUS *HYGRONEMOBIUS*

A. Mesa & **A. R. Miyoshi,** Dept. de Biologia, Instituto de Biociências, Univ. Estadual Paulista (UNESP), Av. 24-A 1515, 13506900, Rio Claro, SP, BRAZIL. E-mail alejomesa@linkway.com.br.

The new species *H. grandis* was collected upon stones of the Indaiá River, which is near the locality of Ubatuba, in the São Paulo littoral. The species is relatively large if compared with other species in the genus. Photographic illustration of male and female as well as chromosomes and drawing of the male genitalia of the species are provided. The interpretation of the phallic sclerites here reported differs from the one proposed by other authors.

Index terms: cricket, Nemobiinae, chromosomes.

[3804] A NEW SPECIES OF THE NEMOBIINAE CRICKET *ZUCCHIELLA*

A. Mesa & **C. B. Portugal,** Depto. de Biologia, Instituto de Biociências, Univ. Estadual Paulista (UNESP), Av. 24-A 1515, 13506900, Rio Claro, SP, BRAZIL. E-mail: alejomesa@linkway.com.br. Supported by FAPESP.

The monotype genus *Zucchiella* was erected for the species *Z. atlantica*, collected in leaf litters of São Paulo littoral forest. In the present paper, a new species collected in "cerrado" vegetation, in a locality close to Corumbataí town (São Paulo State), is described. Photographic illustration of both species, drawings of the male concealed genitalia and chromosome information are provided. The chromosome number is the same in both species but the position of the centromeres in several chromosomes is different. The phallic structure is basically the same, presenting differences only in detail. The interpretation of the phallic structures is different to that reported in the description on *Z. atlantica*. Measurements of several characters indicate significant divergences between the two known species.

Index terms: crickets, chromosomes.

[3805] REVISION OF THE SUBGENUS *CERATITIS* (*PTERANDRUS*) BEZZI (DIPTERA: TEPHRITIDAE)

M. De Meyer[1] & A. Freidberg[2], [1]Entomology Section, Koninklijk Museum voor Midden Afrika, Leuvensesteenweg 13, B-3080 Tervuren, Belgium, E-mail: demeyer@africamuseum.be; [2]Zoology Department, Tel-Aviv University, Tel Aviv, Israel, E-mail: afdipt@post.tau.ac.il.

The Afrotropical fruit fly genus *Ceratitis* MacLeay comprises several important pest species, attacking a wide range of unrelated fruits. Within the scope of a global study of this genus, the representatives of the subgenus *Pterandrus* Bezzi are revised. Thirty-two species are recognised within the genus, including six new to science. Morphological characters allow an unambiguous species identification in most cases, and particularly characters of the mesonotal pattern, genitalia and male leg feathering indicate well delimited species groups. A detailed study of the latter structures reveals that the feathering observed within the subgenus is not homologous. The different patterns are discussed. Two main subgroups within the subgenus can be defined but their relationship is still unclear. Within the subgroups, well defined clades can be recognised and their interrelationships partly resolved. For some clades, the monophyly is correlated with a particular host plant range.

Index terms: fruit fly, pest species, morphology, leg feathering

[3806] THE PHYLOGENY AND TAXONOMY OF THE PARASITIC WASPS SUBFAMILY CAMPOPLEGINAE (HYMENOPTERA, ICHNEUMONIDAE)

M. I. Miah, Department OF Zoology, University of Chittagong, Chittagong 4331, Bangladesh.

This study deals with the phylogeny and taxonomy of the ichneumonid wasp subfamily Campopleginae where taxonomy at genus level is in a poor state. The subfamily contains over 69 genera, of which many are very large and poorly defined, and several are arbitrarily delimited. This makes classification and identification difficult, despite the fact that many of them are parasitoids of economically significant insect pests. The presently accepted classification of the Campopleginae has been assessed by cladistic analysis of a data matrix comprising 249 morphological characters and 86 taxa. The relationship of the Campopleginae with four other closely related subfamilies was also determined. The results show that the Campopleginae is not monophyletic. Two aberrant tribes, Hellwigiini and Nesomesochorini, were always grouped with other subfamilies, with good bootstrap and jack-knife support, and they are removed from the Campopleginae. Within the Campopleginae (*sensu stricto*), the taxa *Dusona, Delopia, Campoplegidea* and *Kartika* were found to form a basal grade in unweighted trees followed by *Casinaria, Charops* and *Scenocharops*. However, in the reweighted trees, their precise positions varied. The following monophyletic clades are found consistently with high bootstrap and jack-knife support: *Dusona, Delopia, Campoplegidea and Kartika; Casinaria, Charops* and *Scenocharops*; *Sinophorus* and *Sesioplex*; *Cymodusa* and *Cymodusopsis*; and *Tranosema* and *Tranosemella*. The rest of the taxa do not form any consistent groupings and it would be premature to make any formal change to tribal-level classification. It is proposed that *Alcima, Dusona* and *Slenda* are taken out from synonymy. The *Diadegma stenosomum* species group is suggested to be given generic status.

[3807] A REVISION OF THE GENUS *TIPHYSA* MULSANT AND TRANSFERENCE TO BRACHIACANTHADINI (COLEOPTERA, COCCINELLIDAE)

J. Milléo [1] & L.M. Almeida [1], [1] Dept. of Zoology, Univ. Fed. of Parana, P.O.Box 19020, 81531-990, Curitiba, Parana, Brazil. E-mail lalmeida@bio.ufpr.br.

Tiphysa was described by Mulsant in 1850 with only one species, *T. plumbea*, from French Guiana, in the "Hyperaspiens" group. Crotch (1874) described *T. egae* from Amazonas. *Tiphysa* was included in the Tribe Hyperaspini because the presence of globular spermatheca and absence of infundibulum. This study showed that the spermatheca is in fact alantoid and there is a clear infundibulum. These characters are typical of the Tribe Brachiacanthadini. The genus *Tiphysa* Mulsant is transferred to this tribe and redescribed including morphological characters of the mouth pieces, endosternites, wing venation, male and female terminalia. The type material was borrowed from University Museum of Zoology, Cambridge, England. A key to species is added. A detailed morphological comparative study of *Tiphysa* and the genera *Brachiacantha*, *Hinda* and *Cyra* are made. The most important common characters for these genera are: glabrous integument; emarginated eyes with a little projection under the antennal insertion; 11 segmented antennae; 2° tarsomerous triangular; female with 6 abdominal segments, 7 in male. *Tiphysa* presents the anterior tibia with a foliaceous structure and could be distinguished from *Brachiacantha* for the anterior tibia with external tooth or spine; in *Hinda* the anterior tibia with margin serratulate and in *Cyra* the ornamentations are absent.

Index terms: *Tiphysa*, Brachiacanthadini, transference, revision, morphology.

[3808] ASPECTS OF MALPIGHIAN TUBULES, POSITION, ATTACHMENT AND COILING, AS TAXONOMIC CHARACTERS IN ISOPTERA

L. R. Miller, CSIRO Entomology, GPO Box 1700, Canberra, ACT 2601, Australia. E-mail: leigh.miller@ento.csiro.au

Characters of Malpighian tubules have been little used in systematic studies of Isoptera, although it is recognised that there is a reduction in number in derived taxa, and that the position and form of their attachment to the midgut at their point of origin is variable. As part of a study of the Nasutitermitinae, a comparative study was made of the patterns of coiling of individual tubules within the gut of eight species of Australian Nasutitermitinae, in order to determine whether taxonomic characters useful at species or genus level could be discerned. In addition, species of four genera of Termitinae were examined for comparison. The study revealed that, in all species examined, tubules always follow the same pathway or pattern within the gut, with the path of each of the four individual tubules unique and precisely defined. Since both total gut length and length of individual segments varies between species, there are minor differences, but the overall pattern was similar in all species. In the Termitinae examined, tubules follow the more or less the same basic patterns of those of Nasutitermitinae. These overall similarities, both within the Nasutitermitinae and at least some sections of the Termitidae, indicate that there was limited use for tubule pathways as taxonomic characters for the taxa in question. However, the study did reveal striking differences between some genera of soil-feeding Termitinae, in which the overall pattern follows the general model but tubules are comparatively longer, so that the actual pathway is far more intricate and variable than any observed within the Nasutitermitinae. While characters based on Malpighian tubule coiling proved to be of little use when applied to the nasute genera studied, there is sufficient variation in some Termitinae to indicate that they may prove significant in studies of other taxa. Also, the fact that individual tubules follow so rigidly defined, different, patterns suggests they are linked to variations in function which warrant further investigation in order to increase understanding of isopteran physiology.

[3809] THE SIGNIFICANCE OF THE ANOJUGAL LOBE AND "RADIAL SECTOR" IN ISOPTERAN WING VENATION

L. R. Miller, CSIRO Entomology, GPO Box 1700, Canberra, ACT 2601, Australia. E-mail: leigh.miller@ento.csiro.au

The presence of a well-developed anojugal lobe in the hindwing of the Mastotermitidae, often regarded, with other plesiomorphic characters, as evidence of a link between Mastotermitidae and Blattodea, has hitherto been considered lacking in all other termites. A comparative study of wing venation and articulation in Isoptera shows that the hindwing anojugal lobe is present in a reduced form in the families Termopsidae, Hodotermitidae Kalotermitidae and Rhinotermitidae and separated from AA by a single fold. The lobe and AP are well-developed in Mastotermitidae, but the form of the fold, being single, is not homologous with that of the anojugal lobe of Blattodea, which consists of a series of fan-like folds. In this respect, the presence of a well-developed anojugal lobe in the hindwing cannot be considered a symplesiomorphy of Mastotermitidae and cockroaches. Instead, a hindwing anojugal lobe, separated by a single fold from AA, should be considered an apomorphic character of Isoptera, although it is reduced or vestigial except in Mastotermitidae. The definition of Hodotermitinae has been based largely on "the conspicuous inferior branches of the radial sector" and the proportion of wing area occupied by various veins. This study identifies these "inferior branches" as distal branches of MA, which is fused with RP in both termites and cockroaches. Their presence in termites is therefore symplesiomorphic and should not outweigh the apomorphic characters which unite the genera *Hodotermes*, *Microhodotermes* and *Anacanthotermes*, *i.e.* the Hodotermitidae *s. str.* Among authors who do not recognise the validity of the Termopsidae, there is inconsistency in the placement of the fossil genera *Ulmeriella* and *Meiatermes*. This study shows that there exists variation in wing venation within extant species which is comparable with that used to define fossil species and genera. This greatly reduces the weight of venation-based characters. It is suggested that *Ulmeriella* and *Meiatermes* should be placed within the Termopsidae.

[3810] REVISION OF THE GENUS *CERALOCYNA* (COLEOPTERA, CERAMBYCIDAE)

M. L. Monné[1] & D. S. Napp[1], [1]Dept. de Zoologia, Universidade Federal do Paraná, Caixa Postal 19020, Curitiba - PR, 81531-990, Brazil. E-mail mlmonne@bio.ufpr.br.

The genus *Ceralocyna* is revised. At present, the genus includes fourteen Neotropical species. A detailed morphological study of the species including the terminalia of some of them is presented. A key to the species and maps of their distribution are provided. The morphological study of *Ceralocyna* along with the species of *Ancylocera*, *Callancyla* and *Cercoptera* including the type species, allowed the recognition of new characters to Ancylocerina as well as to *Ceralocyna* and its species. Features of the mouth parts, endosternites, wing venation, empodium and ovipositor are indicated as suprageneric. Otherwise, the shape of the male 8th sternite is not corroborated to define Ancylocerina. For *Ceralocyna*, besides the external morphological characters described herein, the male 8th sternite and the tegmen are hypothesized as proper of the genus. Two groups of species were recognized, mainly by the shape and punctation of the prothorax. In one group in which the prothorax is red, the pronotum is strongly convex, presenting prominent gibbosities and is finely punctated. In the other group, with black prothorax, the pronotum is flattened and coarsely punctate. Species with intermediate features do not allow, at the moment, the establishment of subgenera or even distinct genera. Specimens examined are deposited in the following collections: Museu Nacional, Universidade Federal do Rio de Janeiro; Museu de Zoologia, Universidade de São Paulo; Coleção de Entomologia Pe. Jesus Santiago Moure, Departamento de Zoologia, Universidade Federal do Paraná; California Academy of Sciences, California.
Index terms: Ancylocerina, Cerambycinae, revision, Trachyderini

[3811] A NEW NEOTROPICAL GENUS OF THE TRIBE TRACHYDERINI (COLEOPTERA, CERAMBYCIDAE)

M. L. Monné[1] & M. A. Monné[2], [1]Dept. de Zoologia, Universidade Federal do Paraná, Caixa Postal 19020, Curitiba - PR, 81531-990, Brazil. E-mail mlmonne@bio.ufpr.br; 2 Dept. de Entomologia, Museu Nacional, Universidade Federal do Rio de Janeiro, Rio de Janeiro - RJ, 20940-040, Brazil.

The tribe Trachyderini, in the Americas, include two subtribes, Ancylocerina with six genera and 38 species and Trachyderina with 118 genera and 369 species. The subtribe Trachyderina has a cosmopolitae distribution and is very well represented in the western hemisphere. The new monotipic genus proposed is nearest to the genus *Trachelissa* by the following characters: prothorax broader than long; elytra about three times as long as prothorax; mesepimera, mesepisternum and metepisternum opaque, finely, densely and shallowly punctate and with dense pubescence; the first segment of metatarsi as short as the following conjointly. The new genus differs from *Trachelissa*: antennae 12-segmented, in males exceeding elytral apices by one segment; antennal segment 3 with a apical semicircular expansion; prosternal process unarmed; femora very short and fusiform. The unique species described cames from Cáceres, Mato Grosso, Brazil. The specimens examined are deposited in the following Brazilian collections: Departamento de Zoologia, Universidade Federal do Paraná, Curitiba and Museu Nacional, Universidade Federal do Rio de Janeiro, Rio de Janeiro.
Index terms: Cerambycinae, new genus, new species, Trachyderina

[3812] PHYLOGENETIC RELATIONSHIPS OF BRAZILIAN *METHONA* BUTTERFLY BASED ON LARVAE

P. C. Motta, Dept. of Zoology, Univ. of Brasília, 70910-900, Brasília, DF, Brazil. E-mail mottapc@unb.br.

Geographic (phenotypic) variation of the larvae, pupae and adults was studied in *Methona* populations in central Brazil and the differences compared with other known Brazilian populations. *Methona* spp. (Nymphalidae, Ithomiinae) are widely distributed on the Neotropics and they are among the most common butterflies on urban environments of much of Brazil. *Methona* has seven species, and *Methona themisto* is the most widely distributed one, with 3 subspecies: a) North of Pará, Maranhão and Ceará states; (b) Southeast and South of Brazil, Paraguay, Uruguay and Argentina; (c) central Brazil (Central Plateau or Brasília). This subspecies were determined by adult wings. The larvae are monophagous on the leaves of *Brunfelsia* (Solanaceae), a common ornamental. The goal of this study was to compare to phylogenetic relationships among the three subspecies. Caterpillars were sought on 849 plants in 128 localities in Brazil. A total of 665 larvae was collected, described and their geographic distributions were mapped. Substantial phenotypic and geographical variations were recorded According to the cladistic analysis, there are four monophyletic groups: (a) Southern and Southeastern populations; (b) Uberlândia (Southeastern, about 500 km far from Brasília); (c) Brasília; (d) Northeastern. The central plateau population probably has a common ancestor with *M. singularis* (from Northeast) not shared by *M. themisto* (from South and Southeast). The phenotypic pattern of the larvae of the town of Uberlândia suggest that is a hybridization zone between populations of the Central Brazilian Plateau and southeastern Brazil, and with more genetic contribution from Central Plateau than Southeastern. The populations from Central Plateau are morphologically different and are apparently isolated from Southeastern, Northern and Northeastern, although there are not no geographic barriers nowadays. The color pattern of the larvae and the pupae of many of the populations investigated leads one to question the phylogenetic and taxonomic relationships generally accepted in this genus. For example, what is the taxonomic status of central Brazil *Methona* populations?
Index terms: Lepidoptera, Nymphalidae, Ithomiinae, immature stages, geographic variation

[3813] REVISION AND CLADISTIC ANALYSIS OF THE NEOTROPICAL GENUS *ANDINAGRION* BULLA (ODONATA: COENAGRIONIDAE)

J. Muzón[1,2] & N. von Ellenrieder[2], [1]Departamento Científico de Entomología, Museo de La Plata, Paseo del Bosque s/n, 1900 La Plata, Argentina, E-mail **Erro! Indicador não definido.**. [2]Instituto de Limnología R.A. Ringuelet, C.C. 712, 1900 La Plata, Argentina.

The genus *Andinagrion* was erected by Bulla in order to include *Oxyagrion peterseni* and *O. saliceti*. *Andinagrion peterseni*, presently known only from Argentina, was first described from Mendoza province by Ris, and later recorded by Bulla from Jujuy to Mendoza provinces along the Andes, northern Patagonia, and Buenos Aires province southern hills (between 23° and 41° S). On the other hand, *A. saliceti* is restricted to eastern Buenos Aires and Uruguay (between 34° and 38° S). These species share a typical red – blue color pattern, quadrangular hind lobe of female prothorax, horizontal male cerci with a ventroapical apophysis and distal segment of the penis with an internal fold and two pairs of lateral lobes. *Andinagrion* has been considered to be related to several genera, mainly to *Oxyagrion*. The aim of this communication, based on a cladistic analysis, is to provide an updated revision of the *Andinagrion* species, redefine the genus, and compare it with the genera included in Kennedy's *Enallagma – Acanthagrion* series. The cladistic analysis was based on 27 characters, mainly from adult genitalia, terminalia morphology and color pattern. Ultrastructure of male penis and cerci was examined using a scanning electron microscope. The data matrix was analyzed using the computer programs PAUP and Hennig86.
Index terms: Zygoptera, *A.peterseni*, *A.saliceti*, phylogeny, distribution

[3814] REVISION OF THE NEOTROPICAL SUBGENUS *AESHNA (MARMARAESCHNA)* CALVERT (ODONATA: AESHNIDAE)

J. Muzón[1,2] & N. von Ellenrieder[2], [1]Departamento Científico de Entomología, Museo de La Plata, Paseo del Bosque s/n, 1900 La Plata, Argentina, E-mail **Erro! Indicador não definido.**. [2]Instituto de Limnología R.A. Ringuelet, C.C. 712, 1900 La Plata, Argentina.

The neotropical subgenus *Aeshna (Marmaraeschna)* was erected by Calvert in order to include *Aeshna brevifrons, A. intricata,* and *A. vigintipunctata*, which share a marbled color pattern in the pterothorax. Later, Calvert included also *A. pallipes*. These species are distributed mainly in lotic environments along the Andes from Venezuela to 33° S in Argentina and Chile, and in the central hills of Argentina, being its southernmost limit Sierra de La Ventana in Buenos Aires province (Argentina). The taxonomic status of these taxa is extremely confusing due to the scarcity and poor conservation of collected specimens and types, incomplete original descriptions and several missidentifications in previous works. The aim of this communication is to clarify this situation by means of the redescription of available type specimens, re-examination of specimens previously studied, search of new characters and elaboration of a key. The main characters used in this work are those of adult genitalia, terminalia, ventral abdominal terga and color pattern. The results include the description of three new species based on specimens previously assigned to *A. (M.) brevifrons* (sp. 1), *A.(M.) intricata* (sp. 2) and *A.(M.) vigintipunctata* (sp.3). In addition, for each species a new diagnosis is provided and its distribution pattern is discussed.

Index terms: Anisoptera, *A.(M.) brevifrons, A.(M.) intricata, A.(M.) vigintipunctata, A.(M.) pallipes*

[3815] AN ILLUSTRATED GUIDE TO THE STAPHYLINIDAE (COLEOPTERA) OF MEXICO

J. L. Navarrete-Heredia[1], A. F. Newton[2], M. K. Thayer[3], J. S. Ashe[4] & D. S. Chandler[5], [1]Entomología, Centro de Estudios en Zoología, Univ. de Guadalajara, Apdo. Postal 234, 45100 Zapopan, Jalisco, MÉXICO, E-mail snavarre@maiz.cucba.udg.mx; [2,3]Field Museum of Natural History, 1400 South Lake Shore Dr., Chicago IL 60605-2496, USA, E-mail anewton@fmnh.org, mthayer@fmnh.org [4]Div. of Entomology, Snow Hall, KU Biodiversity Research Center/Natural History Museum, Univ. of Kansas, Lawrence, KS 66045, USA, E-mail ashe@falcon.cc.ukans.edu ; [5]Dept. of Zoology, Univ. of New Hampshire, Durham NH 03824, USA, E-mail: dsc1@christa.unh.edu.

The tremendously diverse beetle family Staphylinidae, including Pselaphidae and several small former families such as Micropeplidae and Scaphidiidae, numbers over 46,000 described species worldwide. Staphylinids occur in a wide variety of habitats, but especially in forested and other mesic areas. The most recent published estimate (Navarrete and Newton 1996) for the size of the Mexican fauna, excluding Pselaphinae, was at least 1,235 species of Staphylinidae (both described and known, but undescribed, species) in 253 genera. Inclusion of Pselaphinae, study of specimens in additional collections, and further fieldwork raise those totals to at least 1,559 species, placed in 394 genera; another 30 genera may occur in Mexico. Of these species, at least 68 are new, and some of the 105 other species not yet identified may also be new. Although some North American generic revisions have included Mexican species, this rich fauna has received far from adequate attention from systematists in the 100+ years since Sharp's major contribution, the Biologia Centrali-Americana (1883-1887), and the limited literature is widely scattered. To stimulate and facilitate work on this rich and interesting fauna, particularly by those resident in Mexico, we have developed an identification guide to the genera occurring there. It includes illustrated keys to subfamilies and genera, habitus illustrations for most genera, an up-to-date checklist of described species, notes on the biology and distribution of each genus, and a supporting bibliography.

Index terms: identification, rove beetles, checklist

[3816] PHYLOGENETIC STUDIES OF THE SUBFAMILY ERIOPINAE (LEPIDOPTERA: NOCTUIDAE): FIRST RESULTS

F. R. Navarro, E. Luft & L. Guardia, Instituto Superior de Entomología (INSUE) "Dr. Abraham Willink", Fac. Cs. Naturales e Instituto Miguel Lillo, Univ. Nac. de Tucumán, Miguel Lillo 205, 4000 Tucumán, Argentina, e-mail: instlillo@infovia.com.ar.

The Eriopinae comprise a small group separated of the old Amphipyrinae and it consists of a single large genus, *Callopistria*, ocurring primarily in the tropical and subtropical regions of the world, which larvae feed on ferns. This genus is highly autapomorphic; the males possess strong modifications to the antennae and the genitalia, besides of some peculiarities of the basal hair pencils (Poole, 1995). According to Poole some unplaced genera of the New World tropics may belong to the Eriopinae, such as: *Cropia, Speocropia, Paratrachea* and *Heterochroma*. Although some of these taxa are very distinctive, its definitions are completely phenetic and unclear. In this work we pretend to determine which genera are members of the Eriopinae and to justify the generic classification of the subfamily. Outgroup taxa comprised *Phosphila* (Amphipyrinae) and *Condica* (Condicinae), both genera are sister-groups of Eriopinae. Cladograms were rooted between *Condica* and the remaining genera. The data were analyzed using Pee-Wee 2.5.1 (Goloboff, 1996) under the options 'mult*50' (10 random addition sequences with TBR swapping) and 'hold 50' (save up to 50 trees). All multistate characters were treated as additive. Clade robustness was evaluated by parsimony jacknifing (Farris et al., 1996), but using a more exhaustive search than Wagner trees in each replication. Pee-Wee found only one most parsimonious tree with fit= 380.0 (55%) and a length of 310 steps. The monophyly of Eriopinae is supported by seven synapomorphies of the male genitalia. In the jacknifing analysis this group was strongly supported, with 88% of the replications. The Eriopinae are here restricted to the genera *Callopistria*, *Speocropia* and *Gen. A* (an undescribed genus), with the former as sister-group of the remaining genera. The relationship of the Eriopinae with the others subfamilies remains uncertain. The inclusion of *Cropia*, *Paratrachea* and *Heterochroma* in the Eriopinae is not supported by the present analysis. These genera are closely related (although with a weak support) to the Phosphilini, one of the tribes of Amphipyrinae s. str.

Index terms: Amphipyrinae, *Callopistria, Speocropia*, systematics, phylogeny

[3817] SYSTEMATIC KEY TO THE *PROCTACANTHUS* OF NORTH AMERICA, THE PHILADELPHICUS GROUP (DIPTERA: ASILIDAE)

C. R. Nelson, Dept. of Zool., Brigham Young Univ., Provo, UT, USA 84602

I will present keys, scanning electron micrographs (Fig. 1-2), and photographs to aid in separating species in the Philadelphicus Group of the genus *Proctacanthus* using morphological characters. This clade is found in southern Canada, throughout the United States, and in northern Mexico. I will also present characters and a key to be used for separation of the groups of *Proctacanthus* as well as several genera currently recognized as distinct. I recognize 14 species that have been described in the Philadelphicus group, including: *P. brevipennis, P. coquilletti, P. duryi, P. gracilis, P. heros, P. longus, P. micans, P. milbertii, P. nearno, P. nigriventris, P. nigrofemoratus, P. occidentalis, P. philadelphicus*, and *P. rodecki*.. Additionally, several undescribed species are known to exist and will be briefly noted in the presentation. At a more general level I will discuss the generic concept within the *Proctacanthus* group of genera and outline key morphological characters useful in separating them.

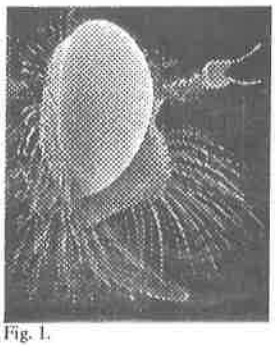


Fig. 1.

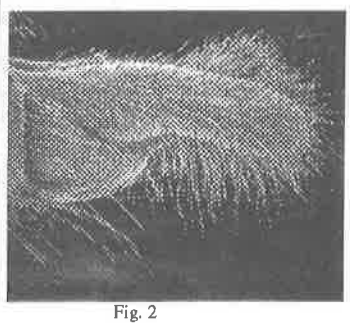


Fig. 2

Fig. 1. ***Proctacanthus philadelphicus***, lateral view of head, specimen from New York: Long Island.

Fig. 2. ***Proctacanthus philadelphicus***, lateral view of male terminalia, specimen from New York: Long Island.

[3818] INTRASPECIFIC VARIATION IN GREEN LACEWING, *CHRYSOPERLA NIPPONENSIS* OF JAPAN USING COURTSHIP SONG AND MOLECULAR PHYLOGENETIC ANALYSES

M. Nomura, H. Taki, T. Takahashi & S. Kuroki, Fac. of Horticulture, Chiba University, Matsudo, Chiba, 271-8510, JAPAN. E-mail: mnomura@midori.h.chiba-u.ac.jp

The green lacewing, *Chrysoperla nipponensis* (Okamoto) – recently separated from *C. carnea* (Stephens) - is an important natural enemy of various crop pest especially aphids. In Japanese fauna, there are two types (A and B) of larval form with different head capsule markings. The type A form is distributed throughout Japan, but the type B form has limited distribution (mainly Nagano Prefecture, Central Japan). Our field study in Nagano, the two types of *C. nipponensis* distributed sympatrically. Adults use abdominal vibration as their mating communication (courtship song). We analyzed oscillogram (using phonograph cartridge and DAT recording system) of the courtship song among Japanese populations of *C. nipponensis*. The oscillograph tracing of courtship song between the types A and B is very different. We also examined crossing experiments between the females and males from the two types. Copulation successful ratio between the same-type combinations (70 to 94 %) is greater than between the different-type combinations (0 to 7 %). We use molecular phylogenetic approach to the intraspecific variation of *C. nipponensis*. Allozyme analysis (17 loci) using polyacrylamide gel electrophoresis among several populations in Japan was suggested there are different genetic components between the types. We also use DNA sequences data (using PCR direct sequencing method) of cytochrome oxidase subunits I and II (COI and COII) region (about 900bp length) among Japanese populations of *C. nipponensis*. DNA sequences of COI and II between two types were different, and based on the phylogenetic analysis (using parsimony analysis), the two types belong to separate clades, although a part of the type A population in Nagano prefecture was included in type B group. These data suggested there is a little gene flow between the two types. Our results suggested possible reproductive isolation between the two types of *C. nipponensis* in Japan. The two types of *C. nipponensis* might be different species or subspecies in the future.
Index terms; *Chrysoperla carnea*, intraspecific variation, two types of larval form, courtship song, molecular phylogeny

[3819] PHYLOGENETIC RELATIONSHIPS OF THE CARABID (COLEOPTERA) SUBFAMILY HARPALINAE BASED ON MOLECULAR SEQUENCE DATA

K. A. Ober[1] & D. R. Maddison[1], [1]Dept. of Entomology, Univ. of Arizona, 1140 E. S. Campus Dr., Tucson, AZ 85721, USA, e-mail: kober@u.arizona.edu.

The carabid subfamily Harpalinae contains most of the species of carabid beetles. This family with over 25,000 species radiated in the Cretaceous to yield a large clade that is diverse in morphological form and ecological habit. While there are several morphological, cytological, and chemical character that unite most harpalines, the placement of some tribes within the subfamily remains controversial, as does the sister group relationships to this large group. In this study, DNA sequences from the 28S rDNA gene and the *wingless* nuclear protein-coding gene were collected from 51 carabid genera representing 31 harpaline tribes in addition to 22 carabid outgroup taxa. Molecular sequence data from these genes, along with additional data from the 18S rDNA gene, were analyzed with a variety of phylogenetic analysis methods, separately for each gene and in a combined data approach. Results indicated that the subfamily Harpalinae is monophyletic with the enigmatic tribes of Morionini, Peliciini, and Pseudomorphini included within it. The brachinine bombardier beetles are closely related to the Harpalinae subfamily as they form the sister group to the harps or, in some analyses, are included within it. The Amblyteline-complex or "austral-psydrines" are the sister group to the Harpalinae + Brachinini clade. This study also offers a preliminary look at some tribal relationships within the carabid subfamily Harpalinae.
Index terms: systematics, ground beetles, ribosomal DNA genes, wingless gene

[3820] MOLECULAR SYSTEMATICS AND EVOLUTION OF BUTTERFLIES OF THE GENUS *PARNASSIUS*, PAPILIONIDAE, BASED ON MITOCHONDRIAL DNA SEQUENCE DATA

K. Omoto[1], T. Katoh[1], A. Chichvarkhin[2] & T. Yagi[3], [1]International Research Center for Japanese Studies, 3-2 Oeyama-cho, Goryo, Nishikyo-ku, Kyoto 610-1192, Japan, E-mail ko8516@nichibun.ac.jp; [2]Insitutute of Marine Biology, Russian Academy of Science, Uladivostok, Russia; [3]Dept of Radiation Genetics, Graduate School of Medicine, Kyoto University, Yoshida-konoe-cho, Sakyo-ku, Kyoto 606-8501, Japan.

The butterflies of the genus *Parnassius* attract collectors for their beauty and diversities, as well as rarity of some species occurring in the remote areas of the Himalayas and other parts of northern Eurasia. At least 47 species are known, and as many as 10 subgenera have been proposed, based on morphological and ecological studies. However, due to the lack of information at the DNA level the phylogenetic relationships among species and the evolutionary scenario of this interesting genus have thus far been only speculative. Here, we report the results of our molecular systematic studies of at least 24 species, more than a half of all the species belonging to *Parnassius* based on mtDNA sequence data. The dendrogram based on the NJ method using Kimura's two-parameter distances show that while the subgeneric grouping based on morphology is supported as a whole, there are several interesting deviations which may call for the revision of classification. In particular, the local diversification at DNA level among the Far East Asian species and subspecies groups of *P. eversmanni*, *P. glacialis*, and *P. stubbendorfii* was examined in detail. We also test the classic hypothesis that the genus *Parnassius* arose from an ancestral group similar to the extant genus *Arcon* in what is now Central Asia and Tibet before the formation of the Great Himalayans during the late Miocene epoch.
Index terms: *Parnassius*, butterflies, phylogeny, mitochondrial DNA

[3821] TWO NEW SPECIES OF THE GENUS *THOMISUS* FROM CHINA (ARANEAE : THOMISIDAE)

X.J. Peng[1], C.M. Yin[1] & J.P. Kim[2], [1]College of Life Science, Hunan Normal Univ., Changsha, Hunan, P.R. China 410081; [2]Dept. of Applied Biology, College of Life Resource Science, Dongguk Univ., #26, 3-ga, Pil-dong, Chung-gu, Seoul 100-715 and The Arachnological Inst. of Korea, Seoul 133-040, Korea; E-mail kjpil@dgu.ac.kr.

Two novel species, *Thomisus sinensis* n. sp., *T. wangi* n. sp., are described on the specimens collected from Hunan province, China, *T. sinensis* is similar to *T. kalaharinous*, but its epigynal septum clearly with visible copulatory canal in the former, while in the latter, spermathecae mono-chamber, without visible copulatory canal and body size much bigger in the former than in the latter. As well, *T. wangi*, is similar to *T. okinawensis*, but its retrolateral tibial apophysis much longer, its distal and with a dorsal spine which can't be found in that of the latter, Bulb with a small conic tubercle near the base of embolus which can't be found in that of the latter and Abdomen with many small tubercles on posterior area, lateral and anterior margins.
Index terms: *Thomisus sinensis, T. wangi.*

[3822] ONE NEW SPECIES OF THE GENUS *XYSTICUS* FROM CHINA (ARANEAE: THOMISIDAE)

X.J. Peng[1], C.M. Yin[1] & J.P. Kim[2], [1]College of Life Science, Hunan Normal Univ., Changsha, Hunan, P. R. China 410081; [2]Dept. of Applied Biology, College of Life Resource Science, Dongguk Univ., #26, 3-ga, Pil-dong, Chung-gu, Seoul 100-715 and The Arachnological Inst. of Korea, Seoul 133-040, Korea; E-mail kjpil@dgu.ac.kr

One novel species, *Xysticus jiangi n. sp.* is described based on the specimens collected from Hunan province, China. *X. jiangi* is similar to *X. chui*, but its spermathecae is smaller, copulatory canals distinct, that of the latter much bigger, copulatory canals invisible and median apophysis about Y-shaped, not hook-shaped found in that of the latter. In addition to that basal apophysis of tegulum much more developed than that of the latter, surrounds half bulb.
Index terms: *Xysticus jiang.*

[3823] FIRST SOUTH AMERICAN RECORD OF FOSSIL LYGAEOIDEA (HETEROPTERA)

J. F. Petrulevicius[1] & M. C. Coscarón[2], [1]Depto. Científico Paleozoología Invertebrados, Museo de La Plata, CONICET, Paseo del Bosque s/n, 1900 La Plata, Argentina, E-mail levicius@museo.fcnym.unlp.edu.ar; [2]Depto. Científico Entomología, Museo de La Plata, CONICET, E-mail coscaron@netverk.com.ar.

Lygaeoidea are rare in the fossil record, there are 26 extinct genera, against about 500 living genera and 4000 species. They come from the Jurassic of China and Kazakhstan, Cretaceous of Mongolia and China, Eocene of USA, Oligocene of Europe and USA, Miocene of Europe, and Pliocene of Germany. The specimen was collected from the late Paleocene-lower Eocene Mafz Gordo Formation, composed by green mudstone and shale (24° 21' S; 64° 59' W), Northwest Argentina. Terrestrial Heteroptera are well represented in this assemblage (about 6.2 % of 390 insects recovered from a preliminary study). All specimens excepting that of the present communication are represented by isolated hemelytra. At present there is no record of aquatic true bugs. The Lygaeoidea is a nearly complete, laterally compressed, female specimen. One hemelytra is also preserved. The specimen has two of the synapomorphies of Lygaeoidea *sensu* Henry 1997, i.e. 3-5 simple veins in hemelytral membrane; fore femora incrassate. Trichobotrial pads, the third synapomorphy of Lygaeoidea, may be not preserved. The specimen shares with the monophyletic group formed by ((Heterogastrinae+Pachygrontinae)+ (Plinthisini+Ryparochromini)), the presence of ventral laterotergites. Other synapomorphies of last group are not preserved. (Heterogastrinae+Pachygrontinae) are to be excluded because the specimen has the sternite VI and VII split by ovipositor [apomorphic condition: sternite V, VI and VII split by ovipositor]. Sutures 2 and 3 are well developed, with respect to suture 4, only its ventral base is present, suture 5 is not visible, sutures 6 and 7 are finally preserved. If we consider that the reduction of sutures 4 and 5 are not artefacts, the specimen could be related to Ryparochromini. However, their relationships remain dubious and uncertain because of the lack or the difficulty in the interpretation of some characters.
Index terms: Lygaeoidea, Paleogene, Argentina

[3824] BIOCONTROL AGENTS ASSOCIATED WITH *PROUTISTA MOESTA*, A VECTOR OF PHYTOPLASMA DISEASES OF PALMS, WITH PARTICULAR REFERENCE TO *HALICTOPHAGUS PALMI*

K. N. Ponnamma & B. Babjan, National Research Centre for Oil Palm, Regional Station, Palode, Pacha 695 582, Trivandrum Dt. Kerala, South India

The planthopper *Proutista moesta* is a vector of root wilt disease of coconut palm, yellow leaf disease of areca nut, and a putative vector of spear rot disease of oil palm. The natural enemy complex – an endoparasitoid *Halictophagus palmi* (Strepsiptera), predators *Maroissa tigrina* (Aracinidaea), *Chelisoches moris* (Dermaptera) and the fungal pathogen *Asoergillus flavus* play a vital role in the biological suppression of the vector. Bioecology, extent of parasitism potential of the strepsipteran parasitie is presented

[3825] TAXONOMIC DISTINCTNESS, ENDEMICITY, AND COMPLEMENTARITY: NEW CLUES TO DEFINE PRIORITIES FOR CONSERVATION IN SOUTHERN SOUTH AMERICA

P. Posadas[1], D. R. Miranda-Esquivel[2] & M. Donato [1], [1]Laboratorio de Sistemática y Biología Evolutiva (LASBE), Museo de La Plata, Paseo del Bosque, 1900 La Plata, Argentina. e-mail: posadas@museo.fcnym.unlp.edu.ar [2] Universidad Industrial de Santander. AA 678, Bucaramanga, Colombia.

Understanding biodiversity requires knowledge of its history; therefore conservation of biodiversity unavoidable needs to take into account historical information. One of the goals of biodiversity conservation is to define areas for conservation. From a systematic point of view, there are three main aspects that must be considered addressed to this objective: (1) taxonomic distinctness of the taxa, (2) its geographical distributional patterns (mainly endemicity), and (3) complementarity between biotas. Cladistic relations between taxa could be used to measure the taxonomic distinctness as an index of phylogenetic diversity. These index values obtained for each taxon could be used to give a value to each area where the taxa inhabit. At present, there are many measures that consider the phylogenetic information addressed to conservation evaluation. In this work we applied node-based methods using the indexes I and W of Vane-Wright et al. (1991, *Biol. Conserv.*, 55: 235-254) modified to include a measure of the endemicity. When one taxon is widespread the index value could be divided among the number of areas where the taxon is present. These new values are called I_e and W_e, respectively. This quotient avoid the overweight of any area due to the presence of widespread taxa. Thus, we propose these new indexes that account for both taxonomic distinctness and endemicity simultaneously. Here we applied a protocol of data analysis to rank 12 biogeographic units of southern South America related to biodiversity conservation priorities. The rank was established based on the information provided for 115 species of arthropods and vascular plants grouped as 12 supraspecific taxa. The 12 areas considered are as follow: Puna province; Coquimbo, Santiago, Curicó, and Ñuble districts from Central Chilean Province; Maule, Valdivian Forest, Magellanic Forest continental and insular areas, Magellanic Mooreland, and Malvinas districts of Subantarctic province; and Patagonian Steppe province. Using these new indexes and applying complementarity, we found that the three areas better ranked for priority conservation are as follow: Santiago, Malvinas, and Magellanic Forest continental area. The methodology employed here considers not only species richness but also the history of the taxa, area endemicity, and complementarity between biotas. This method has the advantage that allows better use of the available information, e.g., surveys, monographs and collections.
Index terms: Conservation, Phylogeny, Southern South America

[3826] SOME WINTER GEOMETRIDS FROM CENTRAL SPAIN (INSECTA: LEPIDOPTERA, GEOMETRIDAE)

L. Romera[1], J. Fernández[1], J. L. Viejo[1] & E. Cascales[2], [1]Dep. de Biología, Univ. Autónoma, Cantoblanco 28049 Madrid, Spain, E-mail luis.romera@uam.es; [2]Dep. de Biología Animal I (Entomología), Univ. Complutense, 28040 Madrid, Spain.

Of the 600 species of geometrid described in Spain, some 190 occur in the Community of Madrid. This study presents data concerning new winter-flying geometrid species captured in the Sierra de Guadarrama (Madrid, Central Spain), some of which are of great interest from a forestry point of view: *Apocheima hispidaria, Apocheima pilosaria, Chemerina caligineraria, Agriopis leucophaearia. Erannis defoliaria, Alsophila aceraria, Colostygia multistrigaria, Alsophila aescularia* and *Operophtera brumata.* The study is based on data obtained from the literature and also from samples taken since 1998 from four localities representing four types of Supramediterranean woods from the Sierra de Guadarrama: holm oak, ash, gall-oak and Pyrenean oak. Three modified portable Heath-type black light (360 nm) traps were constructed and used for sampling. The distribution of each species throughout the world, in Spain and in the Community of Madrid is presented, the data on captured specimens being completed with those from the literature and from the Museo Nacional de Ciencias Naturales de Madrid (Madrid National Museum of Natural History) and the Biology Department of the Universidad Autónoma de Madrid (UAM). Using these data and employing the UTM projection system at a scale of 10 km squares, distribution maps for each species in the Community of Madrid have been produced. Likewise, figures of the genitalia (the andropygium and the gynopygium) are presented and the larval food plants are indicated in each case.
Index terms: Moths, Iberian Peninsula, distribution, food plants, genitalia

[3827] HOW GALL WASPS BECAME GALL WASPS

F. Ronquist[1] & J. L. Nieves Aldrey[2], [1]Dept. Systematic Zoology, Evolutionary Biology Centre, Uppsala Univ., Norbyv. 12, SE-752 36 Uppsala, SWEDEN, E-mail: fredrik.ronquist@ebc.uu.se; [2]Museo Nacional de Ciencias Naturales, CSIC, José Gutierrez Abascal 2, ES-28006 Madrid, SPAIN.

Most gall-forming insects are considered to have evolved through a slow transition from phytophagous but not gall-inducing forms through forms making very simple galls to true gall inducers. The most cited scenario for the origin of gall wasps postulates such a slow transition from stem feeders on herbs in the family Asteraceae to species inducing true galls. However, recent phylogenetic studies suggest that the stem feeders on Asteraceae are not primitive but evolved from ancestors producing typical galls. Instead, the first gall wasps are likely to have induced conspicuous single-chambered galls in the seed capsules of Papaveraceae. Here, we present evidence that these early gall inducers evolved from parasites feeding internally on hymenopteran larvae that lived in, and perhaps induced, similar galls. These ancestral gall parasites lived more than 83 million years ago. The transition from insect parasites to gall inducers involved few morphological changes and left no surviving intermediate forms, which suggest that it was rapid. This indicates that the elusive gall-inducing principle of gall wasps may be a simple modification of a mechanism used by their insect-parasitic ancestors to control the development of the host larva. Furthermore, it means that none of the three traditional adaptive explanations for the origin of galling insects are likely to apply to gall wasps.
Index terms: Cynipidae, insect-plant relations, origin, evolution, phylogeny

[3828] BUTTERFLIES OF FOUR LOCALITIES IN "TIERRA CALIENTE" MICHOACAN, MEXICO

M. V. Rosas[1] & M. Balcázar-Lara[2], [1]Instituto de Biología, UNAM. A. P. 70-153. 04510 México D. F. México. E-mail: ventura@ibiologia.unam.mx; [2]Fac. de Ciencias, U. de Colima, Apdo. Postal No. 11, Colima, C. P. 28000, MEXICO, E-mail mabl@cgic.ucol.mx.

Michocán, Mexico, is a state with a high richness in Lepidoptera, this is due to its diversity in climates, vegetation, and altitudinal ranges. In addition, the Balsas River basin and the Transvolcanic Axis merge along the middle of the state. The latter is of capital importance because the "Mexican Transition" Zone between the Nearctic and Neotropical regions is determined by altitude. The major goal of this work was to produce a species checklist of four localities in this transition zone in Michoacán, and to analyze and compare them with similar works using a phenetic approach. Fieldwork was conducted in two localities of the municipality of Gabriel Zamora (19°10' 00"N, 102° 05'00" W) with an altitude of 640 m, and in two localities of the municipality of Tzitzio (19°34' 00"N, 101°56'00" W) with an altitude of 1575 m. Monthly field trips were done in the localities for a year cycle. Specimens were collected using standard techniques such as entomological nets and traps using rotten fruit as bait (Van Someren – Rydon). Representative specimens of all taxa were pinned and spread. The identification was done basically by comparison at the National Collection of Insects, National University of Mexico (CNIN, UNAM). A total of 196 species in 130 genera and 6 families in the superfamilies Papilionoidea and Hesperioidea were collected in the area. Seasonality of the adult forms was variable, with a high richness period between July and December (summer – autumn), which corresponds quite well with the most humid period (higher precipitation). Species accumulation curves were calculated to estimate the total number of species present in the area based on the samples. Also, we made a phenetic analysis for each superfamily, comparing the Lepidoptera fauna in our study with that of seven other localities in Michoacan state. The phenetic results agree well with other works previously published.
Keywords: Lepidoptera, Papilionoidea, Hesperioidea, checklist, faunal survey, phenetics

[3829] TAXOCAENOSIS OF THE FAMILY ASILIDAE (INSECTA: DIPTERA) IN ONE SUBTROPICAL AREA OF ARGENTINA

M. C. Rueda, CRILAR-CONICET-INSUE "Dr. Abraham Willink", Facultad de Ciencias Naturales e Instituto Miguel Lillo, Miguel Lillo 205, San Miguel de Tucumán, C. P. 4000, Tucumán, Argentina, E-mail crueda@crilar.com.ar

The Brachycera Asilidae family is world wide specially in tropical regions. The Neotropical region has an rich and interesting fauna of asilids. Adult of robber flies are, typically visual, sit - and - wait predators that perch in conspicuous sites. This flies attempt aerial capture of flying insect prey. They are usually found in open and sunny habitats. Studies about predators arthropods are scarce, and asilids adults are an excellent opportunity to make quantitative descriptions about seasonal abundance and habitat studies. The study area is located 14 km of San Salvador de Jujuy (Jujuy Province, Argentina), and belongs to the Centro Forestal Aceros Zapla S.A. The area sampled included subtropical forest sections of different ages. The relative abundance of asilids species was monitored between 1997 to 1998 using a census method. Censuses were conducted between 11:00-17:00 hs, because the studied species are active during this daytime. Four sample stations were selected and the samples were taken during four days, aleatory chosen, by month. Measurements of numeric richness of species were determined for each season of the year. The spatial and temporal habitat use was established through the vertical plants stratification and horizontal stratification of the sample stations. The presence of 11 genera belongs to the 4 subfamilies of the 8 presents in Neotropical regions was determined. This work is the first trying to promote ecological studies in subtropical areas of South America. With this study we want to know and to interpret the natural processes that determine the dynamic of a particular insect community such as Asilidae flies.
Index terms: Diptera, Asilidae, predators, taxocaenosis, subtropical.

[3830] THE GENUS *LIMNOCORIS* IN ARGENTINA (HETEROPTERA, NAUCORIDAE)

M. L. L. Ruf, Dept. of Entomology, Museo de La Plata, Paseo del Bosque, 1900 La Plata, Argentina. E-mail: lopezruf@museo.fcnym.unlp.edu.ar

The *Limnocoris* species from Argentina are studied on the basis of external morphological characters. The examined material is deposited in the Museo Argentino de Ciencias Naturales (Buenos Aires). At present, six species of *Limnocoris* are recorded from Argentina: *L. borellii* Montandon from province of Salta, *L.minutus* De Carlo from province of Corrientes, *L. pectoralis* Montandon from provinces of Salta and Jujuy, *L. ovatulus* Montandon from provinces of Salta and Catamarca, *L. pusillus* Montandon from province of Misiones and *L. stali* Montandon from province of Salta. The species can be identified mainly by their size, the shape of the pronotum, the shape and curving of the embolium and the mesosternal carina. This last character is herein established as the most important one to identify the argentinean species. In addition, new distributional data are presented.
Index terms: Nepomorpha, taxonomy, new records, Neotropical Region.

[3831] MONOPHYLETIC GROUPS AND THEIR GEOGRAPHICAL DISTRIBUTIONS IN THE GENUS *RHAMPHOMYIA* (DIPTERA, EMPIDIDAE)

T. Saigusa, Nagazumi, Fukuoka,, Japan. E-mail: saigurcb@mbox.nc.kyushu-u.ac.jp

The genus *Rhamphomyia* is one of the largest genera of the family Empididae. It is a polyphyletic generic group partly due to inclusion of species without vein R4, that undoubtedly belong phylogenetically to some subgenera of the genus *Empis*. Except for a few species of unknown origins in the temperate Southern Hemisphere, the genus is mostly restricted to the Holarctic Region. Although the phylogenetic classification of this genus has not been well established especially for large subgenera *Pararhamphomyia* and *Eorhamphomyia*, most currently recognized subgenera and some species groups appear to be monophyletic, of which the geographical distributions are as follows. Circumpolar Arctic: (*Pararhamphomyia*) *hirticula* gp. Circumpolar Arctic to Subarctic: *Ctenempis*, *Dasyrhamphomyia*. Holarctic Subarctic to Cool Temperate: *Megacyttarus* (including *Choreodromia*). Temperate European: *Holoclera*. Temperate Palae-arctic: *Rhamphomyia*. Temperate Asia-Nearctic: *Calorhamphomyia*, ("*Collin-aria*") *arakawae* gp, ("*Amydroneura*") *umbilicata* gp. European Alps: *Alpino-myia*, *Lundstroemiella*. Warm Temperate East Asian: (*Pararhamphomyia*) *ciliatopoda* gp, *Orientomyia*. Warm Temperate Nearctic: *R. pulchra* gp, *R. curvipes* gp. Central to South European: *Amydroneura*. In addition, in the Nearctic Region, Eastern: *Calorhamphomyia*, ("*Amydroneura*") *umbilicata* gp, *R. pulchra* gp; Western: *R. curvipes* gp, ("*Eorhamphomyia*") *alpina* gp. The following zoogeographical tendencies are detected for the above-mentioned groups. 1 A group adapted to arctic and/or subarctic climates has a wide longitudinal range, usually dispersed over the entire Holarctic Region. 2 A group inhabiting temperate forests often shows an Asia-Nearctic disjunct distribution. 3 A group inhabiting warm temperate habitats is often restricted to a narrow area in either North America, East Asia or Europe. 4 In North America, there is a distinct gap of faunal compoments between eastern and western regions. 5 No species invades the tropical region in Eurasia. In addition, the genus *Macrostomus* s. lat. (including *Porphyrochroa*) which radiated in the Neotropical Region is considered in comparision with *Rhamphomyia*. Mor-phological differences between *Macrostomus* and the subgenus *Rhamphomyia* are less conspicuous than those between some *Rhamphomyia* subgenera, i.e. *Rhamphomyia* appears to be paraphyletic with respect to *Macrostomus*. I consider the radiation of *Macrostomus* in the Neotropical Region resulted from invasion of the tropical environments by an ancestral species or a monophyletic group having a temperate Nearctic ancestor, and the radiation was due to the absence of empids competing in its niche. In this respect, the radiation of *Macrostomus* in the Neotropical Region is similar to that of the subgenus *Coptophlebia* of the temperate *Empis* in the Oriental and Afrotropical Regions.
Index terms: *Macrostomus*, *Coptophlebia*, *Empis*, radiation, Neotropical Region.

[3832] MULTIVARIATE STATISTICAL ANALYSIS AIDS TO THE CHARACTERIZATION OF THE GENUS *RETICULITERMES* IN SPAIN (ISOPTERA: RHINOTERMITIDAE)

M. Saiz-Ardanaz[1], M. Gaju[2] and C. Bach de Roca[1], [1] Dept. of Animal Biology, Vegetal Biology and Ecology. Lab. Entomology. Autonomous University of Barcelona. 08193. Bellaterra (Barcelona). Spain. e-mail: ibzo2@cc.uab.es; [2] Dept. of Animal Biology (Zoology). Univ. of Córdoba. C-1 Campus Rabanales 14014 Córdoba (Spain) e-mail: balgarim@uco.es; Work supported by a grant from CTM (Centro Tecnológico de la Madera Europa S.L.).

The use of multivariate statistical analysis has expanded with the development of computing techniques. In order to best characterize the genus *Reticulitermes* in Spain, we have measured 800 winged sexuals belonging to eight populations geographically isolated. The populations studied were picked up in four provinces of Spain, between the years 1997-1999. They were collected in Spring during the swarming time. They come from Barcelona (Barcelona city, Bellaterra (2), La Floresta and St. Boi), Tarragona (L'Ametlla), Murcia (Las Torres de Cotillas) and Córdoba (Palenciana). An attemp has been made to see whether the natural populations could be separated statistically by measurements, so eleven variables for each individual were measured. For each population 50 males and 50 females were dissected in order to know if there are differences between sexes. The results are discussed.
Index terms. *Reticulitermes lucifugus*, morphometrics, Spain.

[3833] DIPTERA CALIPTRATA SUCESSION IN A CARCASS OF *SUS SCROFA*, IN TWO ECOSYSTEMS OF RIO DE JANEIRO, RJ

R.J.B. Salviano [1,3], A.C.M.Nascimento[1], R.C.P. Ramos[1], NLNL Lima[1] & M.S. Couri[2], 'Dept'. de Biologia (IOC/FIOCRUZ), C.P. 926,21045-900, Rio de Janeiro, RJ. [2]Depto de Entomologia (Museu Nacional /UFRJ), 20940-040, Quinta da Boa Vista, São Cristóvão, Rio de Janeiro, RJ. E-mail: salviano@ioc.flocruz.br. 3. Doctorate student (Museu Nacional-UFRJ) and CNPq fellowship

Research done on the colonization of insects during the decay of corpses have given fundamental support to the police investigation, mainly to establish the interval of post-morten (IPM). The experiments were carried out from June 1999 to January 2000 in two different areas of the Forte de São João situated at the Urca neighbourhood, in Rio de Janeiro, Brazil. A trap was set in a rocky coast situated at 5 meters frorn the sea and the other in a woodland area. As an experimental model, we have used a swine carcass of approximately 10kg (one for each season of the studied period). After being sacrificed, the swine was introduced into the trap, in order to evaluate the stage of decay (fresh, bloated, decay, mass and remains). In all seasons, in the woodland area, the succession occurred in the following way: in the first hours after the swine was dead, *Patonella intermutans* began to eliminate the larva; this species stayed over the carcass until the end of the penultimate stage of decay. Eggs of *Hemilucilia segmentaria* were collected in the second day of decay, and larva of first instar were collected from the third day until the end of rnass period. The oviposition of *Ophyra aenescens* occurred in the end of deterioration and in the mass period. Their larva were collected in the exudate and in the wet ground, near the carcass. During the mass period and in the beginning of remains, *Fannia pusio* started the oviposition in dry locals of the skin and bones of the carcass and in the foliages (over the ground). The larva were obtained in the exudate and in the ground, mixed with rest of fat of the carcass. A similar pattern of colonization was observed in the area near the sea; however *Peckia chrysostoma* substituted *P. intermutans* which was not collected in any moment of the experiments. In the deterioration stage, *C. megacephala* was present together with *C. albiceps*.
Index tenns: Diptera calliptrata, insect succession in carrion, forense entomology.

[3834] PHYLOGENETIC RELATIONSHIPS OF THE GENUS *THRICOPS* RONDANI AND THE STATUS OF *ALLOEOSTYLUS* SCHNABL (DIPTERA: MUSCIDAE)

J. Savage, Dept of Natural Resource Sciences, McGill Univ, Macdonald Campus, Ste-Anne-de-Bellevue, Quebec, H9X 3V9, Canada.

The Holarctic genus *Thricops* currently contains 40 described species of boreal and alpine Muscidae. The generic limits of *Thricops* are problematic, due to uncertainties regarding the status of the "genus" *Alloeostylus* within *Thricops*. Preliminary results indicate that genitalic characters of the males conflict with the traditional leg bristle character used to support the monophyly of *Alloeostylus*, suggesting that it might prove to be paraphyletic relative to *Thricops*. Additional morphological characters to be used in a cladistic analysis of the genus are evaluated. *Thricops* is currently placed in the tribe Azeliini of the subfamily Muscinae. Current hypotheses of phylogenetic relationships within the Azeliini are reviewed, and the remaining genera of the tribe are evaluated as potential outgroups to polarize both genitalic and non-genitalic characters.

Index terms: Azeliini; Muscinae; phylogeny; systematics

[3835] THE CLASSIFICATION AND DISTRIBUTION OF HYDARINAE (HEMIPTERA: COREIDAE), AND THE SYSTEMATIC POSITION OF THE GENUS *HAIDARA* DISTANT

C.W. Schaefer[1] & I. Ahmad[2], [1]Dept. Ecology & Evolutionary Biology, University of Connecticut, Storrs, CT 06269-3043, USA, e-mail: chaefer@uconnvm.uconn.edu; [2]Dept. Zoology, Karachi University, Karachi 75270 Pakistan, e-mail: biosal@disicom.net.pk.

Based on work by Brailovsky and by Ahmad, the coreid subfamily Hydarinae at present comprises three genera, five species, and one subspecies from the New World Tropics (southern United States south into Argentina); two genera (and a third undescribed) and seven species in subSaharan Africa; and three genera (excluding *Haidara* Distant) with five species (plus several undescribed ones) from the Oriental tropics. Formerly a tribe in the subfamily Coreinae, Hydarinae is worthy of subfamilial rank based on its members' possession of a slender (never incrassate) basal antennal segment which is always apically clavate and is unusually long (at least as long as head and pronotum together); the female's seventh abdominal sternum bears a truncate plica posterior to which the sternum is cleft, a character upon which Bergroth based his definition of Hydraria. In addition, all hydarines have a characteristically shaped head, and distinct features of both male and female genitalia, of alimentary organs, and of eggs. The genus *Haidara* has also been included in Hydarinae. However, in describing this genus and its two species, Distant placed it in his Division Atractaria (now included in the tribe Coreini), "allied to the Palaearctic genus *Spathocera*... and must be placed in this Division" [i.e., Atractaria], between the Divisions Gonoceraria and Hydararia. He thus indicated that *Haidara* is related to both Divisions, but belongs to neither. The basal antennal segment of *Haidara* is short and strongly incrassate, and the female's seventh abdominal sternum apparently is absent (not shown in Distant's illustration); and the shape of *Haidara*'s head differs from that of the hydarines' heads. We do not believe that *Haidara* should remain in Hydarinae. *Haidara* should remain in Hydarinae.

Index terms: Coreidae, Hydarinae, Hemiptera, classification, systematics, *Haidara*.

[3836] THE SUBFAMILIAL PLACEMENT OF THE INDIAN GENUS *LINSHCOSTEUS* (HEMIPTERA: REDUVIIDAE: TRIATOMINAE)

C. W. Schaefer[1] & M. C. Coscarón[2], [1]Dept. Ecology and Evolutionary Biology, University of Connecticut, Storrs, CT 06269-3043; [2]Departamento Científico de Entomológia, Facultad de Ciencias Naturales y Museo de La Planta, Paseo del Bosque, 1900 La Plata, Argentina, e-mail: coscaron@netverk.com.ar.

All genera of Triatominae occur in the New World tropics except *Linshcosteus*, which is south Indian. Several authors have suggested that *Linshcosteus* is not a true triatomine, but has independently adapted to feeding on vertebrate blood (as do true triatomines) and has as a result convergently evolved triatomine-like features. In examining this question, we ask 1) Is *Linshcosteus* a true member of the Triatominae? 2) If so, what is its closest relative? (several species of the mostly neotropical genus *Triatoma* occur in the Asian tropics, and one may be *Linshcosteus*' ancestor--if *Linshcosteus* is a triatomine). 3) If *Linshcosteus* is not a triatomine, to what other subfamily does it belong or is it most closely related to? (Reduviinae has been suggested). Our very preliminary analysis suggests that *Linshcosteus* is indeed a triatomine, not a reduviine, and that these two subfamilies are closely related. Further study of comparative biologies, and of genital, egg, etc. morphology is being undertaken. The probability that *Linshcosteus* is a true triatomine raises an important public health issue. Other triatomines, in the neotropic and subtropics, are vectors of *Trypanosoma cruzi*, the protozoan cuasing Chagas' disease. Relatives of *T. cruzi* occur in India, as do the small mammals which serve as reservoirs of the protozoan. As a triatomine, *Linshcosteus* may be capable of transmitting a Chagas-like trypanosmiasis, should ecological conditions ever favor the transmission of an Indian *Trypanosoma* species to humans.

Index terms: Triatominae, Chagas' disease, *Trypanosoma*, *Linshcosteus*, Reduviidae

[3837] PHYLOGENY AND THE CONTROL OF PESTS ON NEW CROPS IN THE TROPICS

C. W. Schaefer[1], [1]Dept. Ecology & Evolutionary Biology, University of Connecticut, Storrs, CT 06269-3043, USA, e-mail: schaefer@uconnvm.uconn.edu

As new crops are introduced into new areas, it is very important to recognize what indigenous insects (and other arthropods) may feed on these new crops and thereby become pests on them. This is particularly important in tropical countries, where many new crops are being introduced, and where there are far more species of insects (and therefore far more potential new pests) than in temperate-region countries. Recognition of possible new pests can be greatly facilitated by a knowledge of the phylogeny and systematics of local insects. Phylogeny is the study of a species' evolutionary history, and systematics is the application of the results of that study to construct a classification of that species. Both phylogeny and systematics help one to learn what the close relatives of the species are. If these close relatives are pests on a crop in other parts of the world, then one may predict that perhaps their local relatives may also become pests on that same crop when it is introduced into a new region. Several crops have been introduced into Brazil in the past few years. Among these are rice, sugarcane, and soybean. Pests of these crops occur in parts of the world where these crops have been grown for a long time. Each of these pests has close relatives in Brazil which now (or until recently) fed on wild plants. The possibility exists that these Brazilian relatives may become pests on these new crops; several (on soybean) have done so already. Well established pest species in other parts of the world are in general well studied: much is known about their biologies and ecologies. This knowledge can be useful in controlling their relatives when these relatives become pests on new crops. But if this information is to be useful, one must know what these insects' relatives are. And one can know this only from studies of phylogeny and systematics. Thus such studies have great practical importance in applied entomology. Sadly, it is exactly these studies that are the most ignored and the most underfunded and the least supported in third World countries--in countries that need them the most.

Index terms: plant pests, Heteroptera, rice, sugarcane, soybean, systematics

[3838] DESCRIPTION OF THE FIVE INSTARS OF *DYSDERCUS RUFICOLLIS* (HETEROPTERA: PYRRHOCORIDAE)

M. M. Schang[1] & A. C. Valverde[1], 1: Depto. de Cs. Biológicas, Fac. de Ciencias Exactas y Naturales, Univ.de Buenos Aires. Pab. II, 4to. piso. Ciudad Universitaria. 1428- Buenos Aires. Argentina. E-mail: **Erro! Indicador não definido.**

The genus *Dysdercus* is well known worldwide. Of the 36 nominal species in the New World, some of them are considered important cotton pests. The common name for these species is "cotton - stainers". They feed mostly on *Malvaceae* and *Euphorbiaceae* but the major injury is done on cotton balls where they pierce and suck causing sometimes shading, rot balls, and even introduce microorganisms which cause indirect damage on the fiber staining the lint. Many papers have been written about *Dysdercus* including those of Ballou (1906) and Lima et al. (1962). Some of them are revisions of the genus, others are of agronomic importance, and some have ecological data including life cycles. The complete revision done by van Doesburg (1968) describes the adult stages, showing the genitalia in detail, but only a few papers referring to the description of all larval stages have been published. Coscarón (1998) described nymphs III and V of *D. ruficollis* from material that belonged to two museums in Argentina . The aim of this work is to describe the five instars of *D. Ruficollis*.Larval stages and adults of *D. ruficollis* were collected in different locations of Buenos Aires, Entre Ríos and Martín García (Argentina). They were kept on glass containers covered with gauze, provided with hydrated cotton seeds and water, and bred under laboratory conditions. Observations were done using usual laboratory techniques. For the descriptions, about 23 measurements (depending on the larval stage) were taken and were expressed in mm. Five different larval stages were identified using particular characteristics of each stage, measurements and color patterns. Each larval stage is described and illustrated.

Index terms: cotton stainers, nymphs, morphology.

[3839] MOLECULAR SYSTEMATICS OF *FERGUSONINA* SPP. (DIPTERA: FERGUSONINIDAE): HOST SPECIFICITY, HOST-USE EVOLUTION, AND IMPLICATIONS FOR BIOCONTROL OF *MELALEUCA QUINQUENERVA* IN THE FLORIDA EVERGLADES

S. J. Scheffer[1], R. Giblin-Davis[2], G. Taylor[3], M. Purcell[4], K. Davies[3], W. K. Thomas[5], J. A. Goolsby[6], T. D. Center[7], [1]Systematic Entomology Laboratory, USDA-ARS, Bld. 005, Rm. 137, BARC-W, 10300 Baltimore Av., Beltsville, MD 20705, USA, Email sscheffe@sel.barc.usda.gov; [2]Univ. of Florida-IFAS, Ft. Lauderdale Research and Education Center, 3205 College Av., Ft. Lauderdale, FL 33314, USA; [3]Dept. of Applied & Molecular Ecology, Waite Campus, Univ. of Adelaide, PB 1 Glen Osmond, South Australia 5064, Australia; [4]CSIRO Entomology, Australian Biological Control Laboratory, Private Mail Bag #3, 120 Meiers Rd., Indooroopilly, Queensland 4068, Australia; [5]School of Biological Sciences, Univ. of Missouri-Kansas City, 5007 Rockhill Rd., Kansas City, MO 64110, USA; [6]Australian Biological Control Laboratory, USAD-ARS, PrivateMail Bag #3, 120 Meiers Rd., Indooroopilly, Queensland 4068, Australia; [7]Aquatic Plant Control Research Unit, USDA-ARS, 3205 College Av., Ft. Lauderdale, FL 33314, USA.

Within the Fergusoninidae, the sole genus *Fergusonina* contains flies that form galls in obligate association with nematodes on several plant genera in the Myrtaceae. Phylogenetic relationships among *Fergusonina spp.* were investigated using mitochondrial cytochrome oxidase sequence data in order to assess patterns of host-specificity and host-switching in this group. We analyzed multiple larval and adult specimens reared from various gall morphotypes on 20 plant species within the genera *Eucalyptus*, *Corymbia*, and *Melaleuca*. Molecular analysis resulted in clear resolution of fergusoninid species and the relationships among them. Results show that the degree of host specificity of fergusoninids is high, with most species feeding on only a single host plant species and producing only a single gall morphotype. Patterns of host-switching appear to be conservative; most host-shifts have been onto closely related (congeneric) hosts and have been associated with fly speciation. Implications of this work for the use of fergusoninids as biocontrol agents, particularly of the invasive paperbark tree (*M. quinquenerva*) in the Florida Everglades, will be discussed.

Index terms: phylogeny, galls, phytophagous, nematode, mutualism

[3840] DESCRIPTION OF THE NYMPHS AND ADULT GENITALIA OF *ACROSTERNUM (CHINAVIA) UBICUM* (HETEROPTERA, PENTATOMIDAE)

C. F. Schwertner[1], J. Grazia[2] & G. S. Albuquerque[1], [1]Laboratório de Proteção de Plantas, Univ. Est. do Norte Fluminense, Ave. Alberto Lamego, 2000, Campos dos Goytacazes, RJ, 28015-620, Brazil, E-mail: cfs@uenf.br; [2]Dept. Zoologia, Univ. Fed. Rio Grande do Sul, Av. Paulo Gama, s/n, Porto Alegre, RS, 90046-900, Brazil, E-mail: jocelia@ufgrs.br

Several species of *Acrosternum* have been recorded in crops in the American continent, and some may reach pest status, like *A. hilare* in soybean in the United States. In South America, *A. aseadum* is recorded in soybean, *A. impicticorne* in soybean and cotton, *A. marginatum* in soybean and black bean, and *A. bellum* in soybean, black bean, pea, tobacco, okra, wheat, and cabbage, but the nature of their damage is still unknown. On the other hand, there is no host-plant record of *A. ubicum* in the literature, but our preliminary studies have shown that nymphs and adults feed on cowpea and others leguminous plants, like *Crotalaria* spp. A research project under way in the Plant Protection Lab at UENF aims to compare the development of *A. ubicum* individuals fed on native host-plants with those fed on some plants of economic value, to evaluate its ability to adapt to different crops. However, in order to help in the correct identification of this recently described species, we began our project by describing some of its morphological characteristics. The nymphs and adults used in this study were reared on *Crotalaria* sp. under laboratory-controlled conditions. To describe the five nymphal instars, ten individuals from each instar were preserved in alcohol 70%. Information on the color patterns was taken from live specimens. Measurements were performed under a stereomicroscope with a graduated eyepiece. Because the original description of this species does not present the complete characterization of the external and internal genitalia of the adult, and because recent publications on the taxonomy of Heteroptera have emphasized these structures, we also described the genitalia of both sexes. The external genitalia was studied in dried adults, and the males' pygophores were removed from the abdomen after dipping them in Barber's fluid. To study the internal genitalia, the specimens were cleared in KOH, stained with Congo red, and stored in glycerin. The illustrations (nymphal instars and adult genitalia) were made with the help of a drawing tube attached on the stereomicroscope.

Index terms: taxonomy, morphology, reproductive organs, stink bugs

[3841] THE PHYLOGENESIS OF CONIFER/ ANGIOSPERM HOST SHIFT AND DIVERSIFICATION IN GONDWANAN BARK BEETLES

A. S. Sequeira, B. B. Normark & B. D. Farrell, Museum of Comparative Zoology, Harvard University, 26 Oxford Street, Cambridge, MA 02138, USA. E-mail: asequeira@oeb.harvard.edu

We focus on beetles associated with coniferous trees in the genus *Araucaria*, whose Jurassic origin and Gondwanan distribution figure prominently in discussions of continental drift following the Mesozoic break up of Gondwanaland. A goal, therefore, is to discover whether the assembly of these insect plant communities was entirely Mesozoic or includes some more recently dispersed groups as well. Some of the Gondwanan beetle associates of *Araucaria* are also known from Jurassic fossil beds that contain *Araucaria*, and are phylogenetically basal in their respective groups, further corroborating their inferred age. Here we offer our first report on another Gondwanan beetle group associated with *Araucaria*, the scolytid bark beetle subtribe Hylurgonotina (tribe Tomicini, subfamily Hylesininae). The age of the association of Tomicini with *Araucaria* remains an open question. While the worldwide distribution of this diversified tribe and its association with Araucariaceae suggests an ancient origin, bark beetles are only known from the Eocene and members of this tribe are claimed to occupy a very derived position within the Hylesininae. Resolution of the placement of the *Araucaria*-associated Hylesininae could shed light on the age of the bark beetles, which in turn would provide a context for evaluation of the evolutionary consequences of shifts to and from ancient host groups. Here we examine the phylogenetic relationships among the Hylesininae tribes and with members of the Scolytinae subfamily using the DNA sequences of three nuclear genes: protein coding elongation factor alpha (ef1-∝) and portions of two nuclear rDNA fragments, 18s and 28s. The phylogeny obtained from our combined analysis now places the Araucariaceae-associated Tomicini as basal in the Scolytidae. This host association could have been established before flowering plants had appeared. Our combined phylogenetic analysis also shows a single well-supported origin of angiosperm feeding in the Scolytidae, which has been followed by rapid diversification. We argue that the extant diversification of scolytid bark beetles has indeed been shaped by their long standing relation with plant hosts.

index terms: *Scolytidae*, *Araucaria*, DNA sequences

[3842] CHECKLIST OF THE BRENTIDAE (INSECTA, COLEOPTERA, CURCULIONOIDEA) OF THE WORLD

A. Sforzi[1] & L. Bartolozzi[1], [1]Sezione Zoologica "La Specola", Museo di Storia Naturale dell'Università degli Studi di Firenze, via Romana 17, I-50125 Firenze, Italy, E-mail: alessandra@www.specola.unifi.it.

The brentids belong to the weevil superfamily Curculionoidea. Since Kleine's work (1938, Genera Insectorum: Coleoptera, Fam. Brenthidae) no other paper has listed the known species of Brentidae, with the significant exception of De Muizon' s (1960) and Damoiseau's (1967) Monographs on African species. Many changes have occurred since 1938 in the taxonomy and systematics of this family, including the addition of other families, subfamilies or genera of Curculionoidea, not all of which are unanimously agreed upon [see e. g. Morimoto, 1962 (J. Fac. Agric. Kyushu Univ., 12: 21-66), Thomson, 1992 (J. Nat. Hist., 26: 835-891), Kuschel, 1995 (Mem. entomol. Soc. Wash., 14: 5-33), and Alonso-Zarazaga & Lyal, 1999 (A World Catalogue of families and genera of Curculionoidea, excepting Scolytidae and Platypodidae – Entomopraxis, Barcelona, 316 pp.)]. For the preparation of our updated checklist of the Brentidae of the World we decided to follow the classification and nomenclature proposed in the most recent paper of Alonso-Zarazaga & Lyal (1999), who include within the Brentidae Antliarhininae and Cyladinae but not Apioninae. The chapters of the checklist concerning Cyladinae and Antliarrhininae will be written by M. Alonso-Zarazaga and R. Oberprieler respectively. In our checklist 283 genera and 1718 species (excluding *incertae sedis*) are listed, indicating the author and year of description for each taxon. The species name is followed by all its synonyms (with the exception of the *nomina nuda*), each one with the author, year of description and original genus of placement. The location of the type specimens is also given, information we believe to be very useful to present and future workers. A detailed geographical distribution of each taxon is also included, and additional taxonomical, geographical and other information is given in the field 'notes'. The checklist ends with a complete bibliography of the papers concerning Brentidae.

[3843] DESCRIPTION OF THE IMMATURE AND ADULT PHASES OF *PHTHIA PICTA* (HEMIPTERA: COREIDAE)

R. A. da Silva[1], G. S. Carvalho[1,2] & P. S. Flores[1], [1]Dept. Fitossanidade, Univ. Fed. do Rio Grande do Sul, P.O. Box 776, Porto Alegre, RS 90001-970, Brazil; [2] Dept. Biologia, Pont. Univ. Católica do Rio Grande do Sul, P.O. Box 1429, Porto Alegre, RS 90619-900, Brazil, E-mail gervasio@pucrs.br.

The tomato culture has great social and economic importance to Brazil. Among the agents that make difficult the production of tomato for *in natura* consumption is *Phthia picta*, a bug considerate an important pest of this culture. The damage happens when nymphs and adults feeding on fruits. There is not a morfological characterization about this bug, so, it was developed this work aiming to describe the immature and adult phases, for better identification mainly in the field. The study was carried out in the Laboratório de Entomologia, Departamento de Fitossanidade, Faculdade de Agronomia, UFRGS, with insects created using as food leaves and fruits of tomato (cultivars: Empire, Santa Clara and Carmen). The drawings was made using microscope with "drawing attchment", from insects conservated in alcohol 70%. Resulted from this work a full morphological description of the immature and adult phases, with drawings in dorsal view from all of them.
Index terms: bug, tomato, morphology,

[3844] REVISION AND PHYLOGENY OF THE SPECIES OF *EXOMALOPSIS (PHANOMALOPSIS)* (HYMENOPTERA: APIDAE)

F. A. Silveira[1] & E. A. B. Almeida[2], Laboratório de Sistemática e Ecologia de Abelhas, Depto. de Zoologia, Univ. Federal de Minas Gerais, C.P. 486, Belo Horizonte, MG 31270-901, Brazil. E-mails: [1]fernando@mono.icb.ufmg.br; [2]ealmeida@mono.icb.ufmg.br.
Support: Brazilian Council for the Development of Science and Technology (CNPq)

Phanomalopsis was believed to be a monophyletic taxon (*sensu* Hennig), after the recent transference of *Exomalopsis solani* and related species to *Stilbomalopsis*. As considered here, *Phanomalopsis* comprises 13 species (of which 4 are described as new). The group extends from the Argentinean pampas to southern Texas (USA), being more diverse in temperate and semiarid regions to the south of the Amazonian forest. Nevertheless, no species is known from the tropical semiarid "caatinga" of Brazil. Only one species – *E. snowi* – occurs to the north of the Amazonian basin and only one – *E. atlantica* – is endemic in forest environments (the Atlantic rain forest). Approximately 60 characters of external morphology and genitalia were employed in a cladistic analysis to propose a phylogenetic hypothesis for the group. The analyses suggested that *E. solitaria* (and maybe *E. diminuta)* should not be part of *Phanomalopsis* because of the absence of some of the synapomorfies for the group. A monophyletic apical group of species dwelling in xeric habitats is composed by *E. dasypoda*, *E. jenseni*, *E. testaceinervis* and two new species (all from southern South America) and *E. snowi* which inhabits dry areas of northern South America, Central and North America.
Index terms: Exomalopsini, taxonomy, Neotropics, bee

[3845] TAXONOMY OF *SIMULIUM (PSARONIOCOMPSA)* (DIPTERA, SIMULIIDAE) IN THE SOURTHERN REGION OF BRAZIL AND ARGENTINA, WITH A NEW SPECIES DESCRIPTION

M. N. Strieder[1] & S. Coscarón[2], [1]Lab. de Entomologia, Centro de Ciências da Saúde, UNISINOS, Caixa Postal 275 – CEP 93022-000, São Leopoldo, RS – Brasil, E-mail: strieder@cirrus.unisinos.br; [2]Dep. de Zoologia de la Facultad de Ciencias Naturales y Museu de La Plata, Paseo del Bosque S/No., 1900, La Plata, Argentina, E-mail: museu@isis.unlp.edu.ar

Belonging to the subgenus *Psaroniocompsa* Enderlein, 1934, eleven species are reported for southern Brazil and northeastern Argentina of which four share high morphological similarities what makes it difficult to differentiate them, especially when occurring in the same water course and presenting intermediate characters. This may lead to consider all *Simulium* (*P.*) *angrense*, *Simulium* (*P.*) *auripellitum*, *Simulium* (*P.*) *bonaerense* and *Simulium* (*P.*) *jujuyense* as a species complex. Simuliidae collections of the La Plata Museum and the Entomology Laboratory of UNISINOS, comprised of specimens from several different localities of Rio Grande do Sul state, Brazil and Argentina were reviewed. Among those considered *S.* (*P.*) *auripellitum* there were specimens morphologically distinct. These differences support a species status and must be well known to separate as a different taxon from *S.* (*P.*) *auripellitum*. Diagnostic characteristics are described to larvae, pupae, males and females allowing to morphologically distinguish this species as a separated taxon from *S.* (*P.*) *auripellitum* as well as other similar species from "*incrustatum* group". This new species is natural of the northeastern region in Argentina and several localities in Rio Grande do Sul, Brazil; its immature forms were collected in water streams of high flow, mainly on immersed riparian vegetation.
Index terms: Diptera, Simuliidae, *Simulium* (*Psaroniocompsa*).

[3846] EVOLUTIONAL ASPECTS OF A WINGLESS AND LEGLESS FEMALES IN THE FAMILY PSYCHIDAE (LEPIDOPTERA)

M. Sugimoto[1] & T. Saigusa[2], [1]Biosystematics Laboratory, Graduate School of Social and Cultural Studies, Kyushu Univ. , Fukuoka, 810-8560, Japan, E-mail: osugircb@mbox.nc.kyushu-u.ac.jp; [2]Baikoen 2-7-1-402, Fukuoka, 810-0035, Japan.

In the family Psychidae, body structure and behavior have evolved closely with each other, with females displaying remarkable morphological and behavioral diversities which have been classified in four grades (Saigusa, 1962). In the present work, we observed the morphology and behavior of females of the wingless-legless grade (delta grade), and compared the results with those of the wingless-legged grade (gamma grade) of Dierl (1964). The following aspects are clarified: (1) Function of legs: In the gamma grade, a few tergopleural and pleurocoxal muscles are present together with leg muscles in the shortened legs, with which the female can grasp the lower portion of the larval case. In the delta grade, no muscles including tergopleural are found in the ventral portion of the thorax and in the extremely reduced papilla-like legs, but the mesothorax has dorsal longitudinal muscles that are absent in the gamma grade. (2) Movement of body: In the gamma grade, the female maintains a C-shaped posture, not freely moving her abdomen, with fine, sparse, widely separated dorsoventral muscles in the lateral portions of the abdominal segments. In the delta grade, the dorsoventral muscles densely cover the lateral portions of abdominal segments 1-7, and are possibly developed for vermicular movement of the female in her pupal exuviae. (3) Egg laying behavior: In the gamma grade, the anterior and posterior apophyses are long and well developed, to which long well-developed dorsal and ventral longitudinal muscles are attached. These structures enable the female to greatly extend her ovipositor, inserting it into the pupal exuviae for oviposition. In the delta grade, both apophyses are very short and reduced, and may even be obliterated. In this grade, the dorsal longitudinal muscles are attached near the apophyses, which have no muscles to extend it. This condition is associated with the female behavior of remaining within by her pupal exuviae, laying eggs inside and not extending her ovipositor, and also accompanied by specialized copulatory behavior. (4) Head: In the gamma grade, the antennal muscles are present, but in the delta grade, the antennae are reduced to small processes, and the muscles are entirely obsolete. On the other hand, in the gamma grade the dilator muscles of the pharynx are few. While in the delta grade, many dilator muscles including the clypeo-pharyngeal and tentorio-pharyngeal muscles are more developed than in the gamma grade, and considered reminiscent to the condition in males that appear to use these muscles to suck air into the alimentary canal to inflate his abdomen during copulation.
Index terms: musculature, behavior, phylogeny, reduction, grade.

[3847] PHYLOGENY OF EMBIOPTERA (INSECTA) REVISITED

C. A. Szumik, Inst. Superior de Entomología, Univ. Nac. de Tucumán, Miguel Lillo 205, 4000, S.M. de Tucumán, Tucumán, Argentina, E-mail instlillo@infovia.com.ar.

The order Embioptera (Embiidina) is an attractive group for phylogenetic analysis. It is a well defined relictual group of Insecta, and contains a very few taxa (300 species), which makes it possible to have a close look at its classification. In a previous study of the higher classification of the order (Szumik, 1996), 41 taxa and 36 characters were cladistically analyzed; only Anisembiidae and Australembiidae resulted monophyletic, Oligotomidae and Notoligotomidae resulted paraphyletic, and Embiidae was poliphyletic. Teratembiidae was represented by just one terminal and Clothodidae was used as root taxon; thus the monophyly of neither family could be tested. The position of some other taxa (*Microembia*, *Enveja*) was poorly supported (i.e. many suboptimal trees placed them in very different positions). A new cladistic analysis is presented here, adding more taxa (94 species of 43 genera) and many new characters (a total of 108 morphological characters). The new data matrix is analyzed with implied weighting (Goloboff, 1993, 1997). The results and the relationships of the families and genera are discussed.
Index Terms: Embioptera, Classification, Phylogeny.

[3848] A NEW GENUS OF CICADELLINI (HEMIPTERA: CICADELLIDAE) FROM SOUTHEASTERN BRAZIL.

D. M. Takiya[1,3], G. Mejdalani[2] & M. Felix[1], [1] Dep. de Zoologia, Inst. de Biologia, Univ. Fed. do Rio de Janeiro (UFRJ), C. P. 68044, Rio de Janeiro, RJ 21944-970, Brasil; [2] Dep. de Entomologia, Museu Nacional, UFRJ, Quinta da Boa Vista, São Cristóvão, Rio de Janeiro, RJ 20940-040, Brasil; [3] E-mail: takiya@acd.ufrj.br.

A new leafhopper genus from southeastern Brazil is described and illustrated based on a new species. The new genus is placed in the nominate tribe of the subfamily Cicadellinae, although it presents the knees of the posterior legs, at rest, not attaining the lateral lobes of the pronotum, which is a characteristic feature of the tribe Proconiini. It can be distinguished from other Neotropical Cicadellini genera by the combination of the following features: (1) crown produced anteriorly, with disk sculptured with punctures, (2) forewings without an anteapical plexus of veins, (3) first tarsomere of hind legs with two undifferentiated parallel rows of setae, (4) male styles very elongate, (5) aedeagus short and broad, without lateral flanges, (6) paraphyses stalked and symmetrical, and (7) female genital chamber with sclerotized internal sternite VIII. The new genus is placed in the *Cicadella* generic group and appears to be more closely related to the Chilean genus *Helocharina* and to the southern South American genus *Syncharina*. The new species is known only from the adjacencies of the National Park of Itatiaia, between Rio de Janeiro and Minas Gerais states, where it appears to inhabit different microhabitats and probably feeds on different host plants. Specimens were collected on Umbelliferae shrubs in a high altitude field, on an *Eucalyptus* tree in a forest border, and on a damp habitat composed mainly by *Senecio icoglossus* (Compositae) and one Cyperaceae species. Notes on the biology of some other leafhopper species from the same region are given.
Index terms: Cicadellinae, new species, taxonomy, Neotropics.

[3849] SYSTEMATICS AND PHYLOGENY OF CECIDOMYIIDAE (DIPTERA)

R. Tastás-Duque, Dept. of Zoology, Univ. Of Stockholm, S-106 91 Stockholm, Sweden, E-mail zeke.tastas@framfab.se.

The phylogeny of the family was studied integrating previously known morphological characters with new ultrastructural and larval characters. The results of the analyses indicate that the conventional classification of gall midges in two or three subfamilies (Lestremiinae, Porrycondylinae, and Cecidomyiinae) is based on paraphyletic assemblages of genera sharing plesiomorphous conditions. According to both manual and computer assisted phylogenetic analyses, the family is composed of at least nine subfamilies: Catotrichinae, Lestremiinae, Catochinae, Micromyiinae, Heteropezinae, Diallactinae, Winnertzinae, Porrycondylinae, and Cecidomyiinae. A key to subfamilies is included.

[3850] DRUMMING, SKIMMING, AND EVOLUTION OF FLIGHT: A NEW PHYLOGENY OF PLECOPTERA

M. D. Terry & M. F. Whiting, Dept. of Zoology, Brigham Young Univ., Provo, UT 84602, USA, E-mail MDT36@email.byu.edu.

DNA sequence data sets representing all major groups of North American Plecoptera and limited Southern Hemisphere taxa have been assembled for ~50 taxa. These data sets consist of 18S ribosomal DNA, 28S ribosomal DNA, and Cytochrome Oxidase II (~4.4 kB per taxon). These data support the monophyly of all recognized plecopteran families, suggest a basal placement of Nemouridae + Notonemouridae, and support Taeniopterygidae + Leuctridae. The subordinal designation Systellognatha is monophyletic, however Euholognatha appears paraphyletic. Prenuptial "drumming" is most complex in highly derived clades, however polarity and derivation of specific drumming behaviors requires further examination. Skimming behavior in Taeniopterygidae and Leuctridae appears to be a derived character relative to the Plecoptera, with a single origin in the MRCA of Taeniopterygidae + Leuctridae, and subsequent derivation of more complex skimming in the Leuctridae. It is not, however, an ancestral condition for Plecoptera, suggesting that flight did not evolve from a skimming precursor, as suggested by Marden and Kramer (1994, 1997).

Index Terms: Molecular Phylogeny, insect flight, behavior, Leuctridae, Taeniopterygidae

[3851] DISCRIMINATION OF NINE THRIPS SPECIES (THYSANOPTERA: THRIPIDAE) BY PCR-RFLP ANALYSIS

S. Toda & S. Komazaki, Persimmon and Grape Research Center, National Institute of Fruit Tree Science, 338-1 Mitsu, Akitsu, Hiroshima 729-2494, JAPAN, E-mail toda@akt.affrc.go.jp

Thrips is a major pest of fruits, vegetables and ornamental crops. In Japan, 10 species were known as pests of fruit trees. Since their immature stages are morphologically similar among species, high expertise is required for identifying species. We conducted PCR-RFLP analysis to discriminate them easily. Nine species, *Frankliniella occidentalis*, *F. intonsa*, *Thrips hawaiiensis*, *T. coloratus*, *T. flavus*, *T. tabaci*, *T. palmi*, *T. setotus*, and *Scirtothrips dorsalis* were studied. All of them were collected from 2-5 different sites in Japan. *Ponticulothrips diospyrosi* was not analyzed because it has characteristic morphology and can be discriminated from other species easily. The Internal Transcribed Spacer 2 (ITS2) region of ribosomal DNA was amplified by PCR with specific primers. Single fragment was amplified in each species. Some species was not distinguished by the sizes of amplified fragments because size difference was small. Then fragments were digested by 17 kinds of restriction endonucleases. Eight of them digested PCR products. Two endonucleases, *Pst*I and *Rsa*I, digested ITS2 fragments of all species. *Pst*I digested only one site and their banding patterns were non-characteristic. This endonuclease was not useful for discrimination. *Rsa*I had many recognized positions in all species and showed variable banding patterns. These patterns were peculiar to each species. Moreover, each pattern was always identical in different developmental stages and local populations. We concluded that PCR amplifying ITS2 and digestion by *Rsa*I is the best method for discriminating fruit tree thrips.

Index terms: fruit tree, ITS2, endonuclease.

[3852] CLADISTIC ANALYSES OF THE JAPANESE TIPULIDAE (DIPTERA). PART I: PHYLOGENY OF THE TRIBE PEDICIINI (LIMONIINAE)

T. Torii, Department of Biology, Keio Gijuku Senior High School, Hiyoshi, Yokohama C., Kanagawa Pref. 223-0061, Japan; E-mail: glochina@air.linkclub.or.jp

The Pediciini are crane flies with their size being small to very large. Typical members have the following morphological features: compound eyes with short hairs between ommatidia; Sc1 very long, exceeding fork of Rs; Sc2 basal to origin of Rs. In this study, a phylogenetic relationship of the Japanese Pediciini (eleven genera and subgenera) is discussed on the basis of the cladistic analysis of adult morphological characters. In total 50 characters, mainly from wing venation, are evaluated. The results are the following: 1) The tribe Pediciini is a monophyletic group having hairy compound eyes as a synapomorphy, the lack of which was caused by the reversal; 2) Two subgenera of *Pedicia*, s.lat. and four subgenera of *Dicranota*, s.lat. should be raised to full generic status; 3) It is not appropriate to divide the tribe into two subtribes, Pediciaria and Ularia, because the former subtribe would be paraphyletic. Index terms: Pediciaria, paraphyletic, Ularia, *Pedicia*, *Dicranota*.

[3853] CLADISTIC ANALYSES OF THE JAPANESE TIPULIDAE (DIPTERA). PART II: PHYLOGENY OF THE GENUS *ANTOCHA* RECORDED FROM JAPAN AND ITS ADJACENT AREA (LIMONIINAE: LIMONIINI)

T. Torii, Department of Biology, Keio Gijuku Senior High School, Hiyoshi, Yokohama C., Kanagawa Pref. 223-0061, Japan; E-mail: glochina@air.linkclub.or.jp

Antocha is a crane fly genus with its size being small to medium. Typical members have the following wing features: anal angle prominent; Sc close to R, Sc2 not evident; basal section of Rs usually straight, diverging from R1. Until present, 18 species of the genus *Antocha* were recorded from Japan, Korea Peninsula, and far east Russia. In this study, a phylogenetic relationship of the 18 species is discussed on the basis of the cladistic analysis of adult morphological characters. In total 30 characters--mainly from male and female terminalia, and wing venation--are evaluated. The results are the following: 1) Sixteen species are arranged in one clade showing dichotomous branchings; the relationship among the clade and the other two species is left trichotomous; 2) Subgenus *Proantocha* is monophyletic, while subgenus *Antocha* is paraphyletic. Index terms: *Antocha* (*Proantocha*); *Antocha* (*Antocha*); paraphyletic.

[3854] PHYLOGENETIC ANALYSIS FROM SUPERTRIBE LASIOPTERIDI (DIPTERA: CECIDOMYIIDAE), WITH FOCUS IN THE POSITION OF *TROTTERIA*

M. V. Urso-Guimarães[1] & D. S. Amorim[2], [1,2]Depto. de Biologia, FFCLRP, Universidade de São Paulo, 14040-901 Ribeirão Preto SP, BRAZIL. E-mail: [1]mvirgini@usp.br; [2]dsamorim@usp.br.

A phylogenetic analysis of the Lasiopteridi was performed trying to determine the phylogenetic position of genus *Trotteria*, previously placed in a monotypic subtribe Tortteriini, supposed to be somewhat close to the Oligotrophini. A total of 32 characters from adult morphology were used to determine the relative position of 28 Neotropical and Nearctic genera of six tribes of Lasiopteridi —Alycaulini, Lasiopterini, Ledomyiini, Oligotrophini, Trotteriini and Camptoneuromyiini. As outgroups, three tribes of Cecidomyiidi (Asphondiliini, Cecidomyiini and Lopesiini) were considered, as well as species of other subfamilies of Cecidomyiidae and other Sciaroidea families. The data matrix was analyzed using with numerical cladistic programs. The transformation series were gradually constructed using a system of reciprocal illumination, with verification and correction of errors and problems of primary homology, codification and polarization considering the incongruence among the data in successive analyses of the data matrix. Because of the main focus of the analysis, the results are obviously provisional for various parts of the phylogeny, but some levels seem to be well corroborated. The accepted topology shows that Lasiopteridi and the Oligotrophini probably correspond to paraphyletic arrangements; also, that the Cecidomyiidi, usually placed as a supertribe apart, has as sister-group the taxon composed of the following subset of tribes previously belonging to the Lasiopteridi: Ledomyiini, Camptoneuromyiini, Trotteriini, Lasiopterini, Alycaulini, Arcivena. It is possible that Camptoneuromyiini is the closest taxon to *Trotteria*. Lasipteridi and Oligotrophini in their present arrangements are names that may have to be abandoned in future classifications of the Cecidomyiidae or modified to apply to natural (monophyletic) groups. A preliminary study of historical ecology point that an Asteraceae may correspond to the host of the ancestral species of gall makers of the set of tribes related to the Camptoneuromyiini.

Index words: phylogenetic systematics, Cecidomyiidae, Diptera.

[3855] NOT ALL *SCIOMYZIDAE* KILL MOLLUSKS : *SEPEDONELLA NANA* EATS WORMS

J-C. Vala[1], G. Gbedjissi[2], L. Knutson[3] & C. Dossou[2], [1] Faculté des sciences, 33 rue Louis Pasteur, 84000 Avignon, France, e-mail : jean-claude.vala@univ-avignon.fr; [2] UNB, Box 526, Cotonou, Republic of Benin, e-mail : gbedjiss@syfed.bj.refer.org; [3] 4, rue des Erables, 34830 Clapiers, France, e-mail lvknutson@aol.com

Among the 125 ± families of Diptera, Sciomyzidae are the only one considered to feed exclusively on mollusks during larval life. Life cycle studies of about 190 of the 511 ± described species have shown that the larvae attack various families of aquatic and terrestrial gastropods, and bivalve Sphaeriidae. Species are predators or parasitoids, or have mixed behaviors, beginning as a parasitoid, continuing as a predator, and some continue to feed on the decaying tissues of the prey. The feeding behavior indicates the value of sciomyzids as potential biocontrol agents against some snail intermediate hosts of parasitic diseases (e.g. schistosomiasis). All 3 larval stadia of *Sepedonella nana* reared in Benin are efficient predators of *Aulophorus furcatus*, (Annelida: Oligochaeta: Naididae) which lives hidden inside a tube it constructs for protection. During the development period (14 to 21 days) each larva eats 10 to 21 worms. Generally there is only 1 larva and 1 oligochaete per tube, sometimes there are 2 per tube with 1 larva at each end. The extraordinary oligochaete feeding of *S. nana* seems to destroy the concept of the monophyly of the Sciomyzidae as being based largely on the malacophagy of their larvae. Without question, *S. nana* is a true sciomyzid and the morphology of the larva is typical of aquatic species. The posterior disc of the larva has well-developed hydrofuge setae and elongate lobes, the cephalopharyngeal skeleton has the typical serrate ventral arch, which remains as the sole apomorphic feature of all sciomyzid larvae. In the Afrotropical Region (only 5 life cycles of the 62 ± species known) other unusual food sources probably can be found.

Keys words: feeding behavior, Oligochaeta, Afrotropical Region

[3856] SYSTEMATIC POSITION OF TWO POLYMORPHIC SPECIES OF CHELYMORPHA BOH. (COLEOPTERA: CHRYSOMELIDAE: CASSIDINAE)

J. Vasconcellos-Neto [1], D. Windsor [2], Z. J. Buzzi [3] & V. Rodriguez [2], [1] Universidade Estadual de Campinas - Inst. Biologia - Depto. Zoologia. Campinas, SP, Brazil, 13083-970. E-mail: jvascont@obelix.unicamp.br; [2] Smithsonian Tropical Research Institute, Apartado 2072, Balboa, Panama.; [3] Universidade Federal do Paraná, Dpto de Zoologia, 80000 Curitiba,PR,Brazil.

The genus *Chelymorpha*, first mentioned by Chevrolat Dej. Cat., was created by Boheman (18544 in the second volume of *Monographia Cassidarum*. According to Spaeth (1909) the essential characteristics of the genus are " the head not totally hidden under pronotum; conformation of antennal groove and the ventral side of the pronotum adjacent; the conformation of pronotal bases, the tooth of the tarsal claws and the absense of one line of punctuations separating the discal margin form the disc. The strange conformation of the prosternum cannot be considered as essential character of the genus because there exist modifications in some species as in some individuals". *Chelymorpha* has 101 species, distributed between Patagonia and Canada ((Blackwelder, 1946) the genus received relatively little asttention ; only five studies on the biology os species in this group are known. Some valid species are really chromatic forms within a single highly polymorphic species. Zollessi (1968) and Vaio et al. (1975) described the morphological variability existing within *C. variabilis*. Vasconcellos-Neto (1987, 1988) studied the genetic bases of eight morphological forms of c. cribraria. Windisor also studied three forms of C. alternans occuring in Panama. Utilizing information from genetic crosses, external morphology and internal gennitalic morphology, we found at least 14 *Chelymorpha* species existing in diverses localities of south America should be united under a single name, *Chelymorpha cribraria* F. 1775. We also found three species in Central America should be unified, at least temporarily, under the name *Chelymorpha alternans* Boh. 1854 . Interespecific mating was easily obtain under laboratory conditions, and both species of femeles laid infertile eggs.

[3857] CONTRIBUTION TO THE KNOWLEDGE OF BUTTERFLIES IN THE COIBA NATIONAL PARK, PANAMA. *(LEPIDOPTERA: PAPILIONOIDEA)*

J. L. Viejo[1], J. L. Nieves[2], F. Fontal[2], L Romera[1] J. Fernández[1] & C. Sánchez[1], Dep. de Biología, Univ. Autónoma, Cantoblanco 28049 Madrid, Spain, E-mail joseluis.viejo@uam.es; [2]Museo Nacional de Ciencias Naturales, Madrid, Spain.

In this paper we present the first faunistic results relating to the lepidoptera of the Coiba National Park (Panama), obtained from four entomological campaigns carried out between 1994 and 1996. The Coiba National Park is situated in the Pacific Ocean, some 50 km from the west coast of Panama, on the south-western border of the Gulf of Chiriqui approximately between the coordinates 7° 10' 4" and 7° 53' 27' N, and 81° 32' 35" and 81° 56' 15" W. It has an area of 270125 Ha, of which 53528 Ha are insular territory and the rest (216543 Ha) is a marine area. 94% of the insular territory corresponds to the island of Coiba, of 50314 Ha, the largest island of the central American Pacific. There are also eight smaller islands and some 30 islets. In total we identified 276 examples, from 71 species of butterflies of the following families and subfamilies: *Papilionidae (Papilioninae), Pieridae (Dismorphiinae, Pierinae and Coliadinae), Nymphalidae (Charaxinae, Nymphalinae, Heliconiinae, Ithomiinae, Morphinae, Brassolinae and Satyrinae), Riodinidae and Lycaenidae*. We report the presence of 11 species of riodinids, 15 lycaenids, 27 nymphalids, 12 pierids and 6 papilionids in the Coiba National Park. This number is very low compared with the 550 species present in the whole of Panama (including only data from papilionids, pierids and nymphalids, according to DEVRIES, 1987). This can be attributed to two causes. Firstly, our still insufficient knowledge of the butterfly fauna of the Coiba, and secondly to the insular character of the area, which undoubtedly favours the impoverishment of the fauna.

Index terms: Papilionidae, Pieridae, Nymphalidae, Riodinidae, Lycaenidae

[3858] TAXONOMY AND PHYLOGENY OF AFROTROPICAL *MONOLEPTA* AND RELATED TAXA

T. Wagner, Zoologisches Forschungsinstitut und Museum Alexander Koenig, Adenauerallee 160, D-53113 Bonn, Germany.

In the last catalogue of the Galerucinae, about 300 species of *Monolepta* Chevrolat 1837, *Candezea* Chapuis, 1879, and *Barombiella* Laboissère, 1931 from tropical Africa are listed. Most of these species were described between 1890 and 1950 whilst for the last 35 years no further species have been described from Africa. The allocation of these `MonoleptitesA to genera was mostly purely typological, and inconsistently by the plural authors. A taxonomic-phylogenetic revision, including genitalic characters was started. Species rich groups of these chrysomelids have been found to be polyphyletic, many species need to be transferred to other monophyletic groups and many synonyms were found. For the afrotropical fauna, about 80 valid species will be left in *Monolepta*, 30 species in *Candezea*, and 15 species in *Barombiella* only. Furthermore, few *Monolepta* species from South East Asia and Australia were investigated. Most of these species are not congeneric to afrotropical *Monolepta* in a phylogenetical sense, and need to be transferred to other groups also.

Index terms: Chrysomelidae, Africa, revision

[3859] PATTERN OF PHYLOGENETIC RELATIONSHIPS AMONG MEMBERS OF THE TRIBE MELITAEINI (LEPIDOPTERA: NYMPHALIDAE) INFERRED FROM MITOCHONDRIAL DNA SEQUENCES

Niklas Wahlberg[1] and Marie Zimmermann[2]. [1]Metapopulation Research Group, Dept. of Ecology and Systematics, Div. of Population Biology, FIN-00014 Univ. of Helsinki, Finland, E-mail niklas.wahlberg@helsinki.fi; [2]UPRES Biodiversité, Laboratoire de Systématique Evolutive, Université de Provence, Centre Saint Charles, Marseille, France

We report a cladistic analysis of 77 butterfly species of the tribe Melitaeini (Lepidoptera: Nymphalidae) based on mitochondrial DNA gene sequences. We sequenced ca. 536 bp from the 16S rDNA and a 1422 bp sequence from the cytochrome oxidase I gene. Our results suggest that many of the previously proposed genera are paraphyletic and we conclude that there are four distinct groups of species in our phylogeny: the *Euphydryas* group, the *Phyciodes* group, the *Chlosyne* group and the *Melitaea* group. The following genera are found to be paraphyletic: *Castilia*, *Chlosyne*, *Didymaeformia*, *Eresia*, *Melitaea* and *Thessalia*. In addition, recognition of the monophyletic genera *Cinclidia*, *Mellicta* and *Telenassa* would render other genera paraphyletic. Our phylogenetic hypothesis indicates that the melitaeines have originated in the Nearctic and have colonized the Neotropics three times and the Palaearctic twice.

Index terms: molecular phylogeny, Melitaeini, Nymphalidae, Lepidoptera

[3860] ON THE GROUNDPATTERN OF THE REDUVIIDAE (HEMIPTERA, HETEROPTERA)

C. Weirauch, Freie Univ. Berlin, Inst. f. Zoologie, Koenigin-Luise-Str. 1-3, 14195 Berlin, Germany

The groundpattern of a monophyletic group consists of the total of plesiomorphic and apomorphic characters atttributed to the ancestral stem species of this group. This groundpattern provides a point of reference for phylogenetic analysis of subordinate taxa in the given group as well as for a comparison with other groups. The Reduviidae are one of the largest taxa recognized in the Cimicomorpha. Reduviidae and their sistergroup, the Pachynomidae, are supposed to represent the basal branch in the Cimicomorpha, based on characters of the pregenital abdomen, the female internal genitalia, and the wings. Pachynomidae are known as the sistergroup of the Reduviidae and share with them such characters as the pedicellar trichobothria, the so-called Brindley gland, pseudospermathecae, a metacoxal comb and labial structures. The monophyly of the Reduviidae is supported by an unique apomorphic prosternal stridulitrum, absence of a costal fracture on the mesothoracic wing, absence of a maxillary lever and absence of cephalic and ocellar trichobothria. Although a number of monophyletic groups can be recognized within the Reduviidae, their interrelationships are still mostly obscure. By phylogenetic analysis of subordinate taxa of the Reduviidae, I reconstruct the groundpattern of this group. My analysis is based on data from the literature and on morphological studies of chosen character complexes. I investigated external and internal head structures, e.g. head capsule sclerites, arrangement of the labial musculature, and stylet structure. I also studied characters of the thorax and its appendages, including the extension of pleural sclerites (e.g in the groundpattern: no contribution of metepisternal lobe to suprcoxal cavity of mesothorax), evaporatory structures of the metathoracic gland, the evaporatory system of the Brindley gland, tibial adhesive pad and pretarsal structures. Abdominal structures included e.g. the position of the first abdominal spiracle (e.g. in the groundpattern it lies in the thoracico-abdominal membrane) and female and male external and internal genitalia. Further, some diagnostic characters, which are often cited as „typical" for assassin bugs, such as the apparently three-segmented rostrum or the type of external male genitalia, do not belong to the groundpattern of the Reduviidae. In the male external genitalia, the dorsal phallothecal sclerite and the „struta" develop just within the Reduviidae. This is also true for the fusion of the first rostral segment with the head capsule to result in the apparently three-segmented „typical reduviid" rostrum.

Keys words: Cimicomorpha Phylogeny Morphology

[3861] RESOLVING HIGHER RELATIONSHIPS OF ACALYPTRATE DIPTERA: A STRATEGY FOR PROGRESS

T. A. Wheeler, Dept of Natural Resource Sciences, McGill Univ, Macdonald Campus, Ste-Anne-de-Bellevue, Quebec, H9X 3V9, Canada

Most current hypotheses on higher classification of acalyptrate Diptera are unsatisfactory. There are various reasons for this but examination of too few exemplar taxa, reliance on problematic characters and "noise" introduced by highly autapomorphic taxa are common to many of the hypotheses. Resolving the current taxonomic problems will depend on critical study of a range of character suites in key families, inclusion of sufficient exemplar taxa to give adequate resolution of groundplans and subsequent evolutionary trends within lineages, and less reliance on highly autapomorphic taxa at early stages in building higher classifications. The genera related to *Paraleucopis* Malloch will be used to illustrate the major taxonomic changes that may result from more comprehensive studies. Schizophora, *Paraleucopis*, phylogeny; systematics.

[3862] A NEW SPECIES OF *LEIOPHRON* (HYMENOPTERA: BRACONIDAE) FROM ARGENTINA

L. H. Williams, III[1], G. A. Logarzo[2] & S. R. Shaw[3], [1]USDA-ARS SIMRU, P.O. Box 346, Stoneville, MS 38776-0346, USA, E-mail livy@ars.usda.gov; [2]USDA-ARS SABCL, Bolivar 1559 (1686), Buenos Aires, Argentina; [3]Entomology Section, Dept. of Renewable Resources, Univ. of Wyoming, Laramie, WY 82071-3354, USA.

Plant bug (Hemiptera: Miridae) nymphs were field-collected from host plants in Argentina in 1999 and 2000. Several species of plant bugs were collected from more than 40 species of host plants in 12 provinces. We discovered *Leiophron* n. sp. (Hymenoptera: Braconidae) parasitizing nymphs collected in 7 provinces. This poster reports preliminary data on field parasitism, diapause, and other aspects of the wasp's biology, and provides a taxonomic description for the wasp. New host records are given for mirids as well.
Index terms: Miridae, *Taylorilygus*, plant bugs, nymphal parasitoids.

[3863] A SYSTEMATIC STUDY OF THE SUBFAMILY LYCAENINAE (LEPIDOPTERA, LYCAENIDAE)

M. Yago[1] & T. Saigusa[2], [1]Biosystematics Laboratory, Graduate School of Social and Cultural Studies, Kyushu Univ., Ropponmatsu, Chuo-ku, Fukuoka, 810-8560, JAPAN, E-mail: yagorcb@mbox.nc.kyushu-u.ac.jp; [2]Baikoen 2-7-1-402, Fukuoka, 810-0035, Japan, E-mail: saigurcb@mbox.nc.kyushu-u.ac.jp.

The subfamily Lycaeninae (s. str.) contains some 100 nominal species belonging to 19 genera and 5 subgenera. Although the basic structure of the male genitalia is quite uniform in this subfamily, wing shape and wing markings are extremely diverse. These wing characters appear to be frequently evolved independently frequently, therefore early classifications based on these external features were often artificial. More recent classifications are based on genital characters (Sibatani 1974, Zhdanko 1983, 1990, 1993a, 1993b, 1995), but no cladistic analysis of intergeneric relationships in this subfamily has been published, except for an analysis of Nearctic genera (Miller & Brown 1979). In this study, we propose a generic classification of the Lycaeninae in accordance with the phylogenetic relationships, which were inferred from a cladistic analysis based on adults representing 74 of some 100 species. We examined external morphology in detail, especially male and female genitalia, including male genital musculature, and selected 81 characters for the phylogenetic analysis. In this analysis, 34 species of Lycaenidae were selected from the ingroup (29) and outgroups (5). The ingroup was represented by type species of 19 genera and 5 subgenera, and 5 species of which generic assignment appears weakly supported. Outgroup exemplars were selected from 3 lycaenid subfamilies, Curetinae, Theclinae and Polyommatinae. A Heuristic search was performed using PAUP 4.0b1 with the addition sequences 'random' option (100 replications) chosen. Based on the result of this analysis, we propose a new system, in which the Lycaeninae consist of 21 genera and 6 subgenera, including 1 new genus and 2 new subgenera. Although 21 species were not examined in this study, all known species in this subfamily were assigned to genera. Key points of its systematics are as follows: (1) A new genus should be founded for *Lycaena orus* and *L. clarki*. (2) A new subgenus assigned to *Helleia* should be founded for *Helleia salustius*, *H. feredayi* and *H. rauparaha*. (3) A new subgenus of *Heliophorus* should be founded for *H. kiana*. (4) Genus *Boldenaria* was considered a junior synonym of the subgenus *Antipodolycaena*. (5) Subgenus *Apangea* was raised to generic status and included 5 species. (6) Subgenus *Phoenicurusia* of genus *Thersamolycaena* was raised to generic status. (7) Genus *Chalceria* was treated as a subgenus of *Gaeides*.
Index terms: *Lycaena*, *Helleia*, *Heliophorus*, generic classification, phylogeny.

[3864] MOGOPLISTIDAE (ORTHOPTERA: GRYLLOIDEA) OF TAIWAN WITH LECTOTYPE DESIGNATION OF SHIRAKI'S SPECIES

J. T. Yang & F. S. Yen, Dept. of Entomology, National Chung-Hsing Univ., Taichung, 402, Taiwan ROC, E-mail jtyang@dragon.nchu.edu.tw

Twelve species and 5 genera of the scaly crickets, Mogoplistidae from Taiwan were studied in this revision work. The specimens were collected from the island of Taiwan and its adjacent off-shore islands. Three of them are new species, i.e., *Ornebius fastus* n. sp., *Ectatoderus luctisonus* n. sp. and *Micrornebius perrarus* n. sp. The species *Cycloptiloides orientalis* is a new record to Taiwan. This species was occasionally found inside the building of Agricultural Environment Sciences which was just constructed in the campus of National Chung-Hsing University, Taichung, Central Taiwan. It is may be introduced through the transportation with the constructive materials. Seven species of this family which were published by Dr. T. Shiraki were checked and lectotypes were designated in this study. The former name of the original types depository of Entomological Museum, Research Institute of Government, Taihoku, Formosa was changed into the insect collection of the Department of Entomology, National Taiwan University, Taipei.
Index terms: scales, crickets, taxonomy, fauna, key to genera, new species.

[3865] PHYLOGENY AND EVOLUTION OF THE SUBFAMILY COLIADINAE (LEPIDOPTERA: PIERIDAE)

O. Yata[1], T. Yamauchi[1] & A. Venables[2], [1]Biosystematics Lab., Graduate School of Social & Cultural Studies, Kyushu Univ., Ropponmatsu, Fukuoka, 810-8560 Japan; [2]Smithsonian Institution, Washington, D. C. 20560, U. S. A.

Phylogenetic relationships among all genera in the subfamily Coliadinae were inferred based on adult morphology using cladistic analysis. Twenty-three species including three outgroup species were chosen as exemplars and 50 morphological characters were examined. The cladistic analysis supports the monophyly of the Coliadinae, and recognizes two monophyletic groups, the *Nathalis* genus-group (*Nathalis* and *Kricogonia*) and the *Colias* genus-group (*Phoebis*, *Colias*, *Catopsilia*, *Anteos Gonepteryx*, *Dercas*, *Gandaca*, *Eurema*, and *Leucidia*). Within the *Colias* genus-group, *Phoebis* + *Colias* + *Catopsilia* + *Anteos* + *Gandaca*, *Gonepteryx* + *Dercas*, and *Eurema* + *Leucidia* form monophyletic groups, respectively. Furthermore, the most significant result of this analysis is the monophyly of *Phoebis* + (*Colias* + *Catopsilia* + *Anteos*) clade, which is consistent with the result of relationships from DNA sequences ((*Colias* + *Phoebis*) + *Eurema*) presented by Pollock *et al.*(1998). In addition *Eurema* is considered a paraphyletic group because *Eurema (Terias)* and *Leucidia* form a monophyletic group. Based on the present analysis, we tentatively propose a reclassification within the Coliadinae. Biogeography, larval foodplant specificity and adaptation to cold climates in Coliadinae are discussed based on the analysis. Genera are mostly allopatric in distribution within each clade (*Colias-Catopsilia-Anteos*, *Gonepteryx -Dercas*, etc.). This fact supports a vicariant hypothesis of fragmentation of the ancestral population into allopatric daughter populations. The common ancestor of the *Colias* genus-group is regarded as Fabaceae feeder. The foodplants of the *Colias* genus-group have be changed at least twice independently from Fabaceae to Rhamnaceae. The hypothesis of Shirôzu (1960) is supported only in the *Colias* genus-group, but disputed in Coliadinae. According to the cladgram, the arolium has been lost independently at least three times in Coliadinae. Since all genera lacking an arolium occur in alpine, cold or temperate regions, it may be inferred that the absence of an arolium is a climatic adaptation.
Index terms: cladistic analysis, biogeography, foodplant, arolium.

[3866] *SCAPHYTOPIUS* (CICADELLIDAE, SCAPHYTOPIINI): DESCRIPTION OF TWELVE NEW SPECIES FROM SOUTH AMERICA

K M. R. Zanol, Departamento de Zoologia, Universidade Federal do Paraná, Caixa Postal 19020, 81531-990, Curitiba, Paraná, Brasil,
E-mail kzanol@bio.ufpr.br

The genus *Scaphytopius*, distributed in the New World, was proposed by Ball,1931 who designated *Platymetopius elegans* as the type species. In the Neotropical region, this genus is represented for fifty-two species belonging to five subgenus: *Scaphytopius (Protranus)* with one species from Brazil; *Scaphytopius (Fundarus)* with one species from Bolivia; *Scaphytopius (Scaphytopius)* with one species recorded from Guatemala and Mexico; *Scaphytopius (Convelinus)* with twenty species from Mexico, Belize, Costa Rica, Puerto Rico, Cuba, Jamaica, Guatemala, Panama, Bolivia, Peru, Colombia, Guyana, Brazil and Ecuador; *Scaphytopius (Cloanthanus)* with twenty nine species from Mexico, Guatemala, Costa Rica, Honduras, Panama, Puerto Rico, Jamaica, Cuba, Ecuador, Surinam, Bolivia, Brazil, Peru and the Galapagos Islands. In this paper, twelve new species belonging to three subgenus are recognized: six in *Scaphytopius (Scaphytopius)* from Brazil and Peru; two in *Scaphytopius (Convelinus)* from Peru and four species in *Scaphytopius (Cloanthanus)* from Peru and Brazil. A detailed study of external morphology, the male's genitalia and the female's seventh sternite are presented with illustrations.
Index terms: Homoptera, Deltocephalinae, Neotropical, Taxonomy.

[3867] BEHAVIOUR, BIOACUSTIC, PHALLIC SCLERITES AND CYTOGENETIC IN SOME SPECIES OF THE GENUS *ENDECOUS* (ORTHOPTERA, PHALANGOPSIDAE)

E. Zefa & A. Mesa, Dept. de Biologia, Instituto de Biociências, Univ. Estadual Paulista (UNESP), Av. 24A 1515, 13506900, Rio Claro, SP, BRAZIL, E-mail: alejomesa@linkway.com.br. Supported by CNPq.

Species of the genus *Endecous* are found in tropical and sub-tropical forests of the Neotropical region. Most of the studies of this species were limited to short descriptions based on external morphological characters. In the present paper the studies were focused in the behavior, bioacustic, phallic sclerite structures and cytogenetic, in order to solve related taxonomic problems. Eleven species of *Endecous* have been described, five of them collected in brazilian territory. Four of them are considered here: *E. itatibensis*, *E. cavernicolus*, *E. abbreviatus*, *E. betariensis* as well as a new species collected in a cave close to Goianésia town (Goiás). Species of *Endecous* have six different acoustic songs including calling, mating, hierarchic and aggressive songs. The number of syllables of the chirp in the calling song is the most species-specific character. The phallic sclerit are similar in *itatibensis* and *abreviatus*, but considerable different in the species *cavernicolus*, *betariensis* and *Endecous* n. sp. The chromosome number is 2n=19, XO (male) – 20, XX (female) in the species *itatibensis* and *abbreviatus*; and 2n=21, X0 (male) – 22, XX (female) in *cavernicolus*, *betariensis* and *Endecous* n. sp. with differences in chromosome morphology in the three last species. The results obtained suggest that *itatibensis* and *abbreviatus* are the same species.
Index terms: Grylloidea, cricket, calling song, chromosome

[3868] "COECUS GROUP", A PHYLOGENETIC ANALYSIS TO REVIEW THE STACII'S STATEMENTS. (COLLEMBOLA : ARRHOPALITIDAE)

D. F. Zeppelini [1] & D. S. Amorim[2], 1- P.G. Entomologia FFCLRP/USP. zeppelin@usp.br; 2- Lab. Diptera. FFCLRP/USP. dsamorim@usp.br.

Arrhopalites coescus Tullberg, 1871, was described in base of the broadening of the apex of the mucro. However this feature is now known to be shared by many species in the genus, as pointed out already some decades ago. A group of species -coecus group- within *Arrhopalites* has been proposed, most of its species also share a strong medial vel spine at the base of the ventral surface of the dens. A taxonomic revision of the *coecus* group of *Arrhopalites* was prepared. Also, a cladistic analysis taking the species of the group as terminals was performed considering a large set of morphological characters, trying to determine the phylogenetic relationships of the species of the group and even trying to properly define species limit within the group. Anal valve spines, female subanal appendages and ventral setae of the dens also furnish important characters to reconstruct the phylogeny of the group.
Index terms: *Arrhopalites coecus*, Collembola, Phylogeny

[3869] FRUIT PRODUCTION AND MATING DISRUPTION OF CODLING MOTH IN ARGENTINA

L. I. Cichón, INTA Alto Valle, Casilla de Correo 782, 8332 General Roca, Argentina. E-mail: lcichon@inta.gov.ar

The Rio Negro Valley is the main pome fruit growing area of Argentina. Apples and pears total near 1,300,000 tons with less that 1% being organic. *Cydia pomonella* is the key pest. It develops an average of three generations each year and occasionally may have a fourth one depending upon climatic conditions. The Mating Disruption Technique (MD) allowed us to produce fruit with a minimum of pest control through traditional pesticide applications, making Integrated Fruit Production (IFP) and Organic Production (OP) both possibles in our region. The aim of this study was to assess the long-term effects of the MD technique in pilot plots of pears and apples managed either organically or under the directions of IFP. In the IFP blocks regular organophosphates sprays dropped from more than 5 to less than 1 after 2 years of MD. Average codling moth damage in the fruit was less than 0.1% average. However in the organic plots, the situation was a little bit difficult since organic pesticides (botanical, biological and mineral insecticides) are less effective than synthetic insecticides and because of the dearth of alternative tools to control the pests. Percent damage varies from 0.2-5% depending upon climatic conditions. After two years it was possible to decrease the number of dispensers in the center of the plot up to 50% of the regular density. However in OP this approach was limited to blocks with less than 0.5% damage in the previous season and only in situations that guaranteed full pest control in the nearby orchards. In some orchards the use of the MD techniques caused the development of new insects which are being identified and monitored. The efficacy of different strategies to control these pests using Insect Growth Regulator and Mating Disruption was also determined.

Index terms: *Cydia pomonella*, Organic Production, Integrated Fruit Production, Pest Management, Tree Fruit.

[3870] MATING DISRUPTION OF CODLING MOTH AND BEYOND

P. Witzgall, Dept. Plant Protection Sciences, Swedish Agricultural University, Box 44, 23053 Alnarp, Sweden, E-mail: peter.witzgall@phero.net.

Mating disruption of codling moth, *Cydia pomonella*, was studied in apple orchards treated with the main pheromone compound codlemone, (*E,E*)-8,10-dodecadienol, and a blend of codlemone and codlemone acetate, (*E,E*)-8,10-dodecadienyl acetate, a strong pheromone antagonist. Codlemone alone and the pheromone/antagonist-blend had a similar effect on the behavior of males emerging into air-permeated orchards. Male flights within tree canopy and upwind orientation along tree rows were strongly enhanced by both formulations, compared to untreated plots. However, the codlemone/codlemone acetate-blend increased the rate of cross-wind and downwind flights within the orchard, compared to codlemone alone. The major difference between these two formulations was that males from nearby, untreated orchards were attracted towards orchards treated with codlemone, but not towards treatments with codlemone/codlemone acetate. Additional tests were done with an equilibrium blend of codlemone and its geometric isomers. The stimulation of male flight activity by synthetic pheromone explains failures to control codling moth at high population densities with current dispenser formulations. Additional studies on the behavioral mechanisms of mating disruption were done in the wind tunnel. Current work aims at the use of plant volatile compounds for manipulation of male and female behaviours.

Index terms: *Cydia pomonella*, pheromone, plant volatiles

[3871] THE ROLE OF LEPIDOPTERAN MATING DISRUPTION IN FRUIT PEST MANAGEMENT SYSTEMS AND BARRIERS TO ITS ADOPTION IN THE EASTERN U.S.

D. G. Pfeiffer, Dept. of Entomology, Virginia Tech, Blacksburg, VA 24061-0319, USA, E-mail dgpfeiff@vt.edu.

The potential role of mating disruption in eastern U.S. fruit systems is increasing, especially considering recent regulatory changes regarding the most important pesticides used to control lepidopteran pests. A main group of targets has been internally feeding tortricids: codling moth, *Cydia pomonella*, in apple, oriental fruit moth, *Grapholita molesta*, in stone fruits and increasingly in apple, and grape berry moth, *Endopiza viteana*. These species have been generally well controlled by mating disruption in research blocks in commercial settings. Externally feeding tortricids have been a second target for mating disruption, especially a leafroller complex in apple. Although control has been more erratic, the technique holds great promise, and progress has been made in developing a general disruption blend that will control the entire complex. Sesiid borers of peach, grape and apple comprise a third group of targets for this approach. Lesser peachtree borer, *Synanthedon pictipes*, and peachtree borer, *S. exitiosa*, are well controlled by mating disruption, often more effectively than by using standard organophosphate sprays. Grape root borer, *Vitacea polistiformis*, a sesiid pest in vineyards, is also a candidate for mating disruption, though research has been more limited. Dogwood borer, *Synanthedon scitula*, is a problem in some eastern U.S. apple orchards. In some varieties, spray timing of insecticides is very close to harvest. Mating disruption has not been successful to date against dogwood borer. Since borer sprays are often specially applied, it seems likely that adoption will be more rapid. However, to date, practical implementation generally has fallen far short of the potential for this technique; there has been virtually no commercial adoption in the eastern states. This is because of a variety of factors: (1) specificity of the approach, combined with (2) its high cost (The pest complex in the eastern states is more diverse than in the west, where adoption is greater, and growers are reluctant to spend so much on a dingle pest) (3) An unfamiliar technology may also impede adoption. (4) A greater understanding of mechanisms of mating disruption and pheromone ecology would help provide more consistent control. (5) In some cases, there is probably an inadequate conception of the pheromone composition. (6) A final factor is marketing.

Index terms: pheromone, apple, peach, grape

[3872] TRIALS OF CONTROLLING LEPIDOPTERAN PESTS WITH SEX PHEROMONES IN KOREAN APPLE AND PEAR ORCHARDS

K. S. Boo[1], S.W. Lee[2], K.S. Han[1], J.K. Jung[1], K. Choi[1] & C.Y. Yang[2], [1]Seoul Natl. Univ., Graduate School of Agric. Biotechnol., Suwon 441-744, Korea; [2]Natl. Hort. Res. Inst., RDA, Suwon 440-310, Korea

History of research on application of insect sex pheromones are quite young in Korea. We have been investigating sex pheromone composition of lepidopteran pest insects damaging apple tree and fruit for last 5 years and pear for 3 years or so. In Korean apple orchards major pest insects are the Oriental fruit moth (*Grapholita molesta*) and the peach fruit moth (*Carposina sasakii*) on fruits, two leafminers of the apple leafminer (*Phyllonorycter ringiniella*) and the apple lyonetid (*Lyonetia prunifoliella*), and two leafrollers of the smaller tea tortrix (*Adoxophyes orana*) and the asiatic leafroller (*Archippus breviplicanus*). Their sex pheromones were found to be composed of *Z*-8-dodecenyl acetate : *E*-8-dodecenyl acetate : Z-8-dodecenol (95:5:1) for *G. molesta*, Z-7-eicosen-11-one for *C. sasakii*, Z-10-tetradecenyl acetate : *E*4,Z10-tetradecadienyl acetate (4:6) for *P. ringiniella*, Z-9-tetradecenyl acetate : Z-11-tetradecenyl acetate (95:5) for *A. orana* and *E*-11-tetradecenyl acetate : Z-11-tetradecenyl acetate (7:3) for *A. breviplicanus*. The sex pheromone of *L. prunifoliella* are under investigation for their stereochemistry, after finding of three different components including the major component of 10,14-dimethyloctadec-1-ene(Gries *et al.*, 1997). During last two years we deployed polyethylene tubes containing sex pheromones premixed at the rate of 100-150g/ha for *C. sasakii*, *G. molesta* and *P. ringiniella*. The preliminary results were not comparable to those by insecticide treatments yet, partly due to small size of orchards, but promising. Beginning this year we are going to work at a larger scale at farmers' orchards. Korean apple growers are still spraying insecticides 7.5 times and acaricides 3.5 times in a year, which were reduced from previous 10.3 and 4.5 times thanks to sex pheromone monitoring. We are also working on controlling of *G. molesta* in pear orchrads. Besides *G. molesta* and *A. orana*, we have *Adoxophyes* sp. in pear orchards. *Adoxophyes* sp. was found using Z-9-tetradecenyl acetate : Z-11-tetradecenyl acetate (7:3) as their sex pheromone in Korea. We will go after the control of lepidopteran pest insects in apple and pear orchards with sex pheromones and mites and aphids with their natural enemies.

Index terms: apple insects. Pear insects. Sex pheromone, mating disruption

[3873] AEDEAGAL LENGTH PLASTICITY WITHIN SPECIES OF *BACTROCERA DORSALIS* COMPLEX

O. Iwahashi, College of Agriculture, University of the Ryukyus. Nishihara, Okinawa 903-0213, Japan, E-mail oiwahashi@agr.u-ryukyu.ac.jp

A complex of sibling species exists in Southeast Asia which was formerly referred to as the oriental fruit fly, *Bactrocera dorsalis* (Hendel). Although the group is comprised of 52 species, considerable difficulty arose in distinguishing among the species, especially *B. dorsalis*, *B. papayae*, and *B. carambolae*. Recently, aedeagal length was found to be a most reliable trait to distinguish between sympatric species of the *B. dorsalis* complex. *B. dorsalis* is distributed in Thailand, whereas *B. papayae* and *B. carambolae* can be found in Peninsula Malaysia and Indonesia. It is interesting to compare the aedeagal length among populations of these 3 species from different localities including populations from the central part of Peninsula Malaysia, which is considered to be at the margin of the distributions of *B. dorsalis* and *B. papayae*/*B. carambolae*. Adult fruit flies were collected with a methyl eugenol trap from 26 localities in Thailand, Peninsular Malaysia, and Indonesia. The aedeagal length of *B. dorsalis* was intermediate between those of *B. papayae* and *B. carambolae*. However the aedeagal length of *B. dorsalis* varied among local populations such that it was longer in populations from the central part of Peninsula Malaysia than those from northern Thailand, indicating plasticity for this character. Such plasticity was also observed in the 2 sympatric species, *B. carambolae* and *B. papayae*, although aedeagal length of B. carambolae is always shorter than that of B. papayae in any populations. It was notable that a third group with very long aedeagus appeared on Java Island. This group was composed of 2 types of flies: one with morphological characters typical of *B. papayae* and the other more typical of *B. carambolae*. These results indicate that the aedeagal length of a species, which has been considered to be the most reliable trait to identify the species, is not fixed but variable among local populations. Potential ecological pressures that may affect aedeagal length are discussed.
Index terms: *Bactrocera dorsalis*, *Bactrocera papayae*, *Bactrocera carambolae*, aedeagal length

[3874] DEMOGRAPHY OF FRUIT FILIES:; LINKS BETWEEN REPRODUCTION AND MORTALITY

P. Leido

ABSTRACT NOT RECEIVED

[3875] GENETIC CONTROL OF FRUIT FLY PESTS: FUTURE FEATS OR FANTASIES

D. O. McInnis, Pacific Basin Area Research Center, U.S. Department of Agriculture, Agricultural Research Service, 2727 Woodlawn Dr., Honolulu, Hawaii, USA, 96822, E-mail: dmcinnis@pbarc.ars.usda.gov.

Genetic control of insect pests remains a lofty and critically important goal of mankind. In the face of a burgeoning world population, the food supply in the new millennium will depend heavily on the success of insect control programs. Applied insect genetics has its roots in beneficial interests such as improving honey bee and silkworm production. On the other hand, most of the effort to suppress insect pests has been directed toward the development of resistant varieties of food crops. Only in recent decades has man focused concerted energies directly upon insect pests. These efforts have usually been in the form of large-scale, area-wide projects utilizing the sterile insect technique (SIT) and related types of genetic control. Some of these large-scale programs have been directed against Tephritid fruit fly pests around the world. In the past, various genetic techniques have been used to control insect pests, including hybrid sterility and inherited sterility in certain organisms with holokinetic chromosomes (eg. Lepidoptera), or translocation sterility and compound chromosomes in organisms with centromeric chromosomes (eg. Diptera). The sterile insect technique for insect control was conceived with the New World screwworm fly in the 1950's, and has been since seen widespread use primarily against certain mosquito species, lepidopterans, and tephritid fruit flies. In the future, many of the above techniques will continue to be applied against insect pests, including tephritid fruit flies. However, the advent of biotechnology, esp. molecular biology, can greatly improve the efficiency of insect control programs. Genetic transformation of insect pests, or their predators or parasites, should potentially revolutionize insect control. Desirable genes may be inserted into insect genomes to create super strains of biocontrol agents for SIT or beneficial insect programs. In addition, DNA fingerprinting technology will help resolve close genetic relationships among sibling species in order to improve the biological match between control agents and pest species under field conditions.
Index terms: Tephritid fruit flies, insect control, biotechnology, SIT

[3876] BEHAVIORAL STUDIES FOR A BETTER CONTROL OF FRUIT FLY PESTS

J. P. Cayol, CIRAD Flhor Guyane, Campus agronomique, BP 701, F-97387 Kourou Cedex, French Guiana, FRANCE, E-mail cayol_j@cirad.fr.

In the past decades, methods to control fruit fly pests turned from the intensive use of broad spectrum pesticides to more species-specific and environmentally-friendly methods such as the sterile insect technique (SIT). Because of their specificity and the need to be cost effective, such methods strongly rely, at all stages of the program, on the comprehensive knowledge of the target pest behavior for a more fine-tuned control and monitoring. In the case of SIT control programs, success depends mainly upon the ability of sterile mass-reared insects to locate/attract and mate with their wild counterparts. In order to find a mate, it is essential that the mass-reared insects exhibit the full behavioral repertoire of wild insects. Recently, tests have been developed which measure the behavioral quality of mass-reared insects. These tests, integrated as part of the quality control system, are now used (i) to determine the suitability of a strain for SIT, (ii) to decide when the replacement of a mass reared strain is required and (iii) to establish mass rearing procedures that preserve the behavioral traits of the strains. Effective monitoring of the pest population is a key issue in fruit fly control programs or exclusion activities. In fruit flies, monitoring is based on trapping using mainly sexual (for male trapping) but also food (for female trapping) attractants. Behavioral studies done by many authors on various aspects such as lekking, food foraging, host finding are crucial to improve the location and the attractiveness of the traps in the field, for an efficient and reliable monitoring. In the present work, the importance and relevance of behavioral studies for the various activities of an areawide fruit fly control program are reviewed.
Index terms: *Tephritidae*, behavior, control, SIT

[3877] STRATEGIES FOR AREA-WIDE CONTROL OF FRUIT FLIES

A. Malavasi, IICA Office, CFF Programme, Paramaribo, SURINAME, email: iicaeff@sr.net. and Dep. of Biology, University of São Paulo, R. do Matão 277, S. Paulo, SP, 05421-900, BRAZIL, email: malavasi@usp.br

Fruit flies of different species are devastating pest in Latin America, Asia and Pacific regions where production of tropical fresh fruit for export is rapidly growing. Native species cause significant losses. The increase of traffic by air and sea, bringing people and commodities from all parts of the world, is one of the most important factors for disseminating pests from one region to another. Introduced species, besides the native ones, is a major problem for fruit production. Regardless their good potential flight capability, fruit flies have high dispersion potential, either by natural factors as wind or anthropic as movement of infested fruit. In this regard, the concept of local treatment or control for a fruit fly population is ineffective. Treating just a farm, production area or a group of properties is not a feasible strategy due the constant risks of reintroduction. The concept of area-wide approach for suppression or eradication of fruit flies of economic importance, is now being acceptable as the only viable alternative. The most important strategies to be applied for fruit flies are: SIT - sterile insect technique, MAT -male annihilation, biocontrol and BAT - bait application technique. More than on method must be used in order to decrease the fruit fly population and reach the status of Low Fly Prevalence Area. With increasing sophistication, such areas can eventually become Fly Free Areas. Typically, the area-wide techniques can not be applied be individual growers, but has to be a program managed by state/provincial/national governments or international organizations. In different regions, the concept has being applied, and should be expected in near future its use in many multi-species environments worldwide.

Index terms: fruit flies, Tephritidae, suppression, eradication

[3878] DISRUPTION OF MATING IN SPARGANOTIIIS FRUITWORM (TORTRICIDAE) IN CRANBERRIES

S. Polavarapu[1] & G. C. Lonergan[2], [1]Blueberry and Cranberry Research and Extension Center, Rutgers University, Chatsworth, NJ 08019, USA, E-mail polavarapu@aesop.rutgers.edu; [2]Research and Productivity Council, 921 College Hill Road, Fredericton, N. B., E3B 6Z9, Canada.

The feasibility of disrupting mating of *Sparganothis* fruitworm, *Sparganothis sulfureana* (Clemens), with a sprayable microencapsulated formulation of *E*11-tetradecenyl acetate (*E*11-14:Ac), the major pheromone component, was evaluated in New Jersey during 1996-1999. Application of encapsulated *E*11-14:Ac at 25-187.5 g per ha, significantly reduced mating of virgin females placed in treated plots relative to those placed in untreated control plots. Pheromone-baited or virgin female-baited trap captures were significantly lower in pheromone-treated plots, indicating that fewer male moths were able to locate these traps in treated plots. Larval density and fruit damage were significantly lower in plots treated with 62.5, 125, or 187.5 g per ha of pheromone than in untreated control. Air and foliage samples were collected to determine titers of *E*11-14:Ac throughout the flight duration. *E*11-14:Ac levels in air and foliage samples declined sharply during the first week following pheromone application. However, detectable levels of *E*11-14:Ac were present in both air and foliage samples throughout the 3-4 week post-treatment period. During 1998 and 1999, we evaluated the effect of applying pheromone by air and through overhead sprinkler irrigation system (chemigation). In both years, pheromone application by chemigation provided superior trap shutdown and reduction in mating of virgin females than aerial application. The effect of purity of *E*11-14:Ac on mating disruption indicated that cheaper and less pure grade (technical grade) pheromone was not as effective as the more expensive and higher grade (pharmaceutical grade) pheromone in suppressing mating. Fruit damage and larval density were not significantly different among groups of cranberry bogs that received either two applications of the sex pheromone at 37.5 g per application per ha or conventional organophosphate insecticide applications. These studies show that mating disruption is a promising strategy to manage *Sparganothis* fruitworm in cranberries. Microencapsulated formulation of *E*11-14:Ac is now commercially available and in use by cranberry growers.

Index terms: *Sparganothis sulfureana*, mating disruption, cranberries, *E*11-14:Ac.

[3879] MATING DISRUPTION OF CAROB MOTH IN DATES

J. G. Millar[1], H.H. Shorey[1,2], and T.C. Baker[2], [1]Dept. of Entomology, Univ. of California, Riverside CA 92521, USA, [2]Dr. Shorey was killed in a tragic accident while working on this project, [3]Dept. of Entomology, Iowa State University, Ames, Iowa, 50011, USA.

The carob moth *Ectomyelois ceratonia*, is the key insect pest of dates grown in southern California and the Mediterranean basin, where the moth is also a pest of almonds. The pheromone of the carob moth consists of a blend of Z9,E11,13-tetradecatrienal, in combination with lesser amounts of Z9,E11-tetradecadienal and Z9-tetradecenal. The triene aldehyde component is unstable and difficult to work with, and consequently, a formate mimic of the trienal, Z7,E9,11-dodecatrienyl formate, was developed. The formate mimic, when formulated and stabilized, proved to be stable enough to warrant extended field testing. Field trials indicated that the mimic was attractive to male moths when used as a trap bait. However, during testing, it was noticed that few moths were caught in grids of traps, suggesting that disruption of male moth orientation to single point sources, i.e., mating disruption, might be occurring. Preliminary results from small-block mating disruption trials proved encouraging, using the formate mimic loaded into black Celcon fibers. However, further trials spread over several years in both small and large blocks produced mixed results, which will be reviewed and discussed. Overall, these trials have high-lighted several significant and unique problems associated with this system. First, dates may be a particularly difficult crop in which to accomplish mating disruption because of the plant architecture; date gardens essentially consist of a series of tall poles with tufts of vegetation at the top, so that the air volume to be saturated with pheromone is large, and there is little vegetation to slow the wind or hold the pheromone in the treated area. Second, the synthesis of the pheromone mimic has proven difficult to scale up to commercial quantities (1 kilo or more) which has led to long delays in implementing field trials. Third, the pheromone mimic is still somewhat unstable; however, this problem can be dealt with by appropriate choice of dispenser. Fourth, the pheromone mimic is not a natural product, resulting to novel registration issues. Finally, the carob moth is multivoltine, and is present year-round in date gardens, so that continuous suppression may be necessary.

Index terms: *Ectomyelois ceratonia*, pheromone mimic, mating disruption

[3880] DEVELOPMENT OF A STRAIN OF THE SMALLER TEA TORTRIX, *ADOXOPHYES HONMAI* (LEPIDOPTERA: TORTRICIDAE) RESISTANT TO A MATING DISRUPTANT IN JAPAN

C. Numata[1], Y. Kainoh[1], H. Honda[1], H. Sugie[2] & H. Noguchi[2], [1]Inst. Agr. & For., Univ. Tsukuba, Tsukuba, Ibaraki 305-8572, Japan, E-mail (YK): parasite@sakura.cc.tsukuba.ac.jp; [2]Natl. Inst. Agro-Environ. Sci., Tsukuba, Ibaraki 305-0856, Japan.

The effectiveness of mating disruption in *Adoxophyes honmai* Yasuda (Lepidoptera: Tortricidae) has decreased in tea plantations at Hatsukura, Shizuoka Prefecture. Responses to sex pheromone components in the sensitive (S) strain from a laboratory culture and the resistant (R) strain from Hatsukura were compared to reveal behavioral differences in responses to mating disruptants. In a 200-ml flask, pre-exposure to (*Z*)-11-tetradecenyl acetate (Z11-TDA, 1 mg) inhibited responses to the synthetic sex pheromone blend (Z9-TDA: Z11-TDA: *E*11-TDA: 10Me-DA = 60: 30: 5: 5) in S males, while it didn't in R males. Increasing the amount of the mating disruptant during pre-exposure to 2 mg enhanced the inhibition of responses in R males. In wind tunnel experiments, more R males responded to a Z11-TDA-rich ratio blend than the natural ratio. These results suggested that R males of *A. honmai* in the tea plantation have obtained low sensitivity to Z11-TDA over the past 15 years.

Index terms: *Adoxophyes honmai*, Lepidoptera, Tortricidae, mating disruption, (*Z*)-11-tetradecenyl acetate, wind tunnel, resistance.

[3881] PHEROMONES FOR CONTROL OF YELLOW RICE STEM BORER, *SCIRPOPHAGA INCERTULAS* (LEPIDOPTERA: PYRALIDAE) IN INDIA

A. Cork[1], & K. Krishnaiah[2], [1]Natural Resources Institute, University of Greenwich, Central Avenue, Chatham Maritime, Kent ME4 4TB, UK. E-mail: a.cork@greenwich.ac.uk [2] Directorate of Rice Research, Hyderabad-500 030, India. E-mail: kkrishnaiah@drr.ap.nic.in

A hand-applied controlled release formulation, Selibate YSB®, of the female sex pheromone of the yellow stem borer, *Scirpophaga incertulas*, was developed for use in control by mating disruption in India. Researcher-led, on-farm development trials were conducted to optimise the application rate, pheromone blend and timing of application. Four large scale, on-farm trials conducted in a range of agro-climatic zones confirmed the efficacy of the technique. In each case the results were similar, mating disruption with the natural blend of pheromone components, a 1 : 3 ratio of (Z)-9-hexadecenal and (Z)-11-hexadecenal, at an application rate of 40 g AI per ha provided a level of control that was comparable to that obtained with conventional insecticides applied by farmers. Farmer participatory evaluation trials were conducted to assess the significance of the technology to rice cultivators. The trials were co-ordinated by non-governmental development organisations and monitored by socio-anthropologists and entomologists. Results suggested that rice cultivators were interested to participate by providing land for trials, applying the lures and attending meetings arranged to learn more about their social, economic, cultural and institutional constraints to adopting the technology. Nevertheless, there was no evidence to suggest that they were prepared to modify their normal pest control practises when using mating disruption, a situation re-enforced by a natural aversion to risk. The project highlighted deficiences in communication linkages and problems with introducing individual technologies at variance with established pest control procedures. To address these issues a new strategy is proposed that will endeavour to incorporate the pheromone-based control technology into an existing Farmer Field School programme where intervention with insecticides is minimised by relying on pest scouting to monitor insect populations. The advantages and disadvantages of this approach will be discussed.

[3882] LURE AND KILL FOR PEST MANAGEMENT IN ORCHARDS

D.M. Suckling[1], "J. Daly[1]", & J.T.S. Walker[2], & S.J. Bradley[2], HortResearch, PO Box 51, [1]Lincoln and Private Bag 1401, [2]Havelock North, New Zealand.

Pheromones have been widely used in tree fruit orchards for many years, particularly for monitoring, or more recently, for mating disruption. Recent progress has been achieved with another application, using attracticides against leafrollers and codling moth. Trials against lightbrown apple moth were conducted in orchard plots, with up to 95% suppression of trap catch in 0.3 ha plots. Other trials with larger plots in two regions of New Zealand have shown that pest density is a key factor in the level of suppression that can be achieved. The lure and kill tactic is likely to use substantially less insecticide than conventional insecticide-based systems. The system also uses far less pheromone than mating disruption, although high pheromone purity is critical. Other differences between this tactic and the alternatives will be discussed. Lure and kill warrants further investigation for use in horticultural crops.

Keywords: pheromone, orchard, codling moth, leafroller

[3883] MOLECULAR MARKERS IN WHEAT LINKED TO GENES EXPRESSING RESISTANCE TO THE GREENBUG AND THE RUSSIAN WHEAT APHID

C. M. Smith,[1] X. Liu[1], M. Flinn[1], T. L. Harvey[1], B. S. Gill[2] & V. Tolmay[3], [1]Dept. of Entomology, E-mail msmith@oz.oznet.ksu.edu; [2]Dept. of Plant Pathology, Kansas Sta. Univ., Manhattan, KS 66506 - 4004 USA; [3]Small Grain Institute, Private Bag X29, Bethlehem, South Africa, 9700.

Wheat production is severely affected by feeding damage from the greenbug (GB), *Schizaphis graminum*, and the Russian wheat aphid (RWA), *Diuraphis noxia*, in Africa, Asia, North America, and South America. Genes from various Triticeae express resistance to the GB (*Gb* genes) and the RWA (*Dn* genes). We report here the identification of several molecular markers linked to a cluster of existing and new wheat genes expressing resistance to GB and RWA feeding damage, and new specific locations of wheat homeologous chromosomes where these genes reside. The wheat microsatellite PCR primers *Xgwm 44* and *Xgwm 111*, near the centromere and on the short arm of wheat homeologous chromosome 7D respectively, differentially amplify DNA of resistance sources expressing several aphid resistance genes. A new gene from *Aegilops tauschii* (*Gbx*), is linked to *Xgwm 44* at a distance of 10.0 cM. *Xgwm 44 is* also a putative informative marker for *Gb3*, an existing GB resistance gene also from *Ae. tauschii*. *Xgwm111* is linked to the *Dn1*, *Dn2*, and *Dn5a* genes at distances of 4.15, 3.05, and 3.20 cM respectively, and to a new gene, *Dnx*, at a distance of 1.52 cM. *Xgwm 635*, on the distal portion of the short arm of homeologous chromosome 7D, is linked to the *Dn5b* RWA resistance gene at a distance of <3.2cM. *Xgwm 130*, on the short arm of wheat homeologous chromosome 7A, is also a putative informative marker for *Gb3*. A second new GB resistance gene, *Gby*, is linked to *Xksud2*, on the long arm of wheat homeologous chromosome 7A at a distance of 17.9cM and putatively linked to *Xgwm 63* and *Xgwm332*, also on the long arm of wheat homeologous chromosome 7A. Thus, a cluster of no less than 8 cereal aphid resistance genes is located on the wheat homeologous group 7 chromosome. Loci for this gene cluster are homosequential to loci in barley and sorghum previously shown to express greenbug resistance. The functional relationships of the gene cluster to other Triticeae genes expressing aphid resistance will be discussed.

Index terms: *Schizaphis graminum*, *Diuraphis a*, wheat, plant resistance

[3884] USING LANDRACES AS SOURCES OF RESISTANCE TO PESTS: EVOLUTIONARY AND ECOLOGICAL CONSIDERATIONS

N. A. Bosque-Perez[1] & I. W. Buddenhagen[2], 1 Dept. of Plant, Soil & Entomological Sciences, Univ. of Idaho, Moscow, ID, USA 83844-2339 nbosque@uidaho.edu ; 2 Dept. of Agronomy & Range Science, Univ. of California Davis, Davis, CA, USA 95616 iwbuddenhagen@ucdavis.edu

In the transgenic era, it is easy to forget that most insect and disease resistance genes ultimately originate from landraces and adapted varieties. As we consider expanding the use of resistance genes from landraces it is important that we ask: Do landraces just have genes for pest resistance or do they also carry genes that confer local adaptation to undetermined stresses, that make them perform "better" under pest pressure? If so, could landraces that are used for small-scale, low-input agriculture be a source of useful genes for intensified cropping systems or do we disrupt ecological relationships in intensified systems, thus precluding effectiveness of traits such as low levels of resistance that might be effective in low-input agriculture? This leads us to the general question of what needs to be assessed when considering the use of landraces as sources of resistance. It is important that we ask if there is an evolutionary relationship between the landrace and the target pest. For co-evolved systems we must determine if there is any evolutionary pressure for selecting, maintaining and/or increasing levels of resistance in the traditional low-input cropping system where the landrace is being used. How about non-coevolved systems? Is it possible that landraces are more useful as sources of resistance for these systems? We propose that to properly answer these questions, host parasite interactions should be studied in traditional systems where landraces are used, so as to determine their true effectiveness. Armed with such knowledge, we will be better prepared to use genes or gene complexes from landraces that might be valuable in intensive agriculture. Examples from both insect and disease resistance systems are presented and discussed to highlight the importance of studying evolutionary and ecological relationships when considering the use of landraces as sources of pest resistance.

Index terms: host plant resistance, plant breeding, tropics

[3885] MOLECULAR MARKERS IN RICE FOR ENHANCING RICE GALL MIDGE RESISTANCE

M. Mohon

ABSTRACT NOT RECEIVED

[3886] MOLECULAR CHARACTERIZATION OF RICE BROWN PLANTHOPPER POPULATION

S. Mohankumar [1,2], N.SenthilKumar[1], J. Souframanien[1], P. Nagarajan [1], P. Shanmugasundaram [1], S. Sadasivam[1] & M. B. Cohen[3], [1,2] CSES DEPT., VIRGINIA TECH, BLACKSBURG, VA24061, USA, [2]Centre for Plant Molecular Biology, TamilNadu Agricultural Univ., Coimbatore- 641 003, India, [3]International Rice Research Institute, Philippines.

Brown plant hopper, *Nilaparvata lugens* (Stal.) is a persistent pest in rice fields throughout tropical Asia. Since 1970, IRRI has been maintaining green house colonies of three brown plant hopper biotypes, which differ in ability to survive on and injure various rice cultivars containing single genes for resistance. These biotypes are still used today for screening germplasm for resistance to the brown plant hopper. Indian brown planthopper population differed from the above biotypes and designated as biotype 4. The present study aims to characterize Indian BPH population in comparison with other biotypes through molecular markers. Genetic fingerprints of four biotypes were developed using random amplified polymorphic DNA-polymerase chain reaction (RAPD-PCR). Variation within biotype 4 was also analysed using seven populations collected from diverse agro-climatic zones. About one hundred random primers (OPERON) were screened and polymorphic primers were recorded. Each gel was scored for the presence (1) and absence (0) of a specific band. was worked out. A data matrix was generated to calculate genetic similarity index, analysed using NTSYS program and a dendrogram was constructed by using UPGMA. Two clusters were observed and first cluster consists of the biotype 1,2,3 and the second cluster with biotype 4 alone. The biotype 2 and 3 are closely related within the first cluster. Among the seven populations of biotype 4, the population collected from Raipur, Madhyapradesh is distinctly separated from others.
Index terms: Rice, *Nilaparvata lugens* ,biotypes, RAPD-PCR

[3887] ENHANCING INSECT RESISTANCE IN GRASSES THROUGH DEPLOYMENT OF FUNGAL ENDOPHYTES

S.L. Clement, U.S. Department of Agriculture, Agricultural Research Service, Washington State University, P.O. Box 646402, Pullman, WA 99164-6402, USA, E-mail: slclement@wsu.edu.

Infection of C3 grasses with fungal endophytes, *Epichloe* species and their *Neotyphodium* asexual relatives, provide hosts with fitness-enhancing properties such as increased resistance to phytophagous insects. While some *Epichloe* species produce sexual spores and are pathogenic (causing 'Choke disease' on host grasses), asexual *Neotyphodium* fungi are not pathogenic and propagate only by infecting seeds as they develop on infected mother plants. Insect resistance is the result of the endophytic fungus or the grass-fungus interaction producing alkaloids. Both insect deterrence and toxicity are apparent in insect responses to endophyte infection. After *Neotyphodium* endophytes in grasses were linked to insect resistance in the early 1980s, seed companies deployed endophytes in cultivars of turf-type ryegrasses and fescues. Today, companies develop and market turfgrasses with endophyte-enhanced resistance to pests, i.e., the bluegrass billbug, *Sphenophorus parvulus* and sod webworms, *Crambus* spp. This is a good example of the useful application of scientific knowledge for commercial enterprise. Unfortunately, many grass-endophyte associations are detrimental to livestock production because some fungal alkaloids are toxic to grazing animals. Because endophyte-free forage grasses exhibit low tolerance to grazing pressure, efforts are underway to develop endophyte-infected fescues and ryegrasses incapable of producing animal toxins but which produce toxins for insect resistance. To do this, researchers are using endophytes from native grasses which vary considerably in alkaloid profiles and are applying molecular techniques to modify endophytes for specific purposes. With the recent discoveries of *Neotyphodium* fungi in wild barleys (*Hordeum*) and wild wheats (*Triticum*), the potential use of endophytes in cereal crops for insect control has been suggested. Research involving cereal grass endophytes is in its infancy, but new data indicate that the *Hordeum* species/genotype and the *Neotyphodium* species/strain involved affects the expression of resistance to cereal aphids. A thorough understanding of the extent and nature of insect resistance in endophyte-infected cereal grasses, and the chemistry associated with these infections, is necessary before these endophytes can be used for insect resistance in the 21st Century.
Index terms: *Sphenophorus parvulus*, *Crambus* spp., cereal aphids, *Neotyphodium* fungi, plant resistance

[3888] CURRENT STATUS OF BIOPESTICIDES

J. J. Menn[1] & F. R. Hall[2], [1]Agric. and Extension Education, Penn State Univ., Univ. Park, PA 16802, E-mail JJMenn@erols.com; [2] LPCAT, The Ohio State Univ., 1680 Madison, Ave., Wooster, OH 44691, E-mail hall.1@osu.edu.

Over the past two decades, biopesticides have generated much interest especially among academic researchers and they formed the focus of marketing goals of numerous startup agro-biotech companies. Environmental sensitivities and concerns about chemical pesticide residues in food, their safety, and impact on the environment have brought biopesticides into the public limelight. However, the reality to date has been substantially at variance with the expectations. With the exception of products based on Bacillus thuringiensis (Bt), none of the other biopesticide products have achieved any significant share of the $32 billion worldwide chemical pesticide market. The failure to carve out a larger share of the foregoing market is likely due to the inability of small agro-biotech companies to generate sufficient capital to sustain a large scale development effort that is required to bring a product successfully to the market. Furthermore, most biopesticide products have been effective, to date, primarily in small and niche markets. A few biopesticides based on the fungus, Beauveria bassiana, neem based products, primarily Azadirachin and certain baculoviruses, show promise as multifaceted biopesticides. It is likely that biopesticides will gain market share as plant protection programs tend to increase emphasis on sustainable agriculture and integrated pest management
Index words: biopesticides, Bacillus thuringiensis, Beauveria bassiana, Azadirachtin, baculoviruses, IPM

[3889] MYCOINSECTICIDES - OPPORTUNITIES AND CONSTRAINTS

S. P. Wraight, USDA, ARS, U. S. Plant, Soil, and Nutrition Laboratory, Tower Road, Ithaca, NY 14853 USA, E-mail spw4@cornell.edu

Development of entomopathogenic fungi as microbial control agents was pursued intensively during the 1960s and 1970s, and large programs for use of *Beauveria bassiana* and *Metarhizium anisopliae* against a variety of pests of agriculture and forestry were ultimately established by government agencies and grower cooperatives in eastern Europe, Asia, and South America. These successes, however, did not lead to widespread adoption of fungal pathogens for commercial pest control, and reliable products have remained largely unavailable to private growers. The reasons for this are complex and numerous, but relate primarily to problems with production efficiency, product shelf life, and product performance (especially compared to synthetic chemical insecticides). Within the past decade, significant advances in the mass production, formulation, storage stabilization, and application of entomopathogenic fungi have provided solutions to many of these problems and stimulated a renewal of commercialization efforts. Consequently, more than 30 mycoinsecticide products are now registered or trademarked worldwide. Greatest effort has been directed toward the well known pathogens in the order Hyphomycetes. Products based on *Beauveria*, *Metarhizium*, *Paecilomyces* and *Verticillium* spp. have been development, for control of a broad range of stem- foliage- and root-feeding pests of field and greenhouse crops. While these products represent substantial progress in the development of fungal pathogens for microbial control, commercial markets for these new mycoinsecticides have been slow to develop, and difficult challenges remain. This presentation will review the technological breakthroughs that have supported the recent surge in commercialization of fungal pathogens, identify the most important constraints to broader commercial success, and offer an assessment of the near- and long-term potential of these biocontrol agents in various crop production systems.

Index terms: entomopathogenic fungi, *Beauveria bassiana*, *Metarhizium anisopliae*, biopesticides, microbial control

[3890] Messenger TM: Introducing a new protein chemistry to agriculture

J. Butler, President and CEO, EDEN Bioscience Corporation, butlerj@edenbio.com

Messenger®: A case study on the introduction of a novel biochemical for use in the management of plant disease, suppression of certain insects, and enhancement of plant growth and yield. The active ingredient in Messenger is harpin protein, a hypersensitive response (HR) elicitor isolated from *Erwinia amylovora*, the bacterium causing fire blight of pear, apple, and other rosaceous plants. The harpin protein is a highly effective elicitor of systemic acquired resistance (SAR) through the induction of classical SAR genes. In addition, the topical application of harpin protein is now known to also induce other plant defense systems such as the Jasmonic acid/Ethylene pathway. Because of its consistent effectiveness and the broad spectrum of plant activities induced by harpin proteins, Messenger is expected to be the first of a whole new class of novel crop treatments. These products will be non-toxic, environmentally friendly, and should substantially reward growers with increased yields and lower overall production costs. Messenger has been extensively tested in more than 600 replicated field trials in the United States, China, and elsewhere, and product launch has begun in the United States. Yield increases of 10 to 20% or more over traditional chemical crop protection programs are common in Messenger treated crops.

[3891] VIRUSES – PROSPECTS IN CROP PROTECTION

F Moscardi, Embrapa – National Soybean Research Center, P.O. Box 231, Londrina, Pr. 86001-970, Brazil, Email moscardi@cnpso.embrapa.br.

The use of insect viruses in crop protection has been made mostly with viruses of the Baculoviridae family, currently divided in two genera: a) *Nucleopolyhedrovirus* (NPV) and *Granulovius* (GV). The baculoviruses are important tools in IPM programs, because they are regarded as safe and selective biopesticides restricted do invertebrates. Although they have been utilized worldwide against several insect pests, their application has not met their potential to control pests in crops, forests and pastures, with the exception of the NPV of *Anticarsia gemmatalis* in soybean in Brazil, which has lately been used annually in ca. 1,400,000 ha (ca. 10% of the cultivated area with soybean in this country) (for review, see Moscardi, 1999 Annu. Rev. Entomol. 44: 257-289). The main problems that have limited expansion of baculovirus use include, among others: a) narrow host range; b) slow killing speed, when compared to chemical insecticides; c) insect pests maintain normal feeding capacity for 2-4 days after treatment; d) technical and economical difficulties for *in vitro* production; e) variability of field efficacy due to climatic conditions; and f) farmers' attitudes toward pest control, mainly based on application of fast-killing chemical insecticides. Strategies to counteract limitations of baculoviruses, include the use of chemical or biological substances added to virus formulations and genetic engineering, mainly to increase virulence and speed of kill, as well as to reduce the capacity of feeding of pests on host plants. The future of baculovirus use in crop protection will depend on research on key issues to counteract their limitations, as pointed out above, so as to attract greater interest of the industry in producing and commercializing these agents and to improve their acceptance among growers, through a global farmer education toward use of biological control agents. The use of the NPV of *A. gemmatalis* in Brazil will serve as a case-study to discuss the prospects of baculoviruses in crop protection.

Index terms: Insecta, Baculoviridae, Microbial Control

[3892] AZADIRACHTIN AND OTHER PLANT-DERIVED INSECTICIDES

G. Gordh[1], Kika de la Garza Subtropical Agricultural Research Center, Agric. Res. Serv., USDA 2301 South International Blvd. Weslaco, TX 78596, USA E-mail: ggordh@weslaco.ars.usda.gov.

Biopesticides are potentially useful tools in the management of agricultural pests. More than 2,000 natural-product compounds have been suggested or shown to have beneficial properties in the management of pests. Natural products extracted from Neem tree (*Azadirachta indica*) are among the most well known biopesticides, but their potential as pest control agents has not been fully realized. This paper analyzes the Neem industry and discusses the status of active ingredients (Azadirachtin, Nimbin and Salannin) and generic products (Neem Powder, Oil, Bitters, Cake). Promotion. Neem tree is arguably the most highly publicized plant in the arena of biopesticides. The tree received considerable publicity during 1985-1995 with considerable overselling of Neem's potential. Excessive optimism led to financial investor disappointment with a retraction of venture capital and a failure to pursue potentially useful products. Future promotion of Neem products must be conservative and consider all economic aspects of Neem products. This paper explains current economic conditions and areas of financial development. Plantations. Access to raw materials is a significant limitation in the global development of the Neem industry. Currently, most raw material (flowers, seed, leaf) comes from India. Plantations are being developed in Latin America, Africa and Asia. Nearly all attention has focused on Indian Neem, but efforts to evaluate other species are underway. The paper explains the potential of Philippine Neem and Thai Neem in global efforts to expand and refine the Neem industry. Product Development. The status of registered products shows that product effectiveness must be improved. Areas of concern include formulation, application technology and product activity in the field. We must explore and refine the feeding and oviposition-deterrent properties of Neem products. Issues of quality control must be addressed and product registration must be encouraged. We can improve the success rate of biopesticides if we integrate social, economic and scientific issues into our planning. If we focus only on the fine points of science we will continue to have slow development.

Key Words: Azadirachtin, Nimbidin, Salannin; Neem Plantations

[3893] FORMULATION AND APPLICATION OF BIOPESTICIDES

M. R. McGuire, USDA-ARS-NCAUR, 1815 N. University St. Peoria, IL USA 61604, email: Mcguirmr@mail.ncaur.usda.gov

Biopesticides, such as those based on insect pathogens offer an alternative to chemical insecticides. However, commercialization of biopesticides has lagged behind expectations. There are several issues involved with their lack of use including poor shelf stability, limited host range, time to kill, and poor residual activity after application. Host range and time to kill are likely the purview of strain selection and genetic engineering and will not be addressed here. Unlike most chemicals that work on contact, most biopesticides must be ingested to be effective. Entomopathogenic fungi that work on contact are the exception yet it is believed that spores must survive for a period of time so they remain viable if they don't land on a suitable host. The challenge of increasing the acceptance of biopesticides by the consumer must be met with a new paradigm of formulation and application technology. Clearly, formulation techniques used for conventional chemical insecticides will not be suitable for biopesticides. Insect pathogens are particulate and suspension problems may be an issue in the spray tank. They lose activity quickly under direct sunlight and additives may be necessary to shield the active agent from ultraviolet light. Insects must ingest active agents that may be unpalatable (e.g. Bt) so feeding stimulants may be necessary. Formulation science can address these issues. Many insect pathogens may not survive desiccation following production, thus methods for production and formulation may need to be combined to facilitate desiccation tolerance. Application technology also must be addressed to ensure proper deposition and placement of the active agents. Conventional hydraulic applications over the top of plants will have limited success, especially with sunlight sensitive active agents. Many insects, especially the stages most susceptible to biopesticides, spend most of their lives on the underside of leaf surfaces where over the top applications will not reach. Soil borne insects may not be affected unless the agent, especially if it is particulate, is deposited under the surface of the soil. Recent developments in several laboratories will be discussed relevant to improved biopesticide formulation and application procedures. Novel formulations based on natural products such as oils, starches, lignins, and other additives will be discussed in line with novel delivery technologies such as injection, high pressure, or under the leaf application.

Index Terms: Residual activity, entomopathogens, delivery

[3894] INTEGRATING BIOPESTICIDES INTO THE IPM PARADIGM WITHOUT RISKS

J. D. Mumford, T H Huxley School of Environment, Earth Sciences and Engineering, Imperial College of Science, Technology and Medicine, Silwood Park, Ascot, Berkshire SL5 7PY, United Kingdom.

The role of all forms of pest management is to reduce risks for farmers and integrated pest management has been widely successful in achieving this, while at the same time increasing profitability. Biopesticides offer an exciting new tool in the combination of techniques that can be employed in IPM, but as with any new product they are inherently perceived as being more risky than established methods until they are proven effective. Risks are perceived at several levels and may not be shared equally by the various participants and beneficiaries of pest management. Farmers often worry that biopesticides may be slow to act, exposing them to losses in the meantime. Regulators may be concerned about problems of registration of organisms that are naturally not uniform in their activity or genetic make-up. Vendors must cope with new storage and shelf life problems. Home produced biopesticides may be contaminated with toxic, ineffective or competitive organisms. Application equipment makers must develop appropriate designs for markets that may or may not develop. Consumers may be wary of yet another new addition to food crops. Against these risks there are substantial potential benefits from active searching, narrow targeting, economical production techniques and the use of more natural products in the environment. Even if risks (of slower performance, for example) are actually greater they may be outweighed by potential benefits, such as cost or safety. Where these benefits accrue to beneficiaries other than the farmers implementing IPM then compensatory measures would need to be used to redress the internal balance in the decision to use biopesticides. A concerted approach to confronting and overcoming these perceived risks will be essential to establishing biopesticides as a major component in IPM implementation.

Index terms: cost-benefit, consumers, regulators, farmers, implementation.

[3895] BT AND THE TRANSGENICS' FUTURE IN IPM PROGRAMS-INTEGRATION AND RESISTANCE

A. M. Shelton & J. Zhao, Dept. of Entomology, Cornell Univ./NYSAES, Barton Laboratory, Geneva, NY 14456, USA, E-mail ams5@cornell.edu

The expression of proteins produced by *Bacillus thuringiensis* (Bt) in plants to protect them from insect attack can play a major role in IPM programs. Estimates indicate that Bt plants could be a substitute for a third of the $US 8.1 billion spent annually on insecticides. On a worldwide basis in 1999, there was a total of 11.8 x 10^6 hectares planted to Bt crops, and the two dominant Bt crops were corn (9.6 x 10^6 hectares) and cotton (2.1 x 10^6 hectares). Bt crops are part of the larger picture of genetically modified (GM) crops including herbicide-tolerant crops. GM crops have been adopted at a faster rate than any new technology in the agricultural industry, growing more than 23-fold since their introduction in 1996. But adoption of this technology remains variable by region. An analysis of the adoption of cotton in the US from 1996-8 indicates that farmers and the companies producing Bt cotton varieties have shared almost equally in the economic benefits of using this technology. Additional data indicate that the use of Bt cotton has reduced the overall use of insecticides. Despite these economic and environmental benefits, there are biological and social concerns which may limit the implementation of new technologies such as Bt crops. The primary biological concern has been how to implement Bt crops within an effective resistance management program. While resistance management programs have been implemented for some Bt crops in developed countries, these strategies have been based on theoretical models and only limited empirical data. In addition to this important biological question, this technology is being challenged for its social implications, as well as food safety and environmental issues. The combination of these varied issues has caused a crisis for agricultural biotechnology companies. The benefits of these technologies have not been made readily apparent to consumers and highly debated and publicized controversies haunt these new technologies. The future of Bt plants will largely depend on being able to answer questions other than insecticide resistance management.

Index terms: *Bacillus thuringiensis*, transgenic plants, resistance.

[3896] THE EFFECT OF CLIMATE CHANGE ON PESTS AND INTEGRATED PEST MANAGEMENT

R. Harrington[1] & R. A. Fleming[2], [1]Inst. of Arable Crops Research - Rothamsted, Harpenden, Hertfordshire, AL5 2JQ, UK, E-mail: richard.harrington@bbsrc.ac.uk; [2]Natural Resources Canada, Canadian Forest Service, Great Lakes Forestry Centre, Sault Ste. Marie, Ont, P6A 5M7, Canada.

Activity 3.2.1. of the Global Change and Terrestrial Ecosystems core project of the International Geosphere and Biosphere Programme (IGBP-GCTE) currently has three main objectives: i) to define the nature and extent of impacts of global change on pest population dynamics and distributions; ii) to define regions and agroecosystems which are vulnerable to pests under global change and iii) to suggest adaptations to pest management strategies under global change. Climate change can be expected to affect insect development, reproduction, survival and movement, with consequences for abundance, phenology, voltinism and distribution of pests and for epidemiology of crop viruses where the insects are vectors. The response will depend on where, in the range of a given variable, the local conditions occur. For example, those organisms currently limited by low temperature at a given location will respond differently to those currently limited by high temperature. Gradual changes in conditions are likely to lead to adaptive changes in species optima. The speed of such adaptation is likely to be greater in species with higher intrinsic rates of increase (increasing the chance of favourable recombination or mutation and subsequent competitive success) and with greater migratory tendency (increasing the chance of pre-adapted populations displacing existing genotypes) than in those that reproduce slowly and migrate little. Pest species often show the former characteristics and, as a result, may also be better placed to recover from the effect of occasional extreme conditions. These intuitively obvious simplifications may be confounded by the highly complex interactions within and between abiotic and biotic components of change. We have scarcely begun to study and model interactions at more than one trophic level in any system. However, long-term datasets inherently show effects of all of these interactions under conditions experienced during their lifetime. The objectives of this paper are: i) to outline in general terms the range of effects that climate change could have on the pest status of insects; ii) to address the highly complex nature of the problem with objectivity; iii) to highlight examples where such effects are already observable and iv) to consider the potential effects of climate change on current integrated pest management (IPM) practice and how IPM may need to adapt to meet future needs.

Index terms: insects, long term data, IPM

[3897] EFFECTS OF GLOBAL CHANGE ON PLANTS, INDIVIDUAL INSECTS AND IMPLICATIONS FOR POPULATION MODELS

D. Raubenheimer & S.J. Simpson. Dept. of Zoology, Univ. of Oxford, South Parks Road, Oxford, U.K. E-mail: david.raubenheimer@zooolgy.oxford.ac.uk; stephen.simpson@zooolgy.oxford.ac.uk.

Possible effects of global change (e.g. elevated CO_2 levels, nitrogen supply, ozone levels, temperature) on plant growth and composition are currently an extensively researched area. Such effects are likely to reverberate across trophic levels, due to their influence on herbivore nutrient supply. One likely outcome of global change is perturbations to the balance of accessible nutrients in plants, since these may be brought about both by changes in the levels of single nutrients or by various combined changes in nutrient levels. Furthermore, evidence suggests that for herbivores nutrient imbalance is a critical food property, in some respects more so than the levels of individual nutrients or nutrient concentration per se. There exist, however, few systematic studies on the influence of nutrient imbalance on the intake, growth and development of herbivorous insects, and fewer still that compare the responses of species that evolved in different nutritional environments. We report laboratory experiments in which we used synthetic foods to compare the preferred balance of protein:carbohydrate in *Locusta migratoria*, a species that specialises on nitrogen-poor grasses with *Schistocerca gregaria*, an extreme generalist which includes in its diet high-nitrogen forbs. Simultaneously, we compared the responses of these species to foods systematically spanning a range of nutritional imbalances. Our data suggest that the responses of insect herbivores to nutritional imbalance might be critically dependent on the details of the nutritional environment in which they evolved. In particular the grass feeder, which showed an intake preference with relatively low P:C ratio, had a poor ability to deal with excess protein foods, suffering reduced intake, meager ability to excrete excess ingested nitrogen, low development rate, and reduced body mass (particularly lipid stores). By contrast, the forb feeder ingested relatively high levels of protein on the excess-protein foods, and in this way reduced the deficit of carbohydrate ingested. The data suggest that they were, additionally, able to de-aminate excess ingested amino acids, excrete the nitrogenous residues and channel the carbon skeletons to lipid stores. Furthermore the forb-feeding generalist demonstrated a broader tolerance to nutrient imbalance, since in addition to being less sensitive to excess-nitrogen, they showed no evidence of being more susceptible to excess-carbohydrate than was the grass feeder. In fact, on the most nitrogen-deficient food the forb feeder showed *greater* nitrogen utilization efficiency than the grass feeder, as well as greater ability to void excess ingested carbohydrate. These data have implications for models attempting generalized predictions for the effects of climate change on plant-insect interactions.
Index terms: Dietary imbalance, Locusts, nutritional regulation

[3898] THE EFFECT OF CHANGES IN LAND-USE ON IPM

H. R. Herren, Johann Baugaertner and Rajinder Saini, International Centre of Insect Physiology and Ecology, Nairobi, Kenya

Landuse patterns arise as a result of human interactions with the biotic and abiotic environment. Among the many factors influencing landuse patterns and landscape features are the ecological attributes of the environment, the type and intensity of agriculture and forestry as well as socioeconomic factors including the density and structure, according to age, sex, and health status, of human populations. Integrated pest management systems are developed for different spatial scales. The regional level is addressed when landuse patterns and landscape features are modified for the purpose of designing regional integrated pest management systems. Changes in human populations and in their needs within the socioeconomic framework for their activities affect landuse patterns and landscape features. Likewise, changes in abiotic environmental factors, such as weather, and in biotic factors such as disease incidence and vector also affect pest status and have implications for their integrated management. Case studies from sub-Saharan Africa are presented to show how such changes affect regional integrated pest management systems and how landuse patterns and landscape attributes can be modified for the purpose of integrated pest management.

[3899] THE EFFECT OF ACCELERATED INTERNATIONAL TRADE ON PROSPECTS FOR IPM

C. Devorshak[1] and R. L. Griffin[2], [1]FAO-AGPP, Room B-760, Viale delle Terme di Caracalla, 00100, Rome, Italy, Email: Christina.Devorshak@fao.org; [2]FAO-AGPP, Room B-761, Viale delle Terme di Caracalla, 00100, Rome, Italy, Email: Robert.Griffin@fao.org

Globalization and the liberalization of international trade has accelerated dramatically as a result of improved technologies and the effects of harmonization which began with the General Agreements on Tariffs and Trade (GATT) over 50 years ago. The formation of the World Trade Organization and the establishment of the Agreement on the Application of Sanitary and Phytosanitary Measures (SPS Agreement), have strong implications for trade in agricultural commodities as well as the associated agricultural practices used to produce the commodities. Additional multilateral agreements, including the International Plant Protection Convention, the Convention on Biological Diversity, the Montreal Protocol and the Rotterdam Convention also affect agricultural practices and trade in agricultural products. These developments have had and will continue to have both positive and negative effects on the implementation of integrated pest management (IPM) programs throughout the world. As governments negotiate and implement international standards and obligations, measures to protect crops from pests, including IPM strategies, come under increasing scrutiny as options to facilitate trade or as the basis for restrictions. Ecologically based crop management schemes which reduce the need for pesticide applications will prove especially important for developing countries as those countries strive to meet strict standards on pesticides and residues that may be the basis for non-tariff measures deemed necessary for protection purposes. Private sector food processors, distributors, and retailers are developing innovative systems of contract growing, with farmers who export from developing countries, to match even stricter standards demanded by consumers.
Index terms: IPM, International trade, International standards, phytosanitary measures

[3900] THE EFFECT OF TECHNOLOGY CHANGES ON IPM

J.R. Anderson Jr.[1], [1]Technology Development, U.S. Markets, Monsanto Company - 1609 Iredell Drive, Raleigh, NC 27608, United States of America, E-mail: john.r.anderson@monsanto.com

Pest management, in its infancy, dealt with the judicious use of fungicides, herbicides and insecticides to economically control problem diseases, insect pests and weeds. Establishment of economic thresholds enabled knowledgeable crop advisors to create value by offering their clients pest management solutions. Personal computers simplified data collection and record keeping. Crop advisors soon discovered that they could capture more value by integrating crop and pest information to provide agronomic solutions. Discontinuous innovation, in the form of transgenic crops, further empowered pest managers because it created a new body of knowledge foreign to most farmers. It is likely that the transgenic crop, in the early stages of its technological life cycle, will persist for some time as a dominant technology design. However, the second wave of genomics-driven biotechnologies, i.e., the appearance of viable output traits, should allow crop advisors to create and capture additional value by integrating all available technologies into profitable agronomic systems. The widespread application of global positioning systems (GPS) to agricultural operations suggests that geographic information systems (GIS) will become the language that unites crop producers, crop advisors and conservationists in a common vision for agricultural landscapes. Moreover, internet-based GIS applications and wireless communication, in tandem with inexpensive but sophisticated spreadsheet modeling tools, will ultimately enable crop advisors to employ local databases to: (a) swiftly predict the impact of pests on a plethora of business opportunities, (b) create a crop quality control industry and (c) assess financial risks associated with diverse business opportunities.

[3901] OVERVIEW OF INSECT MANAGEMENT WITH PHYSICAL CONTROL METHODS: WHY, HOW AND WHERE

C. Vincent, Horticultural Research and Development Centre, Agriculture and Agri-Food Canada, 430 Boul. Gouin, Saint-Jean-sur-Richelieu, QC, Canada J3B 3E6

The challenges of plant protection are constantly evolving. There are increasing concerns about the protection programs currently implemented in agricultural systems of many countries. Many protection programs currently used in agricultural systems are not sustainable on a long term basis. Chemical control methods are efficient and widely used worldwide. However, they have their limitations, including development of resistance to insecticides, increasing cost of registration and increasing legal constraints. Owing to the general context of agricultural systems, the limits of chemical and biological control technologies and the potentialities of agricultural engineering (actually dynamized by fast advances in microelectronics and global positioning systems GPS), we believe that physical control methods in plant protection should attract the attention of scientists and plant protection practitioners in the years to come. The importance of physical control methods in integrated pest management programs is often overlooked. Physical control methods are often considered as archaïc. In this Symposium, we will present up-to-date information relevant to the concept and use of physical control methods in pre- and post-harvest situations. Several physical control methods will be discussed, including heat treatments, temperature and controlled atmosphere, pneumatic control, physical barriers, radio-frequencies and microwaves, low temperatures and ionizing radiations.

Index terms: Physical control methods, Pneumatic control, Microwaves, Heat treatments, Heat treatments, Radio-frequencies, Ionizing radiations, Physical barriers

[3902] HEAT TREATMENTS FOR DISINFESTATION: MINIMIZING DELETERIOUS EFFECTS ON TREATED COMMODITIES

S. Lurie, Department of Postharvest Science, ARO, Volcani Center, POB 6, Bet Dagan 50250, Israel. E-mail: zeslov@netvision.net.il

High temperature treatments are being actively investigated for postharvest treatments of fresh produce to control insect pests. There are three methods used to heat commodities: hot water, vapor heat, and forced hot air. Hot water was originally used for fungal control, but its use has been extended to disinfestation of insects. Vapor heat treatment was developed specifically for insect control, while forced hot air has been used for both fungal and insect control. The purpose of disinfestation is to eliminate the insect without damaging the commodity. For this objective to be achieved, we must understand the response of the commodity to temperature stress. Sensitivity to heat varies with the stage of ripening. The exposure of the commodity to stresses such as high temperature or water deficit before harvest may confer resistance to heat damage from postharvest treatments. A pretreatment after harvest with a moderate heat stress can also confer thermotolerance, thus allowing the commodity to withstand higher temperatures necessary for effective disinfestation. In addition to controlling insects, high temperature treatments can delay subsequent fruit ripening during or after storage by inhibiting ethylene synthesis and reducing softening. In some heated commodities taste is enhanced because of accelerated acidity loss or increased sugar content. Temperature stress can induce resistance to physiological storage disorders, such as chilling injury, and to fungal invasion that cause postharvest decay. The ideal disinfestation treatment will combine control of insect pests with enhanced maintenance of commodity quality

Index terms: Chilling injury, decay, fruit ripening, thermotolerance

[3903] POSTHARVEST INSECT CONTROL: TEMPERATURE AND CONTROLLED ATMOSPHERE TREATMENTS

R. L. Mangan & K. C. Shellie, United States Department of Agriculture, Agricultural Research Service 2301 S. International Boulevard, Weslaco, TX 78596. U.S.A.

Cold and heat treatments have been used in the United States as methods to achieve quarantine security against commercial transport of fruit flies in fresh fruit for over 50 years. Although research in temperature, humidity and time of treatment effects on fruit has improved the overall quality of the fruit, the treatments still damage appearance, flavor or shelf life of nearly all fruit to some degree. Methods to disinfest fruit of fruit flies must be carried out by viewing the fruit-pest system as one organism living inside another living organism. Successful treatments kill the organism on the inside of the fruit without damaging the living tissues of the outside. Our research concentrates on treatments for citrus with the Mexican fruit fly, *Anastrepha ludens* Loew, as the pest. Our approach is to control respiration rate of both the fruit and the fruit fly by control of temperature. Oxygen demands of both organisms can be increased at higher temperatures and decreased at lower temperatures. Oxygen, CO_2 and Nitrogen levels were controlled by gas mixing boards in laboratory and small scale tests, and in shipping containers using technology patented by TransFRESH Corporation. Freshly harvested Rio Red grapefruit were tested for tolerance to low oxygen (0.05%) and to increases in CO_2. Acceptable quality of grapefruit was observed for treatments up to 18 days and at temperatures from 12 to 16°C. Treatments were done by allowing laboratory colony flies to oviposit into grapefruit and holding fruit for sufficient time for development to the stage to be treated. Mortality from the treatments was estimated as the difference between pooled survival in control and treated fruit. Results indicated that at temperatures above 16 °C, larvae at all stages died within 14 days and earlier instars were more susceptible than later stages. An estimated treatment to achieve "probit 9" security for larvae would be less than 15 days. Eggs have been shown to be more resistant to treatment. Four eggs, of an estimated 11,417 treated, developed to pupal stage at 14 °C giving an estimated 99.96% mortality. The "probit 9" treatment would be more than 22 days, a time that would degrade the quality of the fruit. At present, control atmosphere and ultra-low oxygen appears to have promise as a component in a systems approach (non probit 9) because the treatment is currently being developed as a transit treatment to prevent diseases such as penicillium. Research is focusing on discovering the mechanism allowing the low level of survival and possible use of an auxilliary treatment to kill these eggs.

Index terms: Quarantine treatment, Temperature, *Anastrepha ludens*, oxygen

[3904] PNEUMATIC CONTROL OF INSECTS IN PLANT PROTECTION

Charles Vincent[1], Gilles Boiteau[2] and Phyllis Weintraub[3], [1] Horticultural Research and Development Centre, Agriculture and Agri-Food Canada, 430 Boul. Gouin, Saint-Jean-sur-Richelieu, QC, Canada J3B 3E6; [2] Centre de recherche en pomme de terre, Agriculture et Agro-alimentaire Canada, C.P. 20280, Fredericton, N.B., Canada E3B 4Z7; [3] Agricultural Research Organization, Gilat Experiment Station, Mobile Post Negev 2, 85-280, Israel

Pneumatic control essentially involves the use of an airstream to dislodge and kill insect pests. Insects can be dislodged from plants with negative (aspiration) or positive (blowing) air pressure. Once the insects have been dislodged, they are killed by a system of turbines or are collected and killed in a dedicated system upstream of the blower. There has been, in the last few years, a renewed interest in pneumatic control methods, as evidenced by the numerous articles published in agricultural magazines. Our objective is to summarize key published information on pneumatic control with special reference to three agricultural systems. The first system concern the management of the tarnished plant bug (*Lygus lineolaris* P. de B. (Miridae) on strawberry in Quebec (Canada) and (*Lygus hesperus* Knight (Miridae) in California. Field trials of several pneumatic machine models have been done in commercial strawberry plantations. To acheive a better understanding of the effects of pneumatic treatments and to improve the efficiency of the machine, a test bench to study the influence of relative height of the hood and forward velocity and bug behavior on removal effectiveness was set up. The second system concerns the Colorado potato beetle (*Leptinotarsa decemlineata* Say (Chrysomelidae) on potato in New Brunswick. The results of several experiments will be discussed, including field trials and laboratory experiments to determine the forces of removal of various stages and the terminal velocity of falling insects. The third system concern field trials that have been done in Israel on celery, tomato, potato and melon crops to evaluate the efficacy of the vacuum unit for use in insect pest management. These trials have shown that weekly field vacuuming with our uniquely designed vacuum unit can control *B. tabaci* in melons as well as 2-3 insecticide applications. It was shown that while parasitoid populations were slightly reduced by the field vacuuming, their densities were not significantly lower than the population in the untreated control plots. Although it was demonstrated pneumatic control can be the sole means of insect control, realistically we can foresee its use in insect pest management programs. Field vacuuming is fully compatible with chemical control measures, reducing pest populations either instead of a regular pesticide treatment or immediately before application. Furthermore, by first reducing insect pest populations by field vacuuming and then immediately releasing biological control agents, their efficacy may be greatly improved.

Index terms: Pneumatic control, Miridae, *Lygus lineolaris*, *Lygus hesperus*, Chrysomelidae, *Leptinotarsa decemlineata*.

[3905] PHYSICAL BARRIERS FOR INSECT PESTS IN VEGETABLES AND SMALL FRUITS

R. S. Vernon[1], D. W. A. Hunt[2] & G. Boiteau[3], [1]Agriculture and Agri-Food Canada, P.O Box 1000, Agassiz, BC, V0M 1A0, Canada, E-mail: vernonbs@em.agr.ca, [2]Agriculture and Agri-Food Canada, Research Centre, Harrow, ON, N0R 1G0, Canada, [3]Agriculture and Agri-Food Canada, P.O Box 20280, Fredericton, NB, E3B 4Z7, Canada.

Physical barriers have considerable potential in integrated pest management programs for reducing the colonization of crops by certain pest insects. Plastic-lined, in-ground trenches, for example, act as lethal barriers against walking adult Colorado potato beetles, *Leptinotarsa decemlineata*, moving into or out of potato fields. Potato fields surrounded by plastic-lined trenches have achieved 47-49% reductions in immigrant, overwintered adult populations, and 40-90% reductions in emmigrant summer-generation populations in New Brunswick. A portable, above-ground version of the plastic-lined trench has also been developed that consists of lengths of extruded, PVC plastic trough. A patented attachment to the trough facilitates the exclusion of crawling pests or the entry of beneficial insects into enclosed areas. In field trials in Ontario, levels of Colorado potato beetles and associated defoliation of tomato plants were significantly lower in plots surrounded by the troughs than in open check plots, and yields were similar to plots protected by routine insecticide sprays. Troughs also excluded significant numbers of weevils (i.e. *Barypeithes pellucidus* and *Nemocestes incomptus*) from plots of strawberries. For exclusion of flying insect pests, a fence consisting of vertically oriented black nylon screen panels has been developed and tested in vegetable crops in British Columbia. Female cabbage flies, *Delia radicum* were 81% fewer inside small plots of rutabaga surrounded by a 90 cm high fence, and 90% fewer in large plots of radish surrounded by a 120 cm high fence. Damage to crops in these fenced plots was also significantly reduced over unfenced plots. Exclusion efficacy improved with increases in fence height and with the length of a 45° downward and outward-pointing mesh overhang. Colonization of carrots by the carrot rust fly, *Psila rosae*, as well as ensuing damage to carrots was also significantly reduced in plots enclosed by a 120 cm high fence. Alone, mesh exclusion fences, or in-ground and above- ground trenches will not guarantee economic control of target pests under all field conditions, but can easily be integrated with other control strategies to reduce the current over-reliance on pesticides. The economics of deploying trenches or fences relative to other control strategies are discussed.

Index terms: Exclusion trenches, *Leptinotarsa decemlineata*, Exclusion fences, *Delia radicum*, *Psila rosae*.

[3906] PHYSICAL CONTROL MEASURES FOR POST-HARVEST DISINFESTATION OF CEREAL GRAIN AND DRY BEANS PRACTICABLE IN DEVELOPING COUNTRIES: A REVIEW

F. Fleurat-Lessard[1] & K.A. Bekon[2], [1] INRA - Laboratory of Stored-Products Entomology, P.O. Box 81, F- 33883 Villenave d'Ornon, France, E-mail francis.fleurat-lessard@bordeaux.inra.fr; [2] ENSA Abidjan, 18 B.P. 2458, Abidjan 18, Ivory Coast.

Pilot scale experiments conducted in many tropical countries demonstrated that physical control measures can be used with a good effectiveness for control of insect pests damaging stored cereal and maize grain or dry beans. Among the methods that can be available in developing countries, solar disinfestation, physical and mechanical disturbance, sealing grain stacks in hermetic plastic liners, underground storage pits, hermetic storage in plastic bags, improving the airtightness of traditional granaries with plastic liners, addition of silicagel powder, diatomaceous earth or other minerals to grain, may have a real potential in specifically adapted conditions. The review will discuss the advantages and the limitations in the use of these different physical means after a presentation of the effectiveness that can be expected with each of them in tropical climate conditions. The discussion will outline the reasons of the apparent disinterest of farmers in tropical countries for the use of these methods. It is a general trend that farmers, especially in these countries, tend to ignore or to underrate what has been done before the "golden age" of chemical control started 50 years ago. In the last 20 years, the physical control methods were never seriously considered as a potential alternative to chemical control even in situations where the use of chemicals was impossible because the lack of availability of residual insecticides or fumigants in rural areas. However, a great level of expertise and particular skills to understand the principles of action and their limitations are generally required. To be complete, this review will also focuse on the difficulties encountered in implementing these means at the farm level. With the changes afforded by modern technologies of control that can be applied today to the equipments required to carried out these physical treatments, a full scope of these ones may be expected in the next decade.

Index terms: stored grain insects, physical control means, tropics, farm level

[3907] POST-HARVEST INSECT CONTROL: RADIO-FREQUENCIES AND MICROWAVES AND OTHER HEAT-SHOCK MEANS

F. Fleurat-Lessard & J.M. Le Torc'h, INRA - Laboratory of Stored-Products Entomology, P.O. Box 81, F- 33883 Villenave d'Ornon, France, E-mail francis.fleurat-lessard@bordeaux.inra.fr

Heat disinfestation can be used with specific heat treatment schedules for preventative disinfestation even with heat-sensitive food products such as bread-making wheat flour. An important consideration are the effects of heat on technological properties of the treated products. Heat should not cause unacceptable loss of quality. Consequently, extended treatment times may not be desirable. A rapid increase of temperature can be obtained either by hot-air fluidised bed (with granular products) or by radiofrequency- or micro-waves heating (with any kind or shape of product). Different means or systems using either one means or the other have been experienced to disinfest cereal food products. Heat disinfestation of wheat flour and durum wheat semolinas have been compared in using one of these two means, by a "sharp" increase of temperature level above the upper lethal limit for target pest insect species with specific profiles of heating. With hot-air fluidised bed applied to durum wheat or semolinas heating, the product time × temperature is the bottom line of the success of the disinfestation. Nevertheless, tolerance of different species and developmental stages of insects to high temperature can differ in a large range. A model of relationships between critical points on the physiological scale of target species is tentatively proposed. For the radiofrequency-heating system, the upper lethal temperature for the insect and the level of temperature reached by treated wheat flour or semolina were compared in order to outline the question of differential heating theory (between high moisture content insect and dry product). For radiofrequencies heating, this difference was negligible and cannot be used to reduce significantly the level of temperature or the exposure period required to kill insects. The respective interest of the two methods for potential applications and industrial development will be discussed.

Index terms: stored-product insect, fluidised-bed heating, radiofrequencies.

[3908] LOW TEMPERATURE TO CONTROL STORED-GRAIN INSECTS

P. G. Fields[1] & F. Fleurat-Lessard[2]. [1]Cereal Research Centre, Agriculture and Agri-Food Canada, 195 Dafoe Rd. Winnipeg, MB, Canada, R3T 2M9, E-mail: pfields@em.agr.ca; [2]I.N.R.A. Centre de Recherches de Bordeaux, P.O. Box 81, Villenave d'Ornon, France 33883, E-mail: francis.fleurat-lessard@bordeaux.inra.fr.

Stored-product insects have been controlled using physical means for thousands of years. The basic rule of good seed storage, keep seed cool and dry, was employed in neolithic times in the Nile delta by placing clay jars underground. For a number of years, the use of extreme temperatures, particularly low temperatures, has been extensively used to control stored-product insects. The advantages of this type of control are: no residues left on the product after treatment, effective against insecticide resistant strains, and few risks for operators. The inconveniences that prevent the widespread use of low temperatures are: treatment is dependant upon cold ambient air or refrigeration equipment and durations needed for control can be long depending upon temperatures achieved. There are a number of variables that influence the success of a low temperature treatment: the stage of insect, species, their level of cold acclimation, temperature attained, duration and relative humidity. The goal of this review is to introduce some basic concepts of insect cold tolerance and to demonstrate how low temperature is used to prevent or to control stored-product insect infestations.

Index terms: *Cryptolestes*, *Sitophilus*, *Tribolium*, freezing, storage

[3909] PHYSICAL METHODS TO CONTROL REGULATORY PESTS IN EXPORTED HAY AND DECIDUOUS FRUITS

V. Y. Yokoyama, USDA, Agric. Res. Serv., Hort. Crops Res. Lab., 2021 S. Peach Ave., Fresno, CA 93727, USA

Physical control techniques have been investigated as methods to control pests of regulatory concern in hay and straw, stone fruits and grapes. Compression of standard bales of timothy, alfalfa, oat, Sudan grass, and Bermuda grass hays and rye straw was shown to be an efficacious method to control Hessian fly puparia. Commercial bale compressors tested at 42, 72, and 80 kg/cm^2 resulted in 81, 93, and 97% mortality, respectively. Hessian fly puparia did not survive field drying alone or in combination with any hay-harvesting practice. Compression of hay bales has potential as a single quarantine treatment for field dried, export quality hays. The potential of low temperature storage at 0-1°C has been investigated as a single quarantine treatment for codling moth, oriental fruit moth, and walnut husk fly in stone fruits, and omnivorous leafroller in table grapes. Survival of immatures of codling moth and oriental fruit moth to the adult stage was directly related to age and inversely related to exposure period. Complete mortality of codling moth eggs and 1st, 2nd, and 3rd instars of oriental fruit moth occurred after 21-d in storage. Codling moth females that survived a 7-d storage in the egg stage laid fewer eggs and fewer viable eggs than control females. Two to 5-wk exposures to 0-1°C resulted in 0-6.7% survival and a 6-wk exposure resulted in <1% survival of eggs and 1st-5th instars of the omnivorous leafroller. The 2nd instar was the least susceptible stage of omnivorous leafroller to low temperature storage. Low temperature storage combined with sulfur dioxide slow release pads caused 100% mortality of omnivorous leafroller 2nd instars after 3-wk of exposure in table grapes. Exposure to 0-1°C for 6-wk resulted in 99.8% mortality of onion thrips. Survival to the pupal stage for 2nd and 3rd instar walnut husk fly was significantly lower than controls after exposure to low temperature storage in green walnuts at 1.1-1.7°C for 7, 14, and 21-d. A heat treatment of 45.0°C for 55 min was sufficient to kill all immature stages of the oriental fruit moth. About 39 min was required for the interior of a nectarine to attain 45.0°C. Response of codling moth eggs and first through fifth instars to each 1.0°C increase in temperature from 45.0 to 51.0°C was directly related to a lower LT_{50} and less time to cause 100% mortality for each life stage. Exposure of either codling moth females or males to 44.0 or 45.0°C for 20 min in the 4th or 5th instar resulted in fewer eggs laid per female and lower egg viability than in the unexposed controls.

Index terms: *Mayetiola destructor* (Say), *Cydia pomonella* (L.), *Grapholita molesta* (Busck), *Platynota stultana* Walshingham, *Rhagoletis completa* Cresson , *Thrips tabaci* Lindeman

[3910] ASSOCIATION OF PHYSICAL CONTROL MEANS FOR THE CONTROL OF INSECTS IN CEREAL INDUSTRIES AND PRODUCTS

C. Adler[1], W. Rassmann[1], & P. Juetterschenke[2], [1]Federal Biological Research Centre for Agriculture and Forestry, Inst. for Stored Product Protection, Koenigin-Luise-Str. 19, 14195 Berlin, Germany, E-mail: c.adler@bba.de; [2]Arbes Umwelt GmbH, Koepenicker Str. 325, 12555 Berlin, Germany

The international consent to phase out the use of methyl bromide because of its ozone depleting potential in the world's stratosphere causes a growing need for alternative methods for rapid disinfestation of stored products and structures. Physical control methods may be one way of pest control combining the advantages of being fast in action, non-toxic and thus residue-free. Often these techniques are also less dangerous to apply than toxic grain protectants. Temperatures above 50°C were found to cause complete insect mortality to various species of stored product beetles and moths during the treatment of an empty flour mill with heated air. Critical areas that at first did not reach these temperatures and received special attention in future treatments were around the windows, close to water pipes, and within the outside walls. Another method to control pests in grain could be the application of microwaves or radio-waves in a high frequency (HF) field because insects contain more water than grain and may thus heat up more rapidly. Radio-waves may be favourable to microwaves because they can penetrate grain to a greater depth. In laboratory experiments, adults of the granary weevil *Sitophilus granarius* could be controlled in wheat with a HF generator at 13.56 MHz when a 150 kV/m or more were applied for 8 s or 250 kV/m for 4 s. With 150 kV/m or 200 kV/m and 8 s treatment time it was, however, not possible to completely control the developmental stages within the grain kernels. Especially eggs and young larvae proved to be most tolerant. At 15 % grain moisture content this treatment caused a rise in grain temperatures from 20°C to 41°C or even to 50°C. Lower moisture contents led to reduced grain heating. A mechanical way to control pests in grain, semolina or flour is the use of percussion. Mills consisting of a rotating disk with one or several rows of bolts close to the edge (e.g. Entoleters) can be adjusted in a way that every grain kernel or particle is hit by a bolt, leading to complete control of all insect pests. Diatomaceous earths (DE), possibly in an admixture with silica gel, lead to the dissication of stored product arthropods. Because of their long lasting efficacy they may be used for structural treatments, e.g. in electrical cable ducts and in cracks and cravices of floors and wooden structures that may otherwise serve as sources of a residual infestation.

Index terms: physical control, heat, high frequency, radio-waves, percussion, diatomaceous earth.

[3911] IONIZING RADIATION FOR POSTHARVEST PEST MANAGEMENT

Guy J. Hallman, 1United States Dept. Agriculture, Agric. Research Service, 2301 S. International Blvd., Weslaco, TX 78596. E-mail ghallman@weslaco.ars.usda.gov.

One-half century of research has shown ionizing radiation from electron, x-ray, or gamma sources to be effective at disinfesting agricultural commodities of insects. Many countries have approved irradiation pest management protocols. However, the promising technique has not had much application. One of the disadvantages with stored product pests is lack of any residual activity. Also, the logistics of re-irradiating stored products is challenging. Irrational distrust of irradiated food persists in some segments of society. One of the more promising areas of using irradiation against insect pests is quarantine treatments, used to prevent establishment of exotic pests. For 4 years now irradiation has been used to treat several fruit species which are hosts of fruit flies (Diptera: Tephritidae) shipped from Hawaii to the continental United States. Acceptance by consumers has been good. Last year irradiation began to be used against fruit fly in guavas shipped from Florida to Texas and California, and this year Florida mangoes will be irradiated. Florida has also petitioned California to accept sweetpotatoes irradiated for quarantine control of sweetpotato weevil, *Cylas formicarius elegantulus* (Summers). At doses that will control fruit flies, weevils, and many other important pest groups, irradiation is probably the most widely tolerated quarantine treatment by fresh fruits and vegetables.

Index terms: fruit flies, sweetpotato weevil, irradiation, quarantine treatment, stored product pests

[3912] HISTORY OF THE RISK ASSESSMENT PROCESS: A NORTH AMERICAN PERSPECTIVE ON RISK ASSESSMENT FOR BIOLOGICAL CONTROL INTRODUCTIONS

E. S. Delfosse, USDA-Agricultural Research Service, The George Washington Carver Center, 5601 Sunnyside Avenue, Building 4, Room 4-2238, Beltsville, MD 20705-5129 USA.

The nature and extent of risk from biological control—the deliberate use of living natural enemies (biological control agents) of a pest to reduce the abundance and/or impact of the pest—is receiving increased scrutiny worldwide. Most biological control ecologists consider this to be a good trend. Many regulatory processes purport to use science-based risk assessment to inform decisions. However, the assessment of risk from biological control is a misunderstood and often misapplied process, and few "risk assessments" are sufficiently rigorous. There is a continuum of innate specificity of agents, from monophagy (specific to one species) to oligophagy (specific to a few species in a genus, or is some cases, a few genera in a family) to polyphagy (attacking hosts in many genera and families). Generally, the risk to non-target species (NTS) increases from monophagy to polyphagy, *if and only if species in the ecological host range occur in the region of introduction*. The availability of monophagous organisms in nature is far less than for either oliphagous or polyphagous agents. Therefore, the pre-release host-specificity testing of each potential agent species is critical. Decades of host-specificity testing show that results from physiological (laboratory) testing are predictive of the ecological (field) host range. Most risk (and most fears) in biological control is measured by the *assumption of potential damage to NTS*. However, there is at least an equal risk to NTS from *not* using biological control, and many "risk assessments" do not take all management alternatives into account. Also, it is difficult to isolate the exclusive impact of potential risk from biological control agents on NTS, mainly because factors other than natural enemies influence risk, and if omitted, bias (overestimate) estimates of risk. A key issue is that it is meaningless and misleading to compare risk across different types of organisms or trophic levels. Clearly, the potential risk to NTS from a host-specific rust fungus is far less than risk from an oligophagous or polyphagous biological control agent. Another difficulty is that information is almost always incomplete. This complicates objective estimates of risk because the nature and extent of actual risk may not be understood, so the subjective valuation of risk is biased, and again, usually overstated. Skewed risk aversion plays a strong role in risk perception, and an individual's attitude to risk can greatly affect their acceptance of scientific information. This, in turn, affects decisions relating to introduction of new germplasm for biological control. A model risk assessment procedure for biological control is proposed.

Index terms: Physiological host range, ecological host range, safety

[3913] ECOLOGICAL RISK-BENEFIT ASSESSMENT FOR BIOLOGICAL CONTROL INTRODUCTIONS: AN AUSTRALASIAN PERSPECTIVE

A.W. Sheppard[1] **& R. Hill**[2], [1]Cooperative Research Centre for Weed Management Systems / CSIRO Entomology, GPO Box 1700, Canberra, ACT, 2601, Australia; [2]Research & Consultancy Services, Private Bag 4704, Christchurch, New Zealand

Despite recent concerns of the potential off-target risks of biological control on native species/communities, only New Zealand currently addresses the concepts of a formal ecological risk-benefit-cost (RBC) assessment of biological control introductions. The six key components of formal RBC assessment are; 1) adequate communication/consultation on RBC at all levels, 2) a comparative assessment of the RBC of biocontrol introductions relative to other types of introductions, 3) a full assessment and analysis of all risks, benefits and costs, 4) clearly defined procedure and responsibility in the decision process, 5) procedures to manage risks where appropriate and 6) procedures to evaluate risk analysis following introduction. The first half of this presentation uses RBC procedure and case histories to compare two highly contrasting approaches for assessing the risks of biological control releases. First, the evolved Australian model, which is a closed shop system with an expert committee making recommendations on release applications to regulatory authorities. Such applications are built almost entirely around formal host-range testing of the organisms for release. Second, the recently adopted and radically new New Zealand system which approaches a formal ecological risk assessment procedure with a precautionary approach, open consultation, broad definition of risk taken in the release application, and a judicial basis to the decision. The second half of this presentation discusses an Australasian perspective on the shortcomings in the recognised host-range testing procedure used by biological control workers worldwide with respect to formal risk assessment. Areas where further host specificity research is required are also discussed. Finally we discuss the inherent social risks of making ecological risk assessment of biological control releases a protracted process.

Index terms: host specificity testing, ecological risk assessment, New Zealand.

[3914] RISK ASSESSMENT PROCEDURES FOR BIOCONTROL INTRODUCTIONS IN SOUTHERN SOUTH AMERICA AND A PROTOCOL FOR PREDICTING PARASITOID POST - INTRODUCTION HOST RANGE

E. De Nardo[1], **K.F. Hopper**[2] **& R.M. Williams**[3], [1]Embrapa-CNPMA, QuarantineLab for biological Control Agents, Jaguariuna CEP 1382000 , Sao Paulo Brazil. Email: nardo@cnpma.embrapa.br, [2]USDA-ARS-Beneficial Insect Introduction Research Unit, Newark, DE, USA. Email: khopper@udel.edu, [3]OSU/OARDC Entomology Dept.,Wooster, 44691 ,OH. USA. Email:Williams.14@osu.edu.

Protocols for predicting host ranges of natural enemies for introductions to control weeds have been in place for many years, but protocols for predicting host/prey ranges of natural enemies for introductions to control arthropods are less well developed. However, concerns about the impact of exotic species on native species have led to increased interest in developing better protocols for all such evaluations. Although an international code of conduct for biological control introductions was approved by FAO in 1996, it lacks details about how to predict host ranges of parasitoids or prey ranges of predators prior to introduction. In the southern countries of South America, classical biological control activities have increased rapidly. The South Cone Plant Protection Committee COSAVE (<http://www.cosave.org.py>), formed through an agreement among the governments of its member countries (Argentina, Brazil, Chile, Paraguay and Uruguay) is responsible to harmonize the phytosanitary regulations and procedures to facilitate the regional and international trade of agricultural products. It has already approved a Regional Standard based on the FAO code for natural enemy introductions, but specific protocols are needed for predicting potential hosts of natural enemies proposed for introduction. Greatly increased amounts of quarantine testing might increase project costs too much and make them unaffordable for many countries. We describe a protocol for evaluation of host ranges of parasitoids and test it with retrospective case studies on *Macrocentrus grandii* (Hymenoptera: Braconidae), *Neodusmetia sangwani* (Hymemoptera: Encyrtidae), and other parasitoid species introduced for control of insect pests in North and South America. The protocol emphasizes literature data, turning to additional field and laboratory studies only when absolutely necessary. It relies on data concerning host range in the area of origin, and includes assessments of potential host species taxonomically and ecologically related to target, phylogenetics and other biological characteristics of the natural enemy species, and quarantine assessment of physiological and behavioral host acceptance and suitability for non-target species in the area of introduction.. We discuss problems raised during these case studies.

Index Terms: classical biological control; natural enemy; non-target; risk

[3915] ECOLOGICAL APPROACHES TO DETERMINING THE RISK OF MICROBIAL CONTROL AGENTS

M.B. Thomas, E. Watson & S. Blanford, Leverhulme Unit for Population Biology and Biological Control, NERC Centre for Population Biology and CABI Bioscience, Silwood Park, Ascot, Berks, SL5 7PY, U.K. E-mail: m.thomas@cabi.org.

Recently, the potential for negative, indirect, environmental effects of biological control has received increasing attention in the scientific and popular press. Most reports, however, have tended to focus on the effects of macrobial control agents (whether against weeds or other invertebrates) and not microbial control agents. In part this probably reflects the more wide-scale use of macrobial agents compared with microbial agents, particularly in classical biocontrol which has been the focus of much of the non-target debate. However, we feel it also reflects a poorer understanding of the ecology of insect-pathogen interactions compared with, for example, host-parasitoid interactions, and as a consequence, a more limited appreciation of what type of non-target effects are likely and what approaches and methodologies are appropriate to both evaluate and minimise potential risks. The implications of this lack of ecological understanding are further compounded by the general adoption of a 'chemical pesticide model' for evaluating microbial agents deployed as biopesticides; this chemical pesticide approach does not necessarily allow the biological nature of a microbial active ingredient to be examined in full. The aim of this paper is to highlight how taking a more ecological approach which moves away from simple measures of pathogen impact such as mortality and virulence (be it against target or non-target), and considers more fully the population dynamic and evolutionary aspects of insect-pathogen interactions, could yield increased opportunities for utilising microbial control agents in biological control and improved methods for predicting their impact under different field conditions.

Index terms: Insect pathogens, non-targets, biopesticides, *Metarhizium*, thermal ecology.

[3916] ASSESSING HOST RANGE OF A GYPSY MOTH PARASITOID: *APHANTORHAPHOPSIS SAMARENSIS* (DIPTERA: TACHINIDAE)

R. W. Fuester[1], **M. Kenis**[2], **K. S. Swan**[3], **P. C. Kingsley**[4], **C. López-Vaamonde**[5] **& F. Hérard**[6], [1,3]USDA-ARS, Beneficial Insects Introduction Research, 501 South Chapel St., Newark, DE 19713, USA E-mail: rfuester@udel.edu; [2,5]CABI Bioscience Centre, Switzerland, 1 Rue des Grillons, 2800 Delémont, Switzerland;
[4]USDA-APHIS, PPQ, Bldg. 1398, Otis Methods Development Center, Otis ANGB, MA 02542, USA; [6]USDA-ARS, European Biological Control Laboratory, Campus International de Baillarguet, CS 90013, Montferrier sur Lez, 34988 St. Gely du Fesc CEDEX, France

Aphantorhaphopsis samarensis, a European tachinid, has been released in North America for classical biological control of the gypsy moth, *Lymantria dispar*. The European literature suggested that this parasitoid has a restricted host range, the only previously reported field recoveries being from *L. dispar* and *Orgyia recens*, both tussock moths in the family Lymantriidae. Some tachinids have broad host ranges, so we wished to obtain more information on the host range of *A. samarensis*. Three approaches were used: (1) field collections and subsequent rearings of potential alternate or alternative hosts at European sites where *A. samarensis* was known to occur, (2) choice tests offering females of *A. samarensis* both gypsy moth and indigenous North American species of Macrolepidoptera, and (3) host suitability tests in which European nontarget species were artificially inoculated with mature eggs of *A. samarensis* dissected from gravid females to see if successful parasitism could occur. A total of 851 caterpillars, belonging to at least 54 species in 11 families, were collected in the field studies over several years, but none yielded *A. samarensis*, with two possible exceptions, both Lymantriidae: single larvae of the nun moth, *Lymantria monacha*, and rusty tussock moth, *Orgyia antiqua*, yielded puparia resembling those of *A. samarensis*, respectively, but no adult specimens emerged. In laboratory tests, where females of *A. samarensis* were offered 11 indigenous species of North American Lepidoptera in five families, only the lymantriid *Orgyia leucostigma*) was successfully parasitized. In host suitability studies, 10 species of Lepidoptera in eight families were inoculated with mature eggs of *A. samarensis*, but parasitism was successful only in *L. dispar*. Whereas we observed successful parasitism only in the lymantriid genera *Lymantria* and *Orgyia*, we conclude that *A. samarensis* has a high degree of host specificity.

Index terms: biological control, parasitism, *Lymantria dispar*, host specificity, host suitability

[3917] AN INTERNATIONAL PERSPECTIVE ON RISK ASSESSMENT

J.K. Waage, CABI Bioscience, Silwood Park, Ascot, SL5 7TA, UK, E-mail j.waage@CABI.org

Biological control developed as a public sector, agricultural technology in a few countries early in this century. More recently, biological control has undergone dramatic changes, including the development of an international, commercial trade in biological control agents, the use of biological control in environmental conservation, and the spread of this technology to all countries. These developments challenge traditional approaches to biological control safety and have led to several international efforts to harmonize and extend existing protocols to new countries and sectors, which are reviewed. In future, international conventions, particularly the Convention on Biological Diversity and the International Plant Protection Convention, will play a particularly important role in the evolution of biological control.

[3918] QUARANTINE PESTS AND INTERRUPTED TRADE: EXPERIENCES FROM POLAND AND SOME OTHER COUNTRIES

Stanislaw Ignatowicz, Warsaw Agricultural University, Department of Applied Entomology, 166, Nowoursynowska St., 02-787 Warsaw, Poland.

Agricultural products infested with quarantined pests cannot be exported, unless an appropriate quarantine treatment will be used, e.g. fumigation with gaseous chemicals. However, fumigation is becoming threatened technology. Of a wide range of materials used as fumigants for stored products, only two gases remain yet in widespread use (phosphine and methyl bromide). Even these remaining materials are under pressure because of carcinogenic concerns and ozone depletion. Alternatives to fumigation as quarantine treatment should be soon developed but it is not easy process. Lists of quarantined pests for Poland and some European countries will be presented and compared. History of cases of interception of quarantined pests at Polish border will be presented, using the khapra beetle, *Trogoderma granarium* Ev., and the western flower thrips, *Frankliniella occidentalis* (Pergande) as examples which will be discussed in detail. Procedures with infested products which are intercepted at the border will be evaluated. For exporting countries, the presence of quarantined pests in agricultural products is economically harmful, and it restricts this trade. Cases of interrupted trade because of the interception of a quarantined pest in agricultural product will be compiled and discussed. The impact of methyl bromide ban on the international trade will be mentioned.
Index terms: *Trogoderma granarium*, *Frankliniella occidentalis*, interrupted trade.

[3919] INSTABILITY IN PHYTOSANITARY MARKET ACCESS: IDENTIFYING CAUSES AND MANAGING EFFECTS

T.G. Parnell [1] & C.W. Hood [2, 1] Plant Quarantine Policy Branch, AQIS, GPO Box 858, Canberra, ACT 2601, Australia, E-mail: tom.parnell@aqis.gov.au. [2] Australian Embassy, 2-1-14, Mita, Minato-ku, Tokyo, Japan, 108-8361.

Phytosanitary requirements may have the effect of restricting possible product destinations, reducing volumes shipped, increasing the cost of exports or preventing exports entirely. Improvements in market access arrangements are often gained slowly but may change rapidly if the pest status of a production area changes. Gaining market access involves often lengthy assessment of the pest risks involved by the importing country. However, market access provisions once gained are often inherently unstable for several reasons. Trade disruption or complete loss of access may result from incursions of exotic pests, range expansion of endemic pests or regulatory breakdown of an accepted risk management measure. The response to such events by importing countries' is often initially highly conservative, including the reimposition of import prohibitions. In many cases, such prohibitions can only be removed following provision of detailed information on the changed phytosanitary status of an exporting area, such as the results of delimiting surveys. Thus regaining access may also involve the use of lengthy pest risk analysis procedures. Changes in pest status in the importing country may also lead to gains in market access opportunities. Where a new pest establishes in an importing area and cannot be eradicated, specific measures applied to imported host material may become redundant. However, if a measure has incidentially managed a suite of other quarantine pests, importing countries may need time to re-assess the pest risks involved. Various risk management tools are available for plant pests and include area freedom, non-host status, systems approaches, disinfestation treatments, export windows, restricted use or limited distribution of imports, inspection and testing. In some cases, risks may be able to be managed in several ways. Traditionally, decisions regarding the most suitable risk management procedures have been based on such factors as technical feasibility, the initial cost of research and the on-going cost to implement procedures. However, considerations rarely include inherent differences in the stability of otherwise equivalent phytosanitary management systems. The likelihood of market access disruption becomes greater with increasing instability in the chosen pest risk management tool. The concept of instability in phytosanitary market access arrangements, particularly issues of certainty in the choice between equivalent risk management tools, deserves further consideration. The potential for interruptions to trade in fresh fruits and vegetables, for example, may vary depending on whether pest risk management systems rely solely on commodity treatments, pest free area technologies or systems approaches. To protect trading arrangements, switching rules or defaults to harmonised alternative measures should become routine provisions in phytosanitary protocols.
Index terms: quarantine, trade disruption, area freedom, systems approach

[3920] TOWARD A STANDARD, INTERNATIONAL PROTOCOL FOR RESEARCH TO SURMOUNT QUARANTINE BARRIERS

Guy J. Hallman[1] & Neil Heather[2], [1]United States Dept. Agriculture, Agric. Research Service, 2301 S. International Blvd., Weslaco, TX 78596. E-mail ghallman@weslaco.ars.usda.gov. Univ. of Queensland-Gatton College, Australia. E-mail nheather@gil.com.au.

Trade between countries in a commodity that is potentially infested by a quarantine pest can be hampered by lack of standardized research protocols for developing a quarantine treatment or system. The exporting country must often conduct research on a quarantine pest without full knowledge of the commitment of time and resources involved because the importing country has not published or explicitly outlined a research protocol that would be acceptable. Research requirements can vary dramatically depending on the pest, the crop, and the country. We propose standardized methods that can be used in developing quarantine treatments or systems.

[3921] UPROOTING THE PROBIT 9 STANDARD FOR QUARANTINE SECURITY

P. A. Follett, USDA-ARS, U. S. Pacific Basin Agricultural Research Center, PO Box 4459, Hilo, Hawaii 96720

The probit 9 standard for quarantine treatment efficacy (maximum 32 survivors in a million treated individuals) was originally recommended for tropical fruits heavily infested with fruit flies. This standard may be too stringent for quarantine pests in commodities that are rarely infested or poor hosts. The "alternative treatment efficacy" approach measures risk as the probability of a mating pair, gravid female, or parthenogenic individual surviving in a shipment. This will be a function of many factors including infestation rate and shipment volume. Rambutan (*Nephelium lappaceum*) is an example of a commodity that is a poor host. Three regulatory pests, *Bactrocera dorsalis* (oriental fruit fly), *Cryptophlebia illepida* (koa seedworm), and *Cryptophlebia ombrodelta* (litchi fruit moth), typically have infestation rates of <0.5% on rambutan in Hawaii. A quantitative argument for lowering the probit 9 standard for these pests on this crop is presented. Lowering the probit 9 standard for qualifying pests/commodities will lower the number of required test insects when developing quarantine treatments which will save time and resources, and help farmers export their crop on a more timely basis. This approach also may reduce the severity of the treatment and therefore phytotoxicity.

Index terms: *Bactrocera dorsalis*, *Cryptophlebia illepida*, *Cryptophlebia ombrodelta*, quarantine treatment

[3922] GENERIC TREATMENTS: RESEARCH PANACEA OR PIPE DREAM?

L. G. Neven[1] & M. A. Williams[2], [1]USDA-ARS, Yakima Agricultural Research Laboratory, 5230 Konnowac Pass Road, Wapato, WA 98951, USA, E-mail neven@yarl.ars.usda.gov; [2] Department of Primary Industries, Water and Environment, 13 St Johns Ave, New Town, 7008, Tas, Australia, Margaret.Williams@dpiwe.tas.gov.au.

A generic heat treatment for a given quarantine insect pest can be developed to attain quarantine security. Retention of commodity quality is also essential, however, in order to maintain continued international trade. Although the pest and its host commodity may have coevolved, their thermal tolerances may not be the same. Therefore, the commodity must be tested separately for its tolerance range. The rate of heating used in empirical studies must reflect the milieu in which the insect resides, irrespective of the method of heating that will be applied to the commodity. Internal-feeding insects are thermally buffered by the host (commodity) environment. The thermal capacity of the commodity will determine the rate of heating of the insect and participate in the thermal acclimation timing of the pest. Also, since the commodity must be heated to kill the pest, the commodity will receive a higher incremental heat load than the insect. The ability of the commodity to withstand the heat load will determine the suitability of the treatment for the pest/host complex. The potential of the establishment of a generic heat treatment regime for both insects and commodities will be discussed. Particular focus will be on the physiological adaptations of both organisms in relation to heat tolerance.

Index terms: *Cydia pomonella*, heat treatment, thermal acclimation

[3923] PEST RESPONSE TO QUARANTINE TREATMENTS ON DIFFERENT VARIETIES OF A COMMODITY

V. Y. Yokoyama, USDA, Agric. Res. Serv., Hort. Crops Res. Lab., 2021 S. Peach Ave., Fresno, CA 93727, USA

Evaluation of the efficacy of quarantine treatments to control pests of regulatory concern may include a requirement to determine pest response to the treatment on varieties proposed for export. These tests are often referred to as varietal testing. However, this procedure alone does not definitively show the effect of variety on insect response to the treatment. Relationships between host and pest that may affect insect response to a quarantine treatment were investigated. Insect behavior and physiological interactions between codling moth and stone fruit varieties were studied in laboratory cage tests and through histological examinations. No relationships were found between the insect and host that may affect the efficacy of methyl bromide, a chemical fumigant, to control the pest on different varieties of nectarines. However, based on probit analysis of fumigant dose and insect response data, others have reported that differences in insect response were due to differences in variety of the host. Statistical evaluation of such data did not consider natural variation and alternative methods of analysis. Insect-host or toxicant-host relations that may affect pest susceptibility to toxicants on different varieties must be elucidated before varietal effects can be verified.

Index terms: *Cydia pomenella* (L.), nectarines, probit analysis

[3924] THE TECHNOLOGY AND ECONOMICS OF FRUIT FLY ERADICATION IN PACIFIC ISLAND COUNTRIES

A. J. Allwood[1] & A. McGregor[2], [1]Secretariat of the Pacific Community, Private Mail Bag, Suva, Fiji Islands, Email allwood@is.com.fj; [2]Trade and Development Office, Suva, Fiji Islands, Email koko@homer.is.com.fj

Eradication of fruit fly species (family Tephritidae) has been successful using a variety of techniques, either individually or in combinations. Included are techniques such as sterile insect technique (SIT), male annihilation, protein bait sprays, biological control, and cover sprays with systemic insecticides. SIT has been the most widely used eradication strategy. It involves flooding wild populations with laboratory-reared sterile males so that there is a high chance of a sterile male-wild female mating, thus interfering with reproduction and leading to a population decline. This technique has been used against a number of species, such as medfly (*Ceratitis capitata*) in California and South and Central America, oriental fruit fly (*Bactrocera dorsalis*) in the Northern Mariana Islands, and melon fly (*B. cucurbitae*) in the Kyukyu Archipeligo of Japan. Male annihilation involves the depletion of the male population of a species by attracting male flies to bait stations that consist of blocks impregnated with a male attractant plus an insecticide. Eradication programs targeting oriental fruit fly in French Polynesia (Tahiti and Moorea), Nauru and Palau and Pacific fruit fly (*B. xanthodes*) in Nauru, and employing distribution of fibreboard blocks treated with methyl eugenol and either malathion or fipronil at densities of 400-800 blocks per km², will be discussed. Also, the successful use of male annihilation using cue-lure impregnated blocks, applied during severe drought conditions on a small island, to eradicate melon fly in Nauru will be described. Continuing efforts to eradicate mango fly (*B. frauenfeldi*) from Nauru and a proposed program to eradicate melon fly from Guam and Northern Mariana Islands using a combination of SIT, protein bait sprays and male annihilation will be discussed. The economics of these recent fruit fly eradication programs in terms of costs and impact on the small island agricultural sectors, together with the problems encountered in implementing the programs, will be discussed.

Index terms: *Bactrocera* spp., eradication, male annihilation, economic impact.

[3925] IRRADIATION PROCESSING TO MEET PHYTOSANITARY REQUEREMENTS FOR EXPORT OF BRAZILIAN FRUITS

I.R.Ross

ABSTRACT NOT RECEIVED

[3926] HISTORICAL OVERVIEW OF QUARANTINE TREATMENTS IN INTERNATIONAL TRADE

J. W. Armstrong & P. A. Follett, U.S. Pacific Basin Agricultural Research Center, P. O. Box 4459, Hilo, Hawaii 96720

Postharvest quarantine treatments are used whenever there is a need to disinfest economically important host fruits and vegetables of insect pests before export from the country of origin to foreign markets. This presentation furnishes an historical overview of quarantine treatment development during this century, beginning with the first use of refrigeration to kill Mediterranean fruit fly eggs and larvae in citrus and stone fruits circa 1905. Although the first quarantine treatments were based on thermal manipulation, interest in physical treatments waned for over 30 years following the advent of modern fumigants. However, the loss of ethylene dibromide and international agreements to phase out the use of methyl bromide emphasized the need for alternative quarantine treatment methods. Physical treatments and the development of food irradiation provided suitable alternatives for use against a wide variety of quarantine pests. Today our arsenal of quarantine treatment methods includes thermal manipulation (freezing, refrigeration, and heating in the form of hot-water immersion, forced hot-air, or vapor heat), and ionizing radiation (both gamma and electrical source).
Index terms: Quarantine treatments, postharvest treatments, quarantine pests, irradiation

[3927] REGULATORY REQUIREMENTS FOR QUARANTINE PESTS: BARRIER TO TRADE OR GOOD BUSINESS PRACTICE?

P. M. Grosser, USDA-APHIS, 4700 River Rd., Unit 139, Riverdale, MD, 20737-1236. E-mail: peter.m.grosser@usda.gov

The principal objective of quarantine treatments and plant quarantine activities is the exclusion of exotic, quarantine significant plant pests and pathogens along man-made pathways. Exclusion is an economically and environmentally sound method of control because if the entry of these organisms is prevented, the need for pesticides, biological control agents, or other integrated pest management activities for eradication, suppression, or containment will not be required. International trade is a two-way street: The exports of one country are the imports of another country, and both are concerned with excluding pests. My talk will focus on the economics of pest exclusion by comparing projected agricultural production costs with the introduction of key quarantine pest to current agricultural production costs without these pests.

[3928] LOSS OF METHIL BROMIDE AND ITS IMPACT ON INTERNACIONAL TRADE

K.Vick

ABSTRACT NOT RECEIVED

[3929] INTERNATIONAL HARMONIZATION OF PHYTOSANITARY MEASURES

R. L. Griffin[1] and C. Devorshak[2], [1]FAO-AGPP, Room B-761, Viale delle Terme di Caracalla, 00100, Rome, Italy, Email: Robert.Griffin@fao.org; [2]FAO-AGPP, Room B-760, Viale delle Terme di Caracalla, 00100, Rome, Italy, Email: Christina.Devorshak@fao.org

The objectives of plant protection and free trade intersect under the International Plant Protection Convention (IPPC) where the concept of "safe trade" is addressed through the global harmonization of phytosanitary measures. The primary mechanism for realizing this is the establishment of international standards. Key concepts and principles addressed in international standards under the IPPC provide the basis for globally harmonized phytosanitary measures. By participating in standard-setting processes and observing internationally agreed standards, governments are better able to achieve an appropriate level of protection while reducing the likelihood of trade challenges. The emphasis in standards on feasibility and technical soundness ensures that the same principles and procedures are beneficial where trade is not the primary concern.
Index terms: Phytosanitary measures, IPPC, international standards

[3930] IMPACT OF QUARANTINE PESTS ON TRADE – A NEW ZEALAND PERSPECTIVE

M. Lay-Yee[1], [1]The Horticulture and Food Research Institute of New Zealand Ltd (HortResearch), Private Bag 92169, Auckland, New Zealand. E-mail: mlay-yee@hort.cri.nz

New Zealand is an island nation located in the South Pacific, and as such has remained free from many of the world's virulent horticultural and agricultural pests. As the country's economy is heavily dependent on its primary industries, NZ has developed comprehensive quarantine requirements for imported produce, to protect these industries from the threat of exotic pests. Produce from regions where quarantine pests such as fruit fly are established, must be demonstrated to be non-hosts or treated to control these pests, before it can be imported. New Zealand's fresh fruit exports are subject to similar requirements from many overseas markets. This has resulted in the need for pre-shipment inspection or product disinfestation to gain access to markets such as Australia, USA and Japan. Compliance with such quarantine requirements poses significant challenges for the horticultural export industry in terms of the practicality and cost of compliance, and the impact of specified handling and treatment procedures on produce quality. In addition, the worldwide trend away from the use of chemicals, and a growing emphasis on food safety, has put added pressure on the industry to develop and implement environmentally sustainable methods for pest and disease control to satisfy quarantine and consumer requirements. These issues and their implications will be discussed.
Index terms: fruit, export, environmental sustainability, disinfestation

[3931] COMPARISON OF (EXTRA) FLORAL NECTAR AND HONEYDEW WITH RESPECT TO THEIR SUITABILITY AS ARTHROPOD FOOD SOURCES

F. L. Wäckers, Dept. of Entomology, PO Box 8031, 6700 EH Wageningen, the Netherlands. NIOO CTO, PO Box 40, 6666 ZG Heteren, the Netherlands. E-mail: waeckers@cto.nioo.knaw.nl

Many arthropods feed on carbohydrate-rich food sources such as (extrafloral) nectar, and honeydew. Part of these insects, including many arthropod predators and host-feeding parasitoids, utilize these foods to cover their energetic requirements in addition to an otherwise protein-rich diet. The menu of many other arthropod species is entirely restricted to sugar-rich solutions. The latter group includes the broad range of parasitoid species that refrain from host feeding. Carbohydrate feeding can have a dramatic impact on the longevity and fecundity of sugar feeders and the availability of suitable carbohydrate sources may therefore drive population dynamics in multitrophic systems. Biological control workers have long been aware of the fact that the impact of parasitoids or predators in biological pest control may be constrained by the lack of exogenous carbohydrate sources in agricultural cropping systems. This realization has translated in an increased interest in habitat diversification as a means of introducing food supplements into agroecosystems. Despite the popularity of this approach, little is known with regard to the suitability of different nectars and honeydews as arthropod food sources. To the foraging parasitoid or predator the value of these potential foods will differ considerably depending on a number of criteria, including food source availability, source detectability, foraging risk, nectar accessibility and nectar suitability. In an attempt to provide a sounder foundation for the selection and use of food supplements in (agro) ecosystems I will compare floral nectar, extrafloral nectar and honeydew with respect to these parameters.
Index terms: parasitoid, food ecology, biological control, sugar.

[3932] MECHANISMS OF FOOD FORAGING BY PARASITOIDS: SIGNIFICANCE IN GOVERNING TRITROPHIC INTERACTIONS

W. J. Lewis, USDA-ARS, USA. E-mail: wjl@tifton.cpes.peachnet.edu

Insect parasitoids are free-living as adults. Thus, an adequate source of food is a determinant factor in the distribution and effectiveness of their host foraging activities. Plant nectar is a principle source of food for adult parasitoids and its presence in adequate quality, quantity, and distribution can be an important attribute in the plant's ability to recruit and retain parasitoids as a component of their overall defense system. Parasitoids can learn chemical and visual cues in association with food and host resources. Further, they are able to separately link these cues to the different resources and subsequently balance their responses to these cues based on current physiological state relative to host and food needs. Thus, the provision by plants of effective cues in association with nectar can increase the efficiency of parasitoid foraging. Food provision is an important factor in the tritrophic interactions and evolutionary ecology of plants, herbivores and parasitoids. Understanding and fostering the mechanisms guiding these interaction is a vital component of designing and managing healthy agricultural systems.

[3933] INTERACTIONS AMONG PLANTS AND INSECTS MEDIATED BY EXTRAFLORAL NECTARIES

S. Koptur, Dept. of Biological Sciences, Florida International Univ., Miami, FL 33199, USA, E-mail kopturs@fiu.edu.

Extrafloral nectaries (EFNs) are located outside flowers and are not usually involved in pollination. Their function is not as uniform as that of floral nectaries (which attract pollinators), but they certainly do more than eliminate excess carbohydrates. EFNs are visited by a wide array of animals (primarily ants and other Hymenoptera) and the associated effects on the plants range from beneficial to harmful, depending on the ecological context. The position of the EFNs and the timing of their appearance in the development of a plant suggests what parts of the plant and what developmental stages are vulnerable to herbivore attack and might benefit from ant protection. Many recent studies suggest that extrafloral nectar can be an inducible defense, with plants secreting more nectar when they are damaged (especially in stages of maximum nectar secretion). Although there are some similarities, honeydew-producing Homoptera are not simply animal analogs of EFNs, for a plant cannot regulate the amount of carbohydrate expended through its phloem-feeding herbivores.

Index terms: nectaries, ants, parasitoids, antiherbivore defense

[3934] FEEDING ON PLANT TISSUE BY HETEROPTERAN PREDATORS, A REVIEW OF ITS IMPORTANCE FOR POPULATION DYNAMICS AND BIOCONTROL

M. Coll, Dept. of Entomology, Fac. of Agric, Food and Environ. Qual. Sci., The Hebrew Univ. of Jerusalem, P. O. Box 12, Rehovot 76100, ISRAEL E-mail: coll@agri.huji.ac.il.

A growing body of literature demonstrates the importance of omnivorous predators to pest control. Recent literature compilation shows that substituting water-only diet with plant material enhances the performance of omnivorous Heteroptera. Furthermore, plant material also enhances omnivore performance when it supplements prey-only diet. Therefore, plants provide these bugs with more than just moisture and thus may sustain omnivore populations when prey is scarce. To enhance the level of biological pest control, we must therefore understand how plant-feeding affects predator-prey interactions in agroecosystems. In my talk, I will draw on experimental results and discuss how variability in plant nutritional value and phenology affect the behavior, population dynamics, and level of biological pest control in *Orius* species. Specifically, I will show that nitrogen level in cotton foliage affects the within- plant distribution and intraspecific interactions of *O. albedipennis*; and that mated females defend preferred oviposition sites more vigorously on high-nitrogen than low-nitrogen leaves. At the population level, *O. albedipennis* density is positively correlated with pepper flowering cycle. During the winter, when pepper plants stop flowering in unheated greenhouses, a decline in the availability of pepper pollen results in low *O. albedipennis* densities and in a reduced ability to suppress western flower thrips populations. Clearly, the complex interactions between omnivores and the food plant of their prey should be taken into account in biological control programs.

Index terms: *Orius albedipennis,* Omnivory, Heteroptera, biological control, *Frankliniella occidentalis.*

[3935] THE ECOLOGICAL CONSEQUENCES OF OMNIVORY BY PLANT-FEEDING "PREDATORS"

M.D. Eubanks[1], Dept. of Entomology and Plant Pathology, Auburn Univ., 301 Funchess Hall, Auburn, AL 36849, USA, E-mail meubanks@acesag.auburn.edu

Under some circumstances, omnivores may be more likely to suppress prey populations than strict predators. Animals that feed at multiple trophic levels are unlikely to starve or emigrate when prey are scarce. As a result, omnivores may continue to capture and consume prey at low prey densities and may drive them to local extinction. In contrast, typical predators either starve or emigrate when prey are scarce, allowing prey to escape predation at low densities and populations to rebound. Consequently, feeding at more than one trophic level by omnivores may deny prey density-related refugia from predation. I conducted a series of laboratory and field experiments to test this hypothesis. I found that plant feeding by an omnivorous predator could intensify interactions between the omnivore and its herbivorous prey species. The strength of omnivore-prey interactions, however, was largely mediated by variation in plant quality. Specifically, I found that variation in plant quality altered the functional response of the omnivorous, big-eyed bug, *Geocoris punctipes* (Heteroptera: Geocoridae). The presence of high quality plant parts for the omnivores (lima bean pods) reduced the number of prey (pea aphids and corn earworm eggs) consumed by big-eyed bugs. Pods, therefore, had an indirect, positive effect on the survivorship of herbivorous insects that feed on lima beans. The results of caged field experiments mirrored those of the functional response experiment conducted in the laboratory. Populations of pea aphids were larger when caged with big-eyed bugs on bean plants with pods than on plants without pods. The impact of big-eyed bugs on caged aphid populations was often severe: pea aphid populations were frequently driven to extinction. I conducted an additional open plot field experiment to see if patterns in nature supported the laboratory and field cage experiments. I established 600 m^2 field plots of lima beans with many pods and plots with few pods. I found that populations of herbivores were much smaller in plots of beans with lots of pods than in plots of beans with few pods. In addition, big-eyed bug populations were larger in plots of beans with many pods. It appears that the positive, direct effects of pods on big-eyed bugs overwhelm the positive, indirect effects of pods on herbivore population size, and that pod feeding by big-eyed bugs ultimately results in smaller herbivore populations. This study supports the hypothesis that plant feeding by omnivorous "predators" promotes prey suppression, but prey suppression is ultimately mediated by variation in plant quality.

[3936] DO PLANTS BENEFIT FROM PROVIDING FOOD TO PREDATORS IF IT IS ALSO EDIBLE TO HERBIVORES? MODELS AND EXPERIMENTS

P.C.J. van Rijn, Y.M. van Houten & M.W. Sabelis, Univ. of Amsterdam, Inst. for Biodiversity and Ecosystem Dynamics, Kruislaan 320, 1098 SM Amsterdam, The Netherlands, E-mail: rijn@bio.uva.nl.

It is well established that plants provide alternative foods to predators of herbivorous arthropods. In this way, they may gain protection against herbivory, but cannot prevent others to utilise these foods as well. There are many examples of herbivorous arthropods that can feed on plant-provided foods, such as extrafloral nectar and pollen. The question therefore arises whether individual plants still gain protection when not only the predators but also the herbivores can feed on these foods. We analysed this problem by modelling and by experiments to assess the impact of supplementary pollen on the dynamics of predatory mites (*Iphiseius degenerans*) and herbivorous thrips (*Frankliniella occidentalis*), two arthropods capable of using pollen for reproduction. Greenhouse experiments showed that biweekly addition of pollen to one young mature leaf of a male-sterile cucumber plant increased predator population growth and greatly reduced herbivore numbers. Using a structured predator-prey-pollen model with invulnerable prey stages and experimentally established parameter estimates, three general results were obtained. First, prey equilibria always settled at lower values in presence of pollen. Second, mean thrips numbers during the transient phase following predator release were either higher or lower under pollen supply, depending on the initial numbers of predators and prey. Third, the model showed that limiting the plant area covered with pollen led to a decrease in mean thrips numbers, given an aggregative response of predators to patches with pollen. The latter result explains why plants provide alternative foods at a limited number of sites. Moreover, it leads to new perspectives for the design of biological control methods.

Index: predator-prey interactions, plant-predator mutualism, indirect plant defence, pollen, biological control

[3937] NORTHERN AUSTRALIA QUARANTINE STRATEGY, AUSTRALIA'S FRONTLINE OF DEFENCE

K. L. Anderson, J. F. Grimshaw & K. A. Huxham, Northern Australia Quarantine Strategy, Australian Quarantine and Inspection Service, P.O. Box 1054, Mareeba, QLD, 4880, AUSTRALIA. E-mail: kerrie.huxham@aqis.gov.au

The Federal Government established the northern Australia Quarantine Strategy (NAQS) ten years ago, following a recommendation by Professor David Lindsay in 1987. The Lindsay Report recognised that Northern Australia, in its entirety, remains relatively uninhabited and difficult to traverse. Despite this, tourism in the region is increasing. Recognition was also given to the ease of traditional human movement between Papua New Guinea, the Torres Strait and mainland Australia and also that islands in the Torres Strait could provide stepping stones for exotic insect fauna to enter mainland Australia. Considering these factors and the quarantine integrity of Northern Australia, the region was identified as a frontline for Australian quarantine defence. From Broome in Western Australia to Cairns in Queensland, NAQS plant scientists survey their respective regions with a frequency according to the quarantine risk posed. Surveys and monitoring are carried out to provide early warning of quarantine pests. The Torres Strait is a demonstrably high quarantine risk area because of its proximity to Irian Jaya and Papua New Guinea, which have many insect pests of concern to Australia. The Torres Strait islands therefore, have been divided into two separate quarantine zones. Most of the islands have been assigned to the Protected Zone, which allows for trading and the traditional movement of inhabitants between parts of Papua New Guinea and islands within that group. Islands within the Thursday Island group form the Special Quarantine Zone. These regions, as well as Cape York Peninsula and the northern parts of mainland Australia are discussed with reference to the type of entomological quarantine risks faced, and the NAQS approach to protect Australia's plant health.

Index terms: *Bactrocera cucurbitae, Bactrocera papayae, Apis cerana, Deanolis sublimbalis, and Erionota thrax.*

[3938] INSECTS DAMAGING RESISTANT PLANT CROPS

J. E. Araya, Univ. Chile, Fac. Cs. Agron., Casilla 1004, Santiago, Chile, E-mail: jaraya@abello.dic.uchile.cl.

Inherited variability of pests must be considered in breeding for resistance, as forms may adapt to damage previously resistant plants. The identification of biotypes has strengthened the evolutionary concept of pest resistance. However, the term biotype has many different meanings (e.g., variants differing in diurnal or seasonal activity, size, shape, color, insecticide resistance, migration and dispersal tendencies, pheromones, etc.). XENOTYPE is herein proposed to refer specifically to aggresive pest population variants capable of surviving and reproducing on plant varieties formerly known to be resistant. In general, when large areas of a highly resistant crop are planted, natural selection of the pest occurs, and any genetic change that could result in virulence (the ability to infest) has a high selective advantage. Thus, pest resistance breeding programs are a continuing operation with acceptable levels or resistance or tolerance being temporary. If farmers plant resistant hosts extensively, insects are selected to survive and breed. In time, the general population can shift to a new xenotype. A detailed revision of the literature has indicated that the following insect pests have developed true xenotypes: cabbage aphid (*Brevicoryne brassicae*), corn leaf aphid (*Rhopalosiphum maidis*), English grain aphid (*Macrosiphum avenae*), grape phylloxera (*Daktulosphaira vitifoliae*), greenbug (*Schizaphis graminum*), Hessian fly (*Mayetiola destructor*), pea aphid (*Acyrthosiphon pisum*), raspberry aphid (*Amphorophora rubi*), rice green leafhoppers (*Nephotettix cincticeps, N. virescens*), rice brown planthopper (*Nilaparvata lugens*), rice gall midge (*Orseolia oryzae*), rosy leaf-curling aphid (*Dysaphis devecta*), Russian wheat aphid (*Diuraphis noxia*), spotted alfalfa aphid (*Therioaphis maculata*), and woolly apple aphid (*Eriosoma lanigerum*).

[3939] THE COCOA BLACK ANT (CBA) AS AN INDICATOR OF THE COCOA AND COCONUT AGROECOSYSTEM HEALTH MEASURED INDIRECTLY THROUGH THE LEVEL OF COCOA POD BORER (CPB) INFESTATION

I. Azhar, Cocoa Research and Production Center, Malaysian Cocoa Board (MCB) Hilir Perak, PO Box 30, 36307 Sungai Sumun, MALAYSIA

In agroecosystems, many operational and cultural practices had either direct or indirectly influence the species composition of the ants. Hence, the presence of a dominating species is attributable to the presence of conducive interacting processes, inherent in these agricultural practices, promoting that particular species but limiting the others. On the contrary, the absence of it signifies the lack of these processes measurable directly or indirectly. The cocoa black ant (CBA), *Dolichoderus thoracicus* Smith, is the dominant ant species in cocoa and coconut agroecosystems. It is mutually associated with the cocoa mealybug (CM), *Cataenococcus hispidus* Morrison (Homoptera: Pseudococcidae), a dominant mealybug species in the cocoa and coconut agroecosystems that do not vector any known plant diseases. A well-managed cocoa and coconut agroecosystem seems to provide appropriate environment favorable for the development of dominant CBA that make their main nest in the coconut crowns. The presence of high population of CBA, through its mutual interactions with the CM, limits the infestations of the cocoa pod borer (CPB), *Conopomorpha cramerella* (Snellen) (Lepidoptera: Gracillariidae), a serious pest of cocoa in Malaysia. However, the development of high CBA population levels is a consequence of the prevailing local environmental characteristics, especially the critical presence of CM for honeydew source, optimal shade level and canopy coverage, available nesting sites and available foraging or migration alleys for local spread. On the other hand, CM is itself affected by an optimal set of local environmental characteristics that are temporally varied. Some of the favorable conditions for CM development include optimal shade level and available cocoa pods as their food source. The presence of these favorable environments is critical for the CBA and CM population build-up, hence the lack of which may result in increased infestation of cocoa pods by the CPB. In other words, the increased infestation of the cocoa pods by the CPB is consistently associated with the decreasing numbers or absence of the CBA. Hence, recording the level of CPB infestation (measured through the average damage severity index (ADSI)) may indirectly serve as an indicator of the 'health' condition of the cocoa agroecosystems. This claim is testified by the following study. This study reports the potential use of the CBA as an indicator of cocoa and coconut agroecosystem health. The CPB infestation levels were monitored and compared among the three cocoa blocks in MCB Hilir Perak that had different ant population levels and site characteristics. Ripe pods in each block were sliced and split to determine the number of entrance holes and damage severity, respectively. Larval infestations were consistently lower in the cocoa block with higher ant population (mean 2.12 entrance holes/pod), than those blocks with lower (mean 13.59 entrance holes/pod) and lowest (mean 8.07 entrance holes/pod) ant populations. In addition, the block with highest ant population had lower percentage of pods (mean 11.0%) with moderate and heavy damage than the other two blocks that had lower and lowest ant populations (means of 66.5 and 51.1%, respectively). This was further supported by the consistently lower average damage severity index (ADSI) in the block with highest ant populations (0.67) than other two blocks (2.74 and 2.12, respectively) indicating that the damage was slight with almost all beans from the pod extractable. As the black ants occur naturally in the cocoa and coconut agroecosystems, it holds special prospects to be used an indicator of agroecosystem health that allow for manipulation to our advantage.

[3940] RESULTS REGARDING MAIZE RESISTANCE TO THE EUROPEAN CORN BORER IN ROMANIA

A. Bărbulescu[1], O. Cosmin[2] & I. Sabău[3], [1,2] Research Inst. for Cereals and Industrial Crops, 8264 Fundulea, N. Titulescu Str., 1, Calarasi District, Romania, E-mail:fundulea@cons.incerc.ro; [3] Monsanto Bucharest Romania

Maize hybrids resistant to Ostrinia nubilalis being of economic interest in Romania, a special breeding programme has been performing. This paper represents going forward with research started at Fundulea in 1975 referring to the development of maize inbred lines resistant to the borer, also having satisfactory agronomic characters, stressing achievements obtained in the last experimental years. Methodology. After several previous cycles of crossing and screening for insect resistance, maize inbred lines with a pronounced resistance and increased agronomic characters have been obtained. By crossing these inbred lines with maize forms with acceptable levels of agronomic performance new hybrid combinations were achieved. From these, annually, over 500 lines were submitted to self-pollination under artificial infestation (10 plants for each line with 5-6 egg-masses per plant), retaining only lines showing reduced attack level and suitable agronomic traits. Some inbred lines showing representative attack values were infested with 20 egg-masses per plant. The attack score used the length of tunnels bored in stalks (cm), and the number of larvae per stalk, as counted in autumn by spliting plants. Results. It was found that after 25 years of investigations on maize resistance to Ostrinia nubilalis inbred lines demonstrating constantly reduced attack by the borer have been obtained. Taking into account the data of the last three years of the experiment it was noticed that the attack produced by European Corn Borer was 14-fold lower, in maize resistant inbred lines as compared to that of highly susceptible lines. Some inbred lines showed a certain resistance degree even at a very severe attack. These lines showed a high combinative value and superior agronomic traits. By crossing some of these inbred lines, tolerant hybrids to the borer attack were achieved. Although one of these hybrids had a low level of borer attack, however Monsanto hybrid-Dekalb 512 Bt showed no damage caused by the borer. Conclusions. After 25 years of research on maize breeding for resistance to *Ostrinia nubilalis*, inbred lines have been obtained, possessing a certain degree of resistance, having high combinative value and superior agronomic traits. Among the maize hybrids developed from these inbred lines, the hybrid HSF 1071-96 has been remarked for reduced attack.

Index terms: *Ostrinia nubilalis*, egg-masses, maize inbred line, resistance .

[3941] EFFECTS OF TROPICAL BACULOVIRUS ISOLATES AGAINST *SPODOPTERA FRUGIPERDA* (LEPIDOPTERA: NOCTUIDAE) LARVAE

M. R. Barreto[1], L. L. Loguercio[1], E. Paiva[1] & F. H. Valicente[1], Applied Biology Group (NBA), EMBRAPA Maize & Sorghum, Cx. Postal 151, Sete Lagoas-MG, 35701-970, Brazil; E-mail: barreto@cnpms.embrapa.br

The objective of this work was to verify the susceptibility of *Spodoptera frugiperda* larvae at different developmental stages to distinct isolates and concentrations of tropical baculovirus. Twenty two field isolates of baculovirus, under six different concentrations (10^3 to 10^8 polyhedres.ml^{-1}), were applied to 3rd-and 4th-instar larvae, which were reared under laboratory-controlled conditions of temperature, humidity and light. The experimental design was randomized blocks, each containing 133 treatments (isolates x virus concentrations, plus water as a control) per replication; four replications were used in a total of 532 experimental units, each containing 12 larvae. The experiments were conducted with the larvae placed in plastic 50-ml cups, and individually fed with a piece of maize leaf soaked in the several virus suspensions (1 larvae per cup); after a 4-days exposure, the pieces of treated leaf were replaced by artificial diet. The symptoms of the virus-derived infections were assessed daily, with the larval death generally occurring between the 5th and the 7th day after virus ingestion. Due to the high mortality observed (100%) for the 10^7 and 10^8 concentrations, the parameters of larval and pupae periods, as well as pupae weight, were assessed only for the concentrations of 10^3 to 10^6. Statistically significant differences were found among the isolates in their effect on the larvae period and pupae weight (including a significant interaction effect with the concentrations), but not for the pupae period. The isolates '03' and '09' revealed a significantly high mortality level (>80%) for the concentrations 10^3 and 10^4; the isolate '19' increased the average larval period, and the isolate '06' increased the average pupae period, although it also increased the average pupae weight for the concentrations 10^3 to 10^5. In all cases observed, there was no defective adult emerging from the pupae.
Index terms: *Spodoptera frugiperda*, VPN, Baculovirus Spodoptera, insecticidal activity.

[3942] CONTROL OF *SPODOPTERA FRUGIPERDA* IN CORN FIELD BY DIFFERENT METHOMYL RATES, VOLUMES AND APPLICATIONS METHODS.

J. Belasque Júnior[1] & M. C. Ferreira[2].[1]Dept. Produção Vegetal, Univ. Estadual Paulista-Campus de Jaboticabal, Via de Acesso Paulo Donato Castellane s/n, 14870-000, São Paulo/Brazil, E-mail: belasque@hotmail.com; [2]Dept. Fitossanidade, Univ. Estadual Paulista-Campus de Jaboticabal, E-mail: mdacosta@fcav.unesp.br.

The fall armyworm – FAW – (*Spodoptera frugiperda*) is one of the most important pest of maize. As a rule its control is accomplished by spraying insecticides, although transgenic plants has been used lately in a few countries. Thus, studies for optimisation of this method is still very important to reduce economic and environmental impacts. Taking in account the aforementioned this work was developed aiming to evaluate the effect of methomyl applied by two application methods (band and broadcast), in two rates (0.6 and 0.3 L/ha), and in two volumes (300 and 150 L/ha), on the FAW control, in maize (hybrid Agromen 2012). The field trial was carried out as a randomised block with three replications, and analysed as a factorial $2^3 + 1$ control, on the university farm of Faculdade de Ciências Agrárias e Veterinárias/UNESP – at Jaboticabal, SP – Brazil, starting on 07-april-99. Evaluations were performed 1, 3, 5, and 9 days after applications (daa), by collecting 5 plants per plot, to numeric quantification of dead or alive FAW. To statistical analysis data were changed to $(x + 0.5)^{1/2}$. There were no difference between applications volumes. The rate of 0.6 L/ha induced better FAW control compared to 0.3 L/ha, at 3 and 5 daa, but no difference was observed on 1 and 9 daa. Band showed better FAW control than broadcast application on 1 daa, but no difference was verified on 3, 5 and 9 daa. The control plots presented higher numbers of living FAW per plant on all evaluation times studied, compared to other treatments.
Index terms: Fall armyworm, chemical control, application technology.

[3943] THE ROLE OF ENVIRONMENTAL POLICY AND PROCEDURES IN MITIGATING IMPACTS OF ACRIDID CONTROL IN SAHELIAN AFRICA

Y. T. Belayneh[1], J. Vorgetts[2], & A. Schroeder[3], [1,2,3]USAID/AFR/SD/ CMR-AELGA, 1325 G St., NW, Suite 400, Washington, D.C. 20005 USA, E-mail: ybelayneh@afr-sd.org; jvorgetts@afr-sd.org

Acridid locusts and grasshoppers (l&g), are serious crop and pasture pests throughout Sahelian Africa. Millions of hectares of crop fields and pasture are attacked annually. Control efforts rely almost exclusively on synthetic chemical pesticides. Chemical control costs afflicted countries and the international donors millions of dollars and poses a serious threat to the inhabitants, fauna, and flora of the Sahel and the African continent as a whole. Pesticides are believed to pose more danger to humans and the environment of Sahelian Africa than any other similar activity that has been or is being practiced in the region. Although confirming investigations are yet to be conducted, it is highly likely that permanent changes in the species composition and irreversible adverse impacts have resulted from emergency campaign operations targeted at l&g control in the past. Therefore, strong environmental policy guidelines and implementation procedures are critical to preserving the extremely fragile biodiversity of Sahelian ecosystems. It is equally important that such policies offer flexibility and convenience of execution at grassroots as well as higher political and technical levels. In response to this need, the United States has enacted statutory requirements in the Foreign Assistance Act (FAA: Public Law 87-185) and the Foreign Operations Appropriations Act (PL 105-118). The U. S. Agency for International Development (USAID) and its implementing partners have been directed by Executive Order 12114 to ensure compliance with the applicable environmental provisions of these laws as promulgated in Title 22 of the U.S. Code of Federal Regulations (22 CFR 216), which is commonly referred to as "Reg. 216." These procedures and policy guidelines are often accepted and pursued by other international organizations. For instance, the United Nations Food and Agriculture Organization (FAO), which is a frequent close collaborator with USAID's Africa Emergency Locust/Grasshopper Assistance (AELGA) project, applies these guidelines in tandem with its own, while providing technical and material assistance to afflicted countries, especially where and when U.S. Government funds are involved. The policy guidelines and procedures have been instrumental in ensuring proper implementation of safer and effective preventive and curative control strategies and tactics against l&g in a number of countries in the Sahel and elsewhere that are affected by these pests. They have also served as an impetus for the affected countries to develop their own guidelines and procedures for similar activities.
Key words: biodiversity; human safety; environmental protection; pest control

[3944] TRANSGENIC COTTON, AN ALTERNATIVE TO CONVENTIONAL (NON-TRANSGENIC) COTTON FOR SOUTH AFRICA

A. Bennett[1], E. Louw[2], WM. Green[3], & TJE Uys[4], [1,2] Tobacco and Cotton Research Institute, P/Bag x 82075, Rustenburg, 0300 South Africa E-mail: estelle@nitk1.agric.za; [3,4] Monsanto South Africa (Pty) Ltd., Monsanto House, Building 1, Harrowdene Office Park\Phase 3, Woodmead, Midrand South Africa, E-mail: wally.m.green@monsanto.com

Transgenic cotton, NuCOTN 37[B] and NuCOTN 35[B] containing the Bollgard™ gene (the gene derived from *Bacillus thuringiensis* var. *kurstaki*) became commercially available in South Africa in the 1998/99 cotton-growing season. South Africa has six cotton producing regions, Mpumalanga, Northern Province, Northern Cape, KwaZulu Natal, Orange River and the NorthWest region. The number of small-scale farmers that plant transgenic cotton (Bollgard™) has increased dramatically over the past two seasons. In South Africa, the bollworm complex, which includes the African bollworm (*Helicoverpa armigera* Hübner), Red bollworm (*Diparopsis castanea* Hampson) and Spiny bollworm (*Earias biplaga* Walker & *E. insulana* (Boisduval)), is effectively controlled by the Bt endotoxin. It is economically viable to plant Bollgard, for the farmer benefits by means of an increase in yield, a cost saving of up to 5 insecticide applications which translates into a reduced environmental impact and in turn create a niche for natural enemies of other pests which attack cotton. During the 98/99 season, the cost benefit on irrigated *Bt*-cotton, was approximately 10-15% over conventional irrigated cotton, approx. 20% for dryland cotton and for the small-scale farmer, approx. 30% (excluding seed costs and license agreement costs). The advantages of planting Bollgard, and the resistant management conditions adhered to it, is explained.
Index terms: Bollgard™ gene, bollwurm complex, benefits

[3945] PAST AND PRESENT STRATEGIES FOR THE ECONOMICAL CONTROL OF CODLING MOTH IN SOUTH AFRICAN ORCHARDS USING MATING DISRUPTION

T. L. Blomefield, Pest Management, ARC Infruitec/Nietvoorbij, P/Bag X5013, Stellenbosch, 7599, South Africa, E-mail tom@infruit.agric.za

Cydia pomonella is a key pest in South African pome fruit orchards. Under the climatic conditions experienced in South Africa the reproductive potential of codling moth is high and the pest requires precise monitoring and an intensive control strategy. Fruit infestation commences during blossom and continues through three successive generations, a period of 7 to 8 months. Prior to 1993 growers relied almost exclusively on an organophosphate programme with azinphos-methyl as the central component. Many orchards received up to 12 azinphos-methyl sprays. In 1993 the detection of a very high level of codling moth resistance to azinphos-methyl and some pyrethroids necessitated a restructuring of the chemical control strategy against codling moth, and an assessment of alternative management technologies that could be implemented in a resistance management strategy. Mating disruption of codling moth was studied over a 6-year period (1994-1999) in a block of apple orchards, using Isomate-C supplemented with codling moth sprays when necessary as indicated by pheromone trap catches. By the end of the sixth year the average number of sprays in the mating disruption block had decreased from 10.6 to 1.3, and the average fruit infestation was limited to 0.02%. Exceptional control was achieved considering that there are three generations of codling moth per season and the 1998/99 summer season was exceptionally long, hot and dry. Although cost is cited as one of the main constraints to increasing the widespread use of mating disruption in South Africa, the cost of the combined mating disruption and insecticide programme is comparable to a chemical programme. This cost decreased from $492 per ha in 1994 to $98 per ha in 1999. This paper presents results of the mating disruption trial and future codling moth control strategies in South African orchards.

Index terms: *Cydia pomonella*, apples, resistance management, pome fruit.

[3946] ORIENTAL FRUIT MOTH CONTROL THROUGT MATING DISRUPTION WITH MICROENCAPSULATED PHEROMONE IN PEACH ORCHARDS

M. Botton[1] & F. Kulcheski[1], [1]Embrapa Uva e Vinho, P.O. Box 130, Bento Gonçalves, RS, 95.700-000 Brazil. E-mail marcos@cnpuv.embrapa.br.

Oriental fruit moth (OFM) *Grapholita molesta* (Lepidoptera : Tortricidae) is an important peach pest in Brazil where 18.000 ha are cultivated. Peach farmers have basically small growing areas of around 2 to 3 ha with early, middle and late season cultivars. At the moment, OFM control is based on organophosphate and pyretroids insecticides, sprayed at pre-established intervals without monitoring systems. However, high toxicity of compounds, secondary pests outbreaks, residue and resistance concerns shown a urgent necessity for better techniques of control. Mating disruption using microencapsulated pheromone is a new alternative for *G. molesta* control in peach orchards. During 1999/2000 season, three peach orchards (around 1 ha each) were sprayed every fortnight with 3 M microencapsulated pheromone (187,5 mL/ha of commercial formulation that contains 20% Z-E-dodecenyl acetato, 93:6 v/v), using airblast sprayers (800 L/ha). Trap shutdown was evaluated weekly by using delta traps (Isca Technologias Ltda). At harvest, damages caused by OFM larvae in 2.000 fruits/area were recorded comparing results with chemical control usually used by growers. In all orchards, areas treated with micorencapsulated pheromone resulted in trap shutdown higher than 99%. In early season cultivar Premier (harvested at 11/15) damages caused by pest in treated plots were 3%, higher than those observed with chemical treatment (1,7%). In the late season cultivar Chiripa (harvested at 1/10) damages were 1,4% compared to 2,5% in chemical treatment. In this area however, two chemical sprays treatment with organophosphate insecticides to *Anastrepha fraterculus* control were applied near the harvest period. In a third area (Chiripa cultivar), the number of pheromone applications were reduced in 40% compared to the second one. Trap shutdown was also observed in this area but damages at harvest were 9% compared to 2,3 % in the chemical control. High pest pressure, absence of control of the first generation and small plots were attributed to pest control failure. In these three areas, damages at harvest caused by other catterpillars mainly *Anicla* sp. and leafrollers were higher than OFM. This shows that there is a need for complementary control of other catterpillars in pheromone treated fields. Studies are being conducted to define dosages, application periods, chemical interactions and methods to control secondary pests in microencapsulated treated areas of peaches in Brazil.

Index terms: *Grapholita molesta*, sexual confusion, *Anastrepha fraterculus*

[3947] NEW REGULATORY PROCEDURES FOR FILTH AND EXTRANEOUS MATERIALS IN FOOD

J. R. Bryce[1], [1]U.S. Food and Drug Administration, 200 C Street, S.W., Washington, DC 20204, E-mail: jbryce1@smtpgate.ora.fda.gov.

The Food and Drug Administration is revising its strategy for regulating filth and extraneous materials in food. The goal is to replace, to the extent possible, the existing case-by-case process for reviewing legal actions with a new process, or strategy, that is transparent and places appropriate emphasis on food safety issues. Transparency means that the standards and reasoning for regulatory decisions will be made available publicly by publishing objective, scientific criteria. The first goal was to develop a scientific basis for the new strategy. The science base has been developed and will be published in *Regulatory Toxicology and Pharmacology*. Three articles appeared in the December, 1998 issue of this peer-review journal. These three articles define scientific criteria for the objective evaluation of physical, biological and chemical hazards associated with filth and extraneous materials in food. Two additional articles are planned for later publication. The next objective was to organize the scientific criteria into a transparent process for reviewing legal actions. The criteria are organized into three prioritized categories: 1) Health hazards associated with filth and extraneous materials; 2) violations of Good Manufacturing Practices (GMPs) involving filth and extraneous materials; 3) Aesthetically based filth and extraneous materials. The science base was then used to classify contaminants into one of the three action criteria categories and to develop specific action criteria for the most common types of contaminants. The result will place greater regulatory emphasis on category 1 health hazards and less on harmless, aesthetically based category 3 contaminants. Health hazards are comprised of physical hazards, chemical hazards, and biological hazards. Physical hazards include sharp contaminants that pose a swallowing hazard. The strategy recognizes the emerging science of chemical hazards caused by IgE-mediated allergens from food-contaminating pests including insects and mites. Biological hazards are mainly food borne bacterial pathogens. The strategy identifies the scientifically established insects and vertebrates that act as contributing factors for the spread of food borne disease, as well as identifying the universal behavioral attributes or profiles that would place any pest in this category. The profile for disease carrying pests includes synanthropy, endophily, communicative behavior, attraction to filth and human food, and pathogens isolated from wild populations.

Index terms: strategy, hazards, contaminants, pests

[3948] ASSESSMENT OF TRANSGENIC Bt RESISTANCE FOR CONTROL OF FALL ARMYWORM AND CORN EARWORM INFESTATIONS AND REDUCING AFLATOXIN CONTAMINATION OF CORN

G. D. Buntin[1], J. L. All[2], & D. M. Wilson[3], [1]Univ. of Georgia, Georgia Exp. Station - Entomology, 1109 Experiment Str., Griffin, GA 30223, USA, E-mail gbuntin@gaes.griffin.peachnet.edu; [2]Dept.of Entomology, Univ. of Georgia, Athens, GA 30602; [3]Dept. of Plant Path., Univ. of Georgia, Coastal Plain Exp. Station, Tifton, GA.

Two types of corn hybrids producing the insecticidal protein Cry1Ab derived from *Bacillus thuringiensis* (Bt) have been deployed in the southern USA to control whorl and ear infestations of the fall armyworm, *Spodoptera frugiperda*, and corn earworm, *Helicoverpa zea*. 'YieldGard' type resistance (MON 810 and Bt11 events) provides season-long expression of the toxin in throughout the plant, whereas 'Knockout' type resistance derived from 176 events expresses toxin in the green tissue and pollen only. The effect of Bt resistance on fall armyworm whorl damage, ear damage by fall armyworm and corn earworm, grain yield, and aflatoxin contamination were examined in field corn. In 1998 and 1999, 3 to 4 pairs of conventional temperate near-isogenic Bt hybrids of corn were evaluated at two and seven Georgia Agric. Exp. Stn. Farms, respectively. Hybrids were planted in a split-plot randomized complete whole plot design with 4 replications at the recommended time and usually 4 - 6 weeks later at most locations. In 1998, fall armyworm populations reached outbreak levels resulting in the worst damage to corn in Georgia in the last decade. YieldGard resistance consistently reduced fall armyworm whorl damage to low levels. YieldGard did not greatly reduce the percentage of infested ears by fall armyworm and corn earworms, but did prevent serious damage to infested ears. Resistance at Attapulgus prevented a 28% yield loss which equaled about 34 bu/acre. In 3 plantings at Plains, YieldGard prevent significant yield loss in the second and third plantings. Total grain aflatoxin levels were very high in the recommended planting (Non-Bt = 859 ppb, Bt = 714 ppb) but declined in later plantings. Aflatoxin levels were not significantly different between YieldGard and susceptible hybrids in any planting. In 1999, fall armyworm infestations were low by historical measures and ear infestations were almost exclusively by corn earworm. YieldGard Bt resistance reduced fall armyworm whorl infestations and damage to infested plants. YieldGard also reduced corn earworm infestations in ears at most locations. Knockout resistance usually reduced whorl injury but did not affect ear infestations and damage. However, YieldGard and Knockout resistance did not prevent significant grain yield losses at any location or planting date. Analysis of 1999 samples for grain aflatoxin levels are not complete.

Index terms: *Spodoptera frugiperda*, *Helicoverpa zea*, *Bacillus thuringiensis*, yield loss, plant resistance.

[3949] EXTREME TEMPERATURES FOR RAPID AND NON-TOXIC STORED PRODUCT PROTECTION

C. Adler[1], W. Rassmann[1], P. Juetterschenke[2] & Ch. Reichmuth[1], [1]Federal Biological Research Centre for Agriculture and Forestry, Inst. for Stored Product Protection, Koenigin-Luise-Str. 19, 14195 Berlin, Germany, E-mail: c.adler@bba.de; [2]Arbes Umwelt GmbH, Koepenicker Str. 325, 12555 Berlin, Germany

The international consent to phase out the use of methyl bromide because of its ozone depleting potential in the world's stratosphere causes a growing need for alternative methods for rapid disinfestation of stored products and structures. The use of extreme temperatures may be one way of pest control combining the advantage of being fast in action with those of being non-toxic and thus residue-free.
Temperatures above 50°C were found to cause complete insect mortality during the treatment of an empty flour mill with heated air. Critical areas that at first did not reach these temperatures and received additional heating and close temperature monitoring in future treatments were around the windows, close to water pipes, and within the outside walls. Another method to control pests in grain could be the application of radio-waves in a high frequency (HF) field because insects contain more water than grain and may thus heat up more rapidly. Radio-waves may be favourable to microwaves because they can penetrate grain to a greater depth. In laboratory experiments, adults of the granary weevil *Sitophilus granarius* could be controlled in wheat with a HF generator at 13.56 MHz when a 150 kV/m or more were applied for 8 s or 250 kV/m for 4 s. With 150 kV/m or 200 kV/m and 8 s treatment time it was, however, not possible to completely control the developmental stages within the grain kernels. Especially eggs and young larvae proved to be most tolerant. At 15 % grain moisture content this treatment caused a rise in grain temperatures from 20°C to 41°C or even to 50°C. Lower moisture contents led to reduced grain heating. High-value stored products may be disinfested with extremely low temperatures in a cooling chamber cooled with liquid air or nitrogen. In a commercially available chamber, all caged insect stages were controlled when core temperatures of minus 18°C had been achieved in bagged herbal drugs and spices. The treatment time needed for disinfestation varied between 8 h and 16 h and depends on the thermal conductivity of the treated product, its volume and packing materials.
Index terms: physical control, heat, HF, radio-waves, cold.

[3950] NUTRITIONAL REQUIREMENTS OF MEDITERRANEAN FRUIT FLY

C. L. Chang, R. Kurashima & C. Albrecht, USDA-ARS-PWA-USPBARC, Honolulu, HI 96822, USA, E-mail schang@pbarc.ars.usda.gov

Nutritional requirements of *Ceratitis capitata* larvae, including essential amino acids, non-essential amino acids, growth factors, sugar, minerals, fatty acids, ribonucleic acid (RNA), and cholesterol, have been evaluated for effects on development and growth. A chemically defined diet (Medfly #1 diet) was used as a base diet. Nicotinic acid and 10 essential amino acids (arginine, histidine, isoleucine, leucine, lysine, methionine, phenylalanine, threonine, tryptophan, valine) are indispensable and considered as essential nutrients (larvae cannot survive without each of them). Glycine, serine, riboflavin, pantothenic acid, cholesterol, RNA, and sugar are necessities for growth and development (required nutrients). Minerals (McCollum salt mixture No. 185), 6 non-essential amino acids (alanine, aspartic acid, cystine, glutamic acid, proline, tyrosine), 8 water-soluble growth factors (thiamine, pyridoxine, folic acid, biotin, ρ-amino benzoic acid, ascorbic acid, choline chloride, inositol), & vitamin E (α-tocopherol, lipid-soluble growth factors) are not important, but would enchance the growth if they coexist with some other nutrients. Requirements of fatty acids (linoleic acid, linolenic acid, oleic acid, palmitic acid, palmitoleic acid) are also investigated. Adults of *C. capitata* reared on a complete chemically defined diet (Medfly #2 diet) produce more eggs than those reared on protein hydrolysate-sugar diet that is commonly used in sterile insect programs. This adult diet was a modification of the Medfly #1 diet for larvae. Nutritional requirements of *C. capitata* adults are similar to those for the larvae except higher sugar content (17.6%) is needed for adult survival especially males. Growth factors such as nicotinic acid, riboflavin, pantothenic acid, thiamine, biotin, vitamin B_{12}, ascorbic acid, α-tocopherol, calciferol, pyridoxine, and folic acid are not essential for egg production. However, adult flies fed diets lacking 10 essential amino acids (arginine, histidine, isoleucine, leucine, lysine, methionine, phenylalanine, threonine, tryptophan, valine), 8 non-essential amino acids (alanine, aspartic acid, cystine, glutamic acid, glycine, proline, serine, tyrosine), cholesterol, inositol, or choline chloride produce significantly fewer eggs than those fed control diet.

[3951] POPULATION DYNAMICS OF MEDFLY IN A MEDITERRANEAN AREA (SARDINIA, ITALY)

G. Delrio, S. Ortu, Dipartimento di protezione delle Piante Sez. Entomologia agraria, Università di Sassari, Via E. De Nicola 07100 Sassari (Italy), E-mail: istent@ssmain.uniss.it.

Medfly (*Ceratitis capitata*) population densities are largely determined by climatic factors and by the sequence and availability of host fruits, being highest in areas of mixed fruit cultivation and in subtropical climates. The seasonal fluctuation of this species in the Mediterranean basin shows a characteristic trend with a minimum population in winter, a maximum at the end of summer and an aggregation in citrus groves in autumn. Observations carried out in Sardinia during the last 21 years on the population dynamics in field and on the effects of larval hosts in laboratory on mortality, duration of development and on the quality of adults gives a better understanding of seasonal fluctuations and *C. capitata* population variations over the years. The abundance of adult populations was recorded in a citrus grove from 1979 to 1999 using sticky traps baited with trimedlure. In general, the male captures were observed from July to December, however, the warmer climate during the winter favoured in 1988 and 1990 the presence of the fly from the spring. On the contrary, low winter temperature (below 0°C) and the cold spring weather in 1980 and 1981 determined very low population densities. The annual rainfall affected also the population density of the medfly, in fact, low captures were recorded in the year with the maximum rainfall (1988). Experiments under laboratory conditions (at the constant temperature of 28 ± 1 °C, 75 ± 5 R.H. and 10-12 DL photoperiod) were also conducted using nine different fruits (Clementine, Mandarin, Orange, Peach, Pear, Apricot, Apple, and Prickly pear and Persimmon) collected from untreated trees, in order to evaluate host resistance to the development of the insect, the host influence on the speed of development and the host influence on adult size, longevity and fecundity. The results showed the great importance of the sequence, accessibility and suitability of hosts for the continuation of medfly generations through out the year. The egg-larval mortality varied considerably in different mature fruits. The apricot and peach produced more than 90% survival, while apples and prickly pears showed 70% mortality. Mature citrus fruits were found to be medium suitable hosts. The nature of the hosts directly influenced also the rate of larval and pupal development.
Index terms: *Ceratitis capitata*, climatic factors, host effects

[3952] EXAMINATION OF PROTEINASE AND PROTEINASE INHIBITOR ACTIVITIES IN THE APHID *APHIS GOSSYPII*

C. Deraison[1,2], L. Duportets[1], Y. Rahbé[2] & L. Jouanin[1], 1. Lab. Biologie Cellulaire, INRA, 78026 Versailles cedex, France; 2. Lab. Biologie Appliquée 406, UA INRA 203, 20 av. A. Einstein, 69621 Villeurbanne, France

Aphids are major insect pests affecting crops worldwide. Past and current efforts have failed to isolate toxins that would be used to create aphid resistant transgenic plants. We propose to use proteinase inhibitors (PI) from novel sources, such as insect haemolymph, as the base of alternative strategies for pest control. In this context, we searched for potential PI targets in the aphid.The proteolytic activity of gut and whole insect extracts was assayed on protein substrates such as labelled globulin and azocasein over a broad range of pH. The observed protease activities were further characterized with specific proteinase inhibitors using activity-staining after gel electrophoresis. Our results show for the first time that the major class of aphid proteases is of cysteine type. Such cysteine proteinases were further cloned using RT-PCR and degenerated primers. Using spectrometric activity and gel assay, we have demonstrated the presence of at least one cysteine PI in *A. gossypii* fluid. This PI is able to inhibit gut proteases, and is therefore a good candidate for the control of aphid populations through its expression in transgenic plants. Affinity column assay will be used to purify this PI and complementary PCR experiments with degenerated primers on a whole insect cDNA library will be performed to isolate other proteinase inhibitors.
Index terms: Homoptera, Aphididae; cysteine proteinase, cysteine proteinase inhibitor

[3953] CONTROLLING ONION THRIPS, ONION FLY AND LEEK MOTH IN LEEK BY FILMCOATING SEEDS WITH FIPRONIL

A. Ester Applied Research for Arable Farming and Field Production of Vegetables P.O. Box 430, 8200 AK Lelystad, NL, E-mail A.Ester@pav.agro.nl

The onion thrips, the onion fly and leek moth are the most important pests of leek, in Europe. Leek is grown year-round, including in winter, so host plants of the thrips are continually present. When large populations of thrips develop on leek, silvery spots or stripes appear on the leaves, which decreases the crop's quality and therefore economic value. The onion fly is mainly a problem in the leek seedbeds where plants are raised in high densities before being transplanted to the field about 12 weeks after sowing. Adults of the spring (first) generation of the onion fly emerge in May and lay eggs in the soil next to the food plants. The damage the larvae inflict to the based part of the stem can kill the plant. The eggs of leek moth are deposited on the inner surface of the leaf. The larvae can destroy the entire crop. We aimed at achieving complete protection of the leek plants against the onion fly, onion thrips and leek moth for 12 weeks, plus several weeks of protection against thrips and leek moth after transplanting, by applying systemic insecticide to the seeds. Our field experiments were conducted at 3 locations in The Netherlands, with the varieties Farinto (1993, 1995 and 1996) and Vrizo (1994) provided by Nunhems Zaden. Plots consisted of rows (20 cm between rows) 4-5 m long. Sowing periods were mid-May (1993), mid-April (1994) and end of April (1995) and mid-April (1996). All locations had a sandy soil type. Fipronil was administered to the seeds in a film-coating. The dosages, expressed as grams active ingredient per unit of seed (250.000 seeds) were: 20, 30, 37.5, 50 and 75 grams. Filmcoating leek seeds with 30 and 50 gram fipronil was successful in controlling the onion fly in 1994 and 1995. In 1993, 1994 and 1995, the thrips protection provided by the 30 and 37.5 gram doses was insufficient, but 50 and 75 grams gave good protection for 12 weeks in the seedbed plus 3 weeks after transplanting. We concluded if there is a high population of the leek moth, plants from seed treated with fipronil are protected by the doses upwards of 50 grams a.i. per unit of seed, but a spray of deltamethrin is ultimately necessary in the longer term. We recommend applying fipronil at a rate of 50g per unit of seed as a filmcoating to control onion fly, onion thrips and leek moth in leek; this rate is not phytotoxic. The three advantages of seed treatment are (1) a substantial reduction in the amount of insecticide used, (2) substantial savings (8-fold) over spraying, and (3) for the grower, a reduction of the health hazard of exposure during spraying.

Index terms: *Thrips tabaci*, *Delia antiqua* (Meig), *Acrolepiopsis assectella*, leek, seed filmcoating.

Aphids are major insect pests affecting crops worldwide. Past and current efforts have failed to isolate toxins that would be used to create aphid resistant transgenic plants. We propose to use proteinase inhibitors (PI) from novel sources, such as insect haemolymph, as the base of alternative strategies for pest control. In this context, we searched for potential PI targets in the aphid.The proteolytic activity of gut and whole insect extracts was assayed on protein substrates such as labelled globulin and azocasein over a broad range of pH. The observed protease activities were further characterized with specific proteinase inhibitors using activity-staining after gel electrophoresis. Our results show for the first time that the major class of aphid proteases is of cysteine type. Such cysteine proteinases were further cloned using RT-PCR and degenerated primers. Using spectrometric activity and gel assay, we have demonstrated the presence of at least one cysteine PI in *A. gossypii* fluid. This PI is able to inhibit gut proteases, and is therefore a good candidate for the control of aphid populations through its expression in transgenic plants. Affinity column assay will be used to purify this PI and complementary PCR experiments with degenerated primers on a whole insect cDNA library will be performed to isolate other proteinase inhibitors.

Index terms: Homoptera, Aphididae; cysteine proteinase, cysteine proteinase inhibitor

[3954] TOLERANCE OF *BRACON HEBETOR* (HYMENOPTERA: BRACONIDAE) TO MICROWAVE RADIATION (2450 MHz)

G.G. Fagundes[1], M.E.M. Habib[2] & D.R. Solis[2], [1]Dept. of Parasitology, IB, Univ. of Campinas, SP. Box 6109, 13083-970, Brazil. E-mail giovanna@obelix.unicamp.br. [2]Dept. of Zoology, IB, Univ. of Campinas, SP. Box 6109, 13083-970, Brazil.

Microwave radiation have been studied as an alternative physical method for the control of storage ecosystem pests. However, its insertion in IPM programs depends on evaluations of its possible impact on natural enemies associated to such pests. The present work analyses the tolerance of *Bracon hebetor* , a natural ectoparasitoid of *Anagasta kuehniella*, to microwaves (2450 MHz) radiation. Adults (24 h old; n= 100 in 4 repetitions) were submitted to a pre-determined exposure times of radiation in a microwave oven, Panasonic NN 7954 BH/K. Exposure times used in the bioassays were 69, 83, 100, 120 and 144 seconds. We observed that the mortality varied according to the duration of the exposure time. The mean lethal exposure time (LET_{50}), for the braconid adults, was calculated as 106.57s (inferior limit= 100.36s; superior limit = 113.17s). The longevity and capacity of parasitism, of those adults which survived after an exposition time equal to the LET_{50}, did not suffer any negative effect. The mean number of eggs deposited per female did not differ, statistically, from that of the control group ($t = 1.148$; $df = 9$ and $P = 0.281$). Also, in a comparison with the control group, no significant differences were detected, when we consider the mean percentage of paralyzed larvae ($t = 0.255$; $df = 9$ and $P = 0.805$), as well as that of the parasitized ones ($t = 1.192$; $df = 9$ and $P = 0.264$). The longevity of the treated females was very similar to that reached by the untreated ones ($t = 0.154$; $df = 9$; $P = 0.881$). However, a significant difference was found between exposed and non exposed males ($t = 2.932$; $df = 9$ and $P = 0.017$), where the treated males exhibited a shorter longevity than the control ones. Some biological observations were conducted, related to the offspring of the survived radiated adults, and the data were analyzed. The mean viability of the immature stages was not affected by the radiation ($t = 0.279$; $df = 9$; $P = 0.787$). The same situation was found for the offspring sexual ratio. Therefore, and due to the present work, we conclude that an exposure time of 106 seconds, to microwave radiation, did not provoke any negative impact on *B. hebetor* performance and biology. Also, it could be concluded that this type of radiation can be successfully used in IPM programs against stored product lepidopterous pests, such as *Anagasta kuehniella*.

Index terms: physical control, parasite, reproduction, longevity, IPM

[3955] *ANASTREPHA FRATERCULUS* (DIP.: TEPHRITIDAE) INFESTATION IN STRAWBERRIES IN THE STATE OF SÃO PAULO, BRAZIL

J. A. A. Filho[1], M. F. S. Filho[2] & A. Raga[2], [1]Inst. Agronômico, Caixa Postal 01, Monte Alegre do Sul, SP, 13910-000, Brazil, E-mail: iac-mas@way-out.com; [2]Inst. Biológico, Caixa Postal 70, Campinas, SP, 13001-970, Brazil.

Anastrepha fraterculus (Dip.: Tephritidae) is the most poliphagous and abundant fruit fly species in Brazil. The State of São Paulo cultivates a large number of fruit and vegetables, native and exotic plants, including strawberry (*Fragaria* x *ananassa*). In december 1999 we detected a fruit fly infestation in a miscellaneous strawberry cultivars at Experiment Agricultural Station in Monte Alegre do Sul County (22°41'S; 46°41'W; 748m). Strawberries were cultivated free of any pesticide treatment. The transplanting was realized in May 1999 and the yield was begun in October. During November and December five samples of remaining fruits were collected in the field to evaluate the fruit fly infestation. From 275 puparia emerged 178 *Anastrepha* adults. The samples had an average infestation of 0.46 (0.22-0.67) puparia/fruit and 53.93 (20.18 - 73.55) puparia/kg of fruit. Only *A. fraterculus* was identified from the females. Probably ripe fruits are more atractive to *A. fraterculus*. This is the first report of *A. fraterculus* infestation in strawberries in the State of São Paulo. We believe that fruit fly infestation is absent in commercial strawberry crops because of the tremendous quantity of pesticides used in these crops.

Index terms: fruit fly, *Fragaria* x *ananassa*, host, occurrence.

[3956] A BIOTECNICAL METHOD FOR THE CONTROL OF THE OLIVE FLY IN ORGANIC ORCHARDS

C. Hamard[1], A. Mexia[1] & M. I. Patanita[2], [1] Instituto Superior de Agronomia, Tapada da Ajuda, 1300 – Lisboa; [2] Escola Superior Agrária de Beja, Apartado 158, 7801-902 – Beja. E-mail:ipatanita@esab.ipbeja.pt

A biotechnical method for the control of olive fruit fly (*Bactrocera oleae* Gmelin) was tested in an organic olive orchard from Cordovil variety in Moura (south of Portugal). The lure and Kill method used consisted of olfactory food and sex attractants which lure the insects into a Killing device composed of green paper treated with an insecticide (s.a. : deltametrine). The long –life sex pheromone lure complemented with the ammonium salt lure for females were used as the attractant sources in such targets used at a rate of one per tree or one per two trees or one per four trees. The comparison between the trap zone and the control was made on the basis of the adult olive flies captured in yellow traps with a sex pheromone lure as well as on the olive fruit infestation. The *B. oleae* showed up one month later in the testing field than in the control. The olive fly captures as well as the olive fruit infestation were significantly higher in control compared with the trap zone. However, the diferent rates of traps presented significantly differences only for fly captures.

Index terms: *Bactrocera oleae* Gmelin, biotechnical methods, lure and kill traps, olive-tree.

[3957] *TRICHOGRAMMA TURKESTANICA*, A CANDIDATE FOR BIOLOGICAL CONTROL OF *EPHESTIA KUEHNIELLA* IN FLOUR MILLS

L. S. Hansen, Danish Pest Infestation Laboratory, Ministry of Food, Agriculture and Fisheries, Skovbrynet 14, DK-2800 Lyngby, Denmark.

The Mediterranean flour moth *Ephestia kuehniella* (Lep.: Pyralidae) is an important pest in flour mills. The egg parasitoid *Trichogramma turkestanica* (Hym.: Trichogrammatidae) is being investigated as a possible candidate for biological control of this pest. Investigations have previously been conducted in Germany on this strain, published under the name *T. evanescens* "Lager" strain. The identity of the strain has been revealed by the means of molecular methods, but the taxonomy of this strain is a matter of discussion at present. Relatively low temperatures may prevail for long periods in Scandinavian flour mills so the ability of the natural enemy to be efficient at 15-20°C is essential for the success of the system. In laboratory investigations life table parameters of *T. turkestanica* reared on *E. kuehniella* have been determined at four constant temperatures (15, 20, 25 and 30°C). At these temperatures the development time ranged between 33 and 7 days. No emergence occurred at 10°C although some development took place: the parasitised host eggs turned black thus indicating development until the third larval stage. Fecundity amounted to 67 eggs per female at 15°C, increasing to a maximum of 82 eggs per female at 25°C; the minimum value was found at 30°C. Female longevity ranged from a mean of 32 days at 15°C to 2 days at 30°C. Based on the investigations the intrinsic rate of natural increase was calculated; the maximal value of 0.40 was found at 30°C. The investigations were designed so that the rate of host-feeding as well as the daily parasitism exerted by the parasitoid could be calculated. Daily parasitism ranged between 4 and 15 hosts per female per day, depending on temperature. Host-feeding accounted for up to 49% of the total mortality of the host eggs, after correction for control mortality. These investigations show that host-feeding is an important factor in the total effect of the parasitoid on its host. The lower temperature threshold for female walking activity was investigated; activity was seen at temperatures as low as 7°C. The effect of the parasitoid on a flour moth population in a mills is being calculated. The results give reason to believe that this parasitoid will be efficient even at the low temperatures found in industrial flour mills in early season. Field trials are being planned to elucidate this.

Index terms: life tables, host-feeding, development time, temperature

[3958] USE OF TROPICAL AND TRANSGENIC *BACILLUS THURINGIENSIS* CORN HYBRIDS IN SOUTHEASTERN UNITED STATES GRAIN AND SILAGE PRODUCTION SYSTEMS

D. C. Herzog[1,2] & D. L. Wright[2], [1]Retired, [2]North Florida Research and Education Center, Univ. of FL, 30 Research Road, Quincy, FL. 32351 USA.

Corn is an important crop in the southeastern United States and the Caribbean Basin, grown for both grain and silage production. This region of the U.S. and adjacent islands are grain deficit areas, which means that the product (either grain or silage) must be produced locally or shipped from some other production area. Both grain and silage production are impeded by factors such as inadequate rainfall or severe injury by both insects and diseases. Normal planting dates used by producers in the southeastern U.S. are limited to the months of March and April because of both rainfall patterns and the potential for severe insect injury to the crop. The fall armyworm, *Spodoptera frugiperda*, causes severe injury and significant losses to both grain and silage biomass by feeding in whorl-stage corn. The corn earworm, *Helicoverpa zea*, is primarily a pest of ear-stage corn, where it often produces significant loss of grain yield and may predispose grain to infection by mycotoxin-producing organisms such as *Aspergillus flavus* and *A. parasiticus*, which may render the crop unmarketable. The fall armyworm also secondarily infests ear-stage corn and may reduce grain yields and influence mycotoxin levels in the grain. Two or more species of pathogens producing corn leaf rust diseases are of economic importance and often result in significant losses in grain yield. Results of three years of field experiments with a Pioneer tropical hybrid and several transgenic *B.t.* hybrids from the Pioneer and Novartis breeding programs will be presented. Monthly plantings were made from March to August, 1997-99, to evaluate the effects of differing environmental patterns. Insect populations were monitored in whorl-state and ear-stage corn, and yields of both silage and grain were obtained. Results indicated that even with delayed planting of transgenic corn hybrids, injury by the fall armyworm in whorl-stage corn was significantly reduced. Similar results were observed with the corn earworm in ear-stage corn. Delayed planting of the transgenic hybrids was observed to result in severe injury from leaf rust diseases. Tropical corn hybrids remain susceptible to fall armyworm injury with delayed planting; however, these hybrids are quite resistant to injury by corn leaf rust pathogens. Adaptation of a relative larval consumption index will be described. Plant breeding needs that would enhance corn grain and silage production in the southeastern U.S. and in the Caribbean Basin will be discussed.

Index terms: *Spodoptera frugiperda*, *Helicoverpa zea*, *B.t.* corn, tropical corn, larval consumption index

[3959] REVIEWING A MULTI-AGENCY BIOLOGICAL CONTROL PROGRAM FOR BEMISIA ARGENTIFOLII IN THE SOUTHWEST UNITED STATES: FOREIGN EXPLORATION, MASS CULTURE & EVALUATIONS

K. Hoelmer[1], J. Goolsby[2], A. Kirk[1], W. Roltsch[3] & C. Pickett[3], [1]USDA-ARS, Campus Internat. de Baillarguet, Montferrier 34980, France, E-mail ebcl@cirad.fr; [2]USDA-ARS, Long Pocket Lab, 120 Meiers Rd., Indooroopilly, QU 20705, Australia; [3]CDFA Biological Control Progr., 3288 Meadowview Rd., Sacramento, CA 95832, USA

Outbreaks of *Bemisia argentifolii* (*B. tabaci* strain "B") in the USA during the late 1980s led to a national research and action plan, which included efforts to discover, evaluate and establish more effective biological control agents. Although many parasitoids, predators and pathogens were reported to attack *Bemisia* species around the world, no widespread search had previously been conducted. Foreign exploration for natural enemies of *Bemisia* spp. was therefore conducted during 1991-98 in Africa, the Arabian peninsula, Central and South America, the Mediterranean basin, the Indian subcontinent, and Southeast Asia. Concurrently, indigenous natural enemies attacking *B. argentifolii* in the USA were investigated. Overseas collections of predators, parasitoids and pathogens were shipped to the USA for quarantine, identification and/or evaluation. More than 80 shipments of natural enemies were received. Pathogens were sent to the USDA-ARS entomopathogen repository (Ithaca, NY). The majority of exotic arthropods were received and maintained in culture at the USDA-APHIS quarantine laboratory in Mission, TX. Since many of these species belonged to genera in need of taxonomic revision, initial identifications or characterizations were often made by a combination of morphology and molecular markers while systematic revisions of the genera were undertaken by taxonomists. Colonies and selected mass-rearing cultures of parasitoids and predators were maintained at Mission, TX, in support of field evaluations conducted at various locations in the USA. Following the preparation of environmental assessments, release permits were issued for species of *Eretmocerus*, *Encarsia* and *Serangium*, which were originally associated with *Bemisia* spp. at the foreign collection site. Imported and selected indigenous parasitoids were first compared in the laboratory at Mission, TX, with cotton, cantaloupe, broccoli and sowthistle as host plants. The best-performing species were then re-tested in walk-in field cages on alfalfa, broccoli, cantaloupe and cotton in desert climates. In these evaluations, *Eretmocerus emiratus* (UAE), *E. nr. emiratus* (Ethiopia), *E. mundus* (various sources), and *E. hayati* (Pakistan) were superior to other *Eretmocerus* and uniparental *Encarsia*. Among biparental *Encarsia* tested, one population of *E. sophia* [=*E. transvena*] (Pakistan) was significantly superior to others from Spain, Thailand and Malaysia, and to *Encarsia bimaculata* (India) when evaluated on broccoli, cantaloupe, and cotton in field cages.

Index terms: *Bemisia tabaci* strain "B", parasitoids, *Eretmocerus, Encarsia*

[3960] REVIEWING A MULTI-AGENCY BIOLOGICAL CONTROL PROGRAM FOR BEMISIA ARGENTIFOLII IN THE SOUTHWEST UNITED STATES: ESTABLISHING, CONSERVING & AUGMENTING NEW PARASITOIDS & EVALUATING THEIR IMPACT

K. Hoelmer[1], W. Roltsch[2], G. Simmons[3], J. Gould[4], C. Pickett[2], J. Goolsby[5] & E. Andress[4], [1]USDA-ARS, Campus Internat. de Baillarguet, Montferrier 34980, France, E-mail ebcl@cirad.fr; [2]CDFA Biological Control Progr., 3288 Meadowview Rd., Sacramento, CA 95832, USA; [3]USDA-APHIS, P.O. Box 3149, Laredo TX 78044, USA; [4]USDA-APHIS, 4125 E. Broadway Rd., Phoenix AZ 85040, USA ; [5]USDA-ARS, Long Pocket Lab, 120 Meiers Rd., Indooroopilly, QU 20705, Australia.

Colonization has established *Eretmocerus mundus, E. hayati, E. emiratus* and *E. nr. emiratus* in several desert valleys of Arizona and California and in the temperate southern San Joaquin Valley, CA. More than 50 million pupae and adults were reared in insectaries in TX, AZ and CA, and released during 1993-99 in agricultural field crops and citrus orchards, urban areas, wildlife preserves, managed refuges and commercial plant nurseries. Introduced *Eretmocerus* populations have increased in size and expanded outwards from release sites each year since recoveries were first detected. In 1999, exotic *Eretmocerus* were found at a majority of numerous survey sites in Imperial Valley, CA. *Eretmocerus emiratus* (ex UAE) / *E. nr. emiratus* (ex Ethiopia), which are morphologically indistiguishable but separated by RAPD-PCR, predominate in recoveries and now account for increasing proportions of *Bemisia* parasitism each year. *Encarsia sophia* (ex Pakistan) also appears to have established in the Imperial Valley. Four years of augmentation field trials in Imperial Valley with exotic *Eretmocerus* species demonstrated that parasitism could be increased, and *Bemisia* suppressed, by making open-field inoculative releases. These releases were compatible with the use of selective pesticides in some crops, such as imidacloprid in early-season melons. Exotic *Eretmocerus* were more easily reared and were more effective in these trials, compared to the indigenous *E. eremicus*. Different methods for field distribution of mass-reared parasitoids were evaluated, including mechanical applicators and pre-planting inoculation of melon transplants with parasitoids. Surveys of indigenous, non-target whiteflies have been in progress since 1993, and their parasitoids identified or described to document the native parasitoid complexes. There is no evidence yet of reproduction by exotic species on any of the nontarget whitefly species being monitored. Determining the impact of exotic parasitoids on *Bemisia* populations is complex, because whitefly density varies widely according to weather, natural enemies, host plants, cropping patterns and cultural practices, etc. A multivariate analysis of agricultural crops is in progress in Imperial Valley to correlate whitefly density with these factors and determine the proportion of mortality which is due to introduced parasitoids.

Index terms: *Bemisia tabaci* strain "B", *Eretmocerus, Encarsia*, Aphelinidae

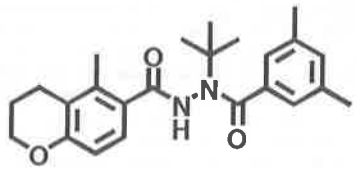
[3961] INSECTICIDAL ACTIVITY OF A NOVEL INSECT PEST CONTROL AGENT, CHROMAFENOZIDE

R. Ichinose[1], S. Sawada[1], Y. Tsukamoto[1], T. Yanai[1], S. Yokoi[1], K. Tanaka[1], S. Kodama[2], M. Yanagi[2], T. Toya[3], Y. Kato[3], T. Watanabe[3] & A. Masui[3], [1]Agroscience Research Laboratories, Sankyo Company, Ltd. 1041 Yasu Yasu-cho Yasu-gun Shiga-ken 520-2342, Japan, E-mail itinos@yasu.sankyo.co.jp; [2]Agro and Fine Chemical Division, Nippon Kayaku Company Ltd. 11-2 1-chome, Fujimi, Chiyoda-ku, Tokyo 102-8172, Japan, [3]Agro and Fine Chemical Research Laboratories, Nippon Kayaku Company. Ltd. 225-1 Koshikiya Ageo-si Saitama-ken 362-0064, Japan

To obtain a new insecticide with high efficacy and also high level of safety against non-targeted organisms, we selected dibenzoylhydrazine as a lead compound and did synthetic research. In the course of the research we discovered the fusing of one of benzoyl groups with an oxygen-containing heterocyclic ring and the introduction of a methyl group into the same benzoyl ring dramatically increased efficacy against lepidopterous pests. Chromafenozide (ANS-118 in code name) is characterized by having methyl chroman in its structure. It acts as ecdysone agonist like other dibenzoylhydrazines. Chromafenozide is highly effective against lepidopterous pests such as *Spodoptera* sp., *Adoxophyes* sp., *Cnaphalalocrocis medinalis* and *Chilo suppressalis*. High level of safety against the pollinators, various predators and parasitoids makes the agent suitable tool for use in integrated pest management (IPM).

Index terms: chromafenozide, ecdysone, IPM

Chromafenozide



[3962] OUTBREAKS OF CEREAL SUNN PESTS (HETEROPTERA: PENTATOMOIDEA) AND SOLUTIONS FOR SUSTAINABLE CONTROL

M. Javahery, Lyman Entomological Museum and Research Laboratory, Macdonald Campus of McGill University, PO Box 140, 21111 Lakeshore, Quebec, Canada H9X 3V9

The cereal Sunn pests (*Aelia* and *Eurygaster* spp.) cause significant reduction in wheat production, and to a lesser extent barley, in a number of countries in the Middle East and Near East. Over the past 40 years outbreaks have occurred every 5 to 8 years. However, from one year to another, fluctuation in population has been related to the physiological condition of the insects (development of the fat reserves) as well as ecological conditions. Several methods of control, including long term chemical treatments used against these bugs, have not resolved this problem and these pentatomoids continue to be major pests. Over the years the adverse effects of chemical application on useful parasitoids (Phasinae and Telenominae) and the environment, and the high costs of applying chemicals, have become evident. Therefore, other control methods such as cultural, behavioral, and the use of pathogens should be integrated as much as possible into current applications.

Key words: *Aelia, Eurygaster* spp., integrated control.

[3963] INSECTICIDAL EFFECTS OF *THUJA OCCIDENTALIS* (CUPRESSACEAE) ESSENTIAL OIL ON *CALLOSOBRUCHUS MACULATUS* [COLEOPTERA: BRUCHIDAE]

Sékou Moussa Kéïta,[1] Charles Vincent,[2] Jean-Pierre SCHMIT[1], John Thor Arnason[3] and André Bélanger[2], [1]Department of Chemistry, University of Quebec at Montreal, P.O. Box 8888, Centre-ville Station, Montreal, Quebec, Canada H3C 3P8; [2]Horticulture Research and Development Centre, Agriculture and Agri-Food Canada, 430 Gouin Blvd., Saint-Jean-sur-Richelieu, Quebec, Canada J3B 3E6; [3]Department of Biology University of Ottawa, 30 Marie Curie, Ottawa, Ontario K1N 6N5 Canada.

Analysis of *Thuja occidentals* L. essential oil by phase gas chromatography revealed the presence of 22 compounds especially α-thujone (49.6%); fenchone (14.1%), and β-thujone (8.9%). Cowpea weevils were reared on chickpeas and newly emerged males and females were deposited on uninfested seeds. Fumigation with pure essential oil and aromatized kaolin (clay) powders, were carried out on adults and eggs. Fumigation of adult bruchids resulted in the following lethal concentrations: three hours (LC_{50} = 1.1µl/insect), six hours (LC_{50} = 0.7µl/insect) and nine hours (LC_{50} = 0.5µl/insect). Treated with aromatised powder, significant differences were found between treatments and control. Application of 100 mg of powder aromatized at 3 µl essential oil/g on bruchids pairs lead to 95% mortality of females and 100% of males with 0% of mortality in the control after a 6 h exposure. Five days after their deposit, about 1.2 % (treated with kaolin powder aromatized with *T. occidentalis* essential oil), 41 % (with kaolin alone) and 44 % of eggs (with control without kaolin) hatched. In the same experiment, adult emergence of 80 % (with kaolin alone), 100 % with control (without kaolin) and 0 % (with kaolin aromatized with *T. occidentalis* essential oil) were recorded 30 days after treatment. Germination was not significantly affected by treatment. After 5 days of sowing, they were 88, 97 and 97 % respectively when grains are treated and exposed, treated and unexposed, untreated and unexposed while those untreated and exposed had 15%.

Index terms:*Thuja occidentalis*, *Callosobruchus maculatus*, Essential Oil, kaolin, fumigation, ethnobotany.

[3964] EVALUATION OF RESISTANT CLONES OF POTATO WITH AND WITHOUT CHEMICAL PROTECTION, AGAINST THE POTATO TUBER MOTH

P. L. Larraín[1], J. Kalazich[2], & C.Quiroz[1], [1]INIA Intihuasi. Colina San Joaquín s/n-Apartado Postal 36-B La Serena, Chile, E-mail plarrain@intihuasi.inia.cl , cquiroz@intihuasi.inia.cl , [2] INIA Remehue, Km 8 Ruta 5 Norte. Casilla 24-O Osorno Chile. E-mail jkalazic@remehue.inia.cl.

At La Serena, Chile (29°-30° lat. S.) field trials were carried out during the seasons 1997/98 and 1998/99, in order to evaluate potato clones resistant to the potato tuber moth (PTM), *Phthorimaea operculella* (Zeller), as compared with the use of insecticides. The original germplasm, introduced by INIA Chile from Cornell University, USA, corresponds to *Solanum tuberosum* x *Solanum berthualtii* "true potato seed". The evaluated clones were previously selected as resistant to PTM in "free-choice" and "non-choice" tests carried out at La Serena. A Split-plot experimental design with four replications was used in the tests. The main factor was the chemical protection(with and without insecticides), while the sub-treatments consisted in three clones pre-selected as resistant, as compared with the susceptible control variety " Cardinal". Resistance was found only on tubers, while foliage expressed damage similar to the control in both seasons for all clones. Results show a significant superior protection against PTM on resistant clones as compared with chemical protection, since it is difficult to protect tubers in the soil. During 1997/98, damage on tubers was 3.5% in the most resistant clon, while the average damage on insecticide protected plots was 13.1%. In 1998/99 season, damage was 14.3% and 23.7% for the same previous comparison. The economical,ecological and social advantages of these results offer a future alternative of management of PTM, one of the main insect pest of potato for many regions in the world.

[3965] MONITORING OF TWO MAJOR FRUIT MOTHS WITH SEX PHEROMONE TRAPS IN KOREAN APPLE ORCHARDS

S.W. Lee[1], K.H. Choi[1], D.S. Kim[1], D.H. Lee[1] & K.S. Boo[2], [1]Taegu Apple Research Institute, NHRI, RDA, Kunwi 716-810, Korea, E-mail leesw@tari.go.kr; [2]Graduate School of Agricultural Biotechnol, Seoul Natl. Univ., Suwon 440-310, Korea, E-mail ksboo@plaza.snu.ac.kr

Synthetic sex pheromones have never been commercially used in Korean apple orchards yet. This report is concerned about research works, conducted during last four years(1996-1999), on monitoring, using the sex pheromone traps, of two major fruit moths(*Grapholita molesta* and *Carposina sasakii*) in Korean apple orchards. The synthetic sex pheromones of *G. molesta* and *C. sasakii* were (Z)-8-dodecenyl, (*E*)-8-dodecenyl acetate and (Z)-8-dodecenol at the ratio of 95:5:1 and (Z)-7-eicosen-11-one, respectively. The sticky wing-type traps were hung on tree branches 1.5-2m above the ground. Average numbers of *G. molesta* and *C. sasakii* males caught to a trap in a year were 815 and 169, respectively. Among 28 tested orchards in 1999, more *G. molesta* males were captured in 26 of them, than *C. sasakii*. Average fruit damage of Fuji cultivar at near harvest times were 0.80 and 0.56%, due to *G. molesta* and *C. sasakii*, in commercial orchards, respectively. *G. molesta* occurred from mid Apr. to mid. Sept. with 4 peaks in late Apr., mid. to late Jun., early to mid. Aug., and early Sept.. *C. sasakii* occurred from early Jun. to early Sept. with two peaks in late Jun. to early Jul. and early to mid. Aug. Insecticides and acaricides were sprayed about 10.3 and 4.5 times, respectively, in conventionally managed orchards in 1993, but pheromone monitoring allowed them to reduce their application to 7.5 and 3.5 times, respectively in 1999. Most of Korean apple growers now accept that the pheromone traps are essential for monitoring the fruit moths, but hope that scouts of governmental Rural Extention Center or Apple Grower's Cooperative conduct monitoring works for them. They also regard that pheromone trap data can be used for timing of insecticide treatment (51.1%), for deciding to spray or not (33.3%), and detecting presence or absence of the pest insect (15.6%). Begining this year, we have started to find out the feasibility of mating disruption in directly controlling the population of pest insects concomitant with biological control of spider mites using the predatory mites. We are hoping that this will lead us to develop a sound IPM program for apple production in Korea.

Index terms: *Grapholita molesta, Carposina sasakii*, seasonal fluctuation, fruit damage, IPM.

[3966] DEFINITION OF ECOLOGICAL PEST MANAGEMENT

A. Lizarrraga, Red de Acción en Alternativas al uso de Agroquímicos, Julio Rodavero 682, Urb. Las Brisas, Lima 1, Perú; raaaper@terra.com.pe

Ecological Pest Management is an activity that has been developing an important rol in agriculture production. This activity has generated massive use of pesticides, with a succession of negative consequences over ecosystems and human health. In the use of pesticides has taken part farmers, agronomist, agricultural techniques, agricultural companies, public and private institutions (co-operatives, associations, universities, institutes, NGO and Ministries of Agriculture). At the same time of the pesticide use evolution, other kind of techniques and strategies has been implemented and researched to reduce costs and harmful effects from substantial quantity of poisons that are used in agriculture. Does it mean that more technology, more quantity of pests and much more impact generated on the environment? Is it true that Ecological Pest Management is noticed only like a good business from important pesticide companies? Do countries have a real interest of pest control be developed in a plan oriented to reduce costs and degradation of natural resources? Is it true that food does not have residues of pesticides? Ecological Pest Management is a system that regulates pest groups with emphasis on the prevention, without using of pesticides, or applying experiences that do not cause risks on farmers, consumers health and ecosystems. Therefore, chemical pesticides from synthetic origin are excluded. The pest is not important for Ecological Pest Management but the whole ecosystem. That is the reason why it is not considered very important the level of economical damage. Ecological Pest Management is the consequence of an ecological agriculture, cultural and technological approach; which is oriented towards the sustainability and is related to the ecosystem and human needs. It considers the abilities developed historically by farmers; its successes and failures accumulated in the effort for controlling pests. The possibilities of Ecological Pest Management can be much more if techniques and possible experiences to implement in a agriculture ecosystem are combined and oriented properly, specially if it is pretended to regulate the dynamism of insect population and other pest organisms. However, making a balance of the achievements reached up to now, these efforts can be isolated and insufficient. There are different limitations in its application that will be controlled only with researching and the proper diffusion of the results.

Index terms: Ecological Pest Management

[3967] TEMPORAL PATTERN OF PROTEIN SECRETION AND INSECTICIDAL ACTIVITY AGAINST TROPICAL FALL ARMYWORM IN THE SUPERNATANT OF THE 'B.t.' STRAIN 'HD125'

L. L. Loguercio[1], M. R. Barreto[1], C. G. Santos[1], F. H. Valicente[1] & E. Paiva[1], Applied Biology Group (NBA), EMBRAPA Maize & Sorghum, Cx. Postal 151, Sete Lagoas-MG, 35701-970, Brazil; E-mail: barreto@cnpms.embrapa.br

'Vegetative insecticidal proteins', or 'Vips', are secreted in the culture supernatant of certain *Bacillus thuringiensis* (B.t.) strains in the log-phase of growth. The B.t. strain 'HD125' has shown to contain a Vip3A-like insecticidal activity against 'fall armyworm' larvae of tropical maize, allowing us to isolate and characterize its corresponding gene. In order to study the pattern of the HD125 total protein secretion in its culture supernatant, aiming to find a possible association between specific culturing times and higher or lower protein-derived (Vip-like) insecticidal activities that could serve as a screening procedure in a large collection of B.t. strains, the total protein was extracted from aliquots of the supernatant collected every 3 hours, starting with 7 h and ending with 25 h of culture. For each collection time, the total supernatant protein was precipitated and subjected to SDS-PAGE; these supernatants were also used to soak artificial diets that were given to 2-day old *Spodoptera frugiperda* larvae to assess the levels of mortality. The protein-derived insecticidal activity (Vip) was monitored by the difference in mortality between non-heated and heated aliquots of the supernatant, since it frequently contains a non-peptidic termostable insecticidal activity (β-exotoxins). The results indicated a qualitative and quantitative variation in the temporal pattern of protein secretion, which appear to be associated with a higher or lower insecticidal activity. Considering that different B.t. strains have previously shown differences in their respective temporal pattern of growth and total protein secretion in the supernatant, the results here presented would suggest that an adequate timing for culture and supernatant collection is a key point to consider when searching for Vip-like insecticidal activity among B.t. strains.

Index terms: *Spodoptera frugiperda*, *Bacillus thuringiensis*, Vegetative insecticidal protein, insecticidal activity.

[3968] ANALYSIS OF SUPERNATANTS FROM CULTURES OF 'B.t.' STRAINS CONTAINING VIP3A-LIKE GENES AND THEIR RELATIVE EFICIENCY IN THE CONTROL OF TROPICAL FALL ARMYWORM LARVAE

L. L. Loguercio[1], M. R. Barreto[1], C. G. Santos[1], F. H. Valicente[1] & E. Paiva[1], Applied Biology Group (NBA), EMBRAPA Maize & Sorghum, Cx. Postal 151, Sete Lagoas-MG, 35701-970, Brazil; E-mail: barreto@cnpms.embrapa.br

Insecticidal proteins 'Vip' are secreted in the culture supernatant of certain *Bacillus thruringiensis* (B.t.) strains during the vegetative growth stage. Fifty nine strains from the EMBRAPA Maize & Sorghum collection were assessed by PCR regarding the presence of Vip3A genes, and for the positive ones, the protein-derived insecticidal activity from the culture supernatants were tested in the mortality effect against 2-day old *Spodoptera frugiperda* larvae. The template DNA for the PCR was obtained through alkaline lysis ('miniprep') of 4-ml overnight grown liquid cultures, and specific primers designed against coding sequences of the Vip3A gene were employed in the reaction. The amplification products were analyzed in 5% acrylamide gels. For the strains showing the correct-size amplicons, which were confirmed by sequencing, the biological activity of their supernatants were tested by growing liquid cultures for 16 h at 30ºC, and centrifuging down the cells to collect the supernatant. In order to discriminate termolabile protein-derived (Vip) insecticidal activity from non-peptidic form of termostable toxins (β-exotoxins), aliquots of those supernatants were differentially treated with temperature (25ºC and 95ºC) before applying to the artificial diets used to feed the larvae. The data suggested that the simple detection of Vip3A-like genes by PCR in a B.t. strain is not sufficient to ensure a high mortality efficiency of the corresponding protein fraction of the supernatant. The supernatant collection in an inadequate culturing time and/or a natural ineficiency of the respective Vip genes against tropical fall armyworm may explain the results.

Index terms: *Spodoptera frugiperda*, *Bacillus thuringiensis*, Vegetative insecticidal protein, biological control.

[3969] PUBLIC EDUCATION AND DEMONSTRATION OF BIOLOGICAL CONTROL PRINCIPLES IN INDOOR PLANTSCAPES IN MINNESOTA, U.S.A.

J.C. Luhman & D.D. Sreenivasam, Minnesota Dept. of Agriculture, 90 West Plato Blvd., St. Paul, MN 55107-2094, USA, E-mail: john.luhman@state.mn.us

The Minnesota Department of Agriculture is educating the public and demonstrating the principles of biological control in indoor plantscapes using a biological control facility. The facility is a greenhouse in which ornamental and crop plants are grown, infested with common household pests, and then exposed to biological control agents. Thus insect and mite biocontrol agents are mass reared for demonstration releases on pest-infested plants in homes, small offices, businesses, and conservatories. Tours for the public and classes for college students are conducted in the facility. Tours include lectures with live demonstrations aided by an imaging system. Insect display drawers and riker mounts demonstrate insect diversity locally and worldwide. Within the three bays of the biocontrol facility people can see how pest insects and mites attack and feed on plants, as well as how their natural enemies control them.

[3970] A HIGHLY INTEGRATED MONITORING SYSTEM TO SUPPORT ON-TIME, ON-LINE DECISION-MAKING IN AGRICULTURE

A. Mafra-Neto[6], P. Luft[6], A. Ly[6], D. Morgan[6], C. E. P. Souza [4], A. Kovaleski[1], E. Vilela[3] & L. Mafra[5] , [1]EMBRAPA/CNPUV, CP 177, CEP 95200-000, Vacaria, RS Brazil; [3]Universidade Federal de Viçosa, Viçosa, MG Brazil; [4] Faculdade de Filosofia, Ciências e Letras de Ribeirão Preto, Universidade de São Paulo, Avenida Bandeirantes, 3900, Ribeirão Preto São Paulo, Brazil,14040-901; [5]ISCA Tecnologias Ltda, Ijuí, RS, BRAZIL, [6]ISCA Technologies, Inc., Riverside, CA USA.

Integrated pest management needs access to accurate information about conditions affecting the density, the distribution, and the dynamics of pest populations as a foundation for management decisions. Data must be collected, tabulated, filtered, statistically analyzed and compared, so that relevant information is delivered to decision-makers in a timely fashion. Current pest monitoring programs, based on pen and paper and multiple databases, lack the speed and the sophistication necessary to efficiently process data to generate the information required by decision-makers. A new pest monitoring program was devised that includes a flexible and fast data management system that emphasizes integration and effectively supports on-time decision making. This PalmTracking system serves as a central repository for insect pest and disease monitoring data. With its centralized database and rapid Internet communication capabilities the system connects groups with similar interests, allowing for data integration, real time data query and data analysis with graphical reporting. Population data are collected from the field using handheld units, and uploaded to a centralized database where they become available for analysis. Ample access through the Internet helps to integrate regional and other area-wide monitoring programs and increases the speed of data processing and report generation. PalmTracking makes available a wide set of data management tools to a broad base of users. Automatic parsing and analysis of the data allows for responsive alarm systems with fast and effective distribution of information. The reliability of data and the speed of information flow allow fortimely decision making. Studies are underway to determine the effects of the PalmTracking system on the process of pest management decision-making and on the community the program serves.

Index terms : monitoring, Palm Tracking, integrated monitoring, decision-makers

[3971] FACTORS INFLUENCING THE ABUNDANCE AND DISTRIBUTION OF FLORAL VISITORS IN DIFFERENT STRAWBERRY CULTIVARS (*FRAGARIA X ANANASSA*): CONSEQUENCES TO POLLINATION, POLLINATORS' CONSERVATION AND COMMERCIAL STRAWBERRY PRODUCTION

K. S. Malagodi-Braga[1] & A. M. P. Kleinert[1], [1]Bee Laboratory, Dept. of General Ecology, Univ. of São Paulo, Rua do Matão, 321, Travessa 14, CEP 05508-900, São Paulo, Brazil.

Along a transect weekly samplings of floral visitors of different cultivars ('Campinas', 'Dover' and 'Toionoka') in two culture areas (Atibaia in 1997 and Valinhos in 1998) were made during strawberry blossom. Registers were made of the number of flowers/m^2, the presence of other blossoms around the area, the culture defensives application, the type of irrigation used in the culture, soil usage in neighbouring areas, the nectar volume produced by each flower, the sugar concentration in nectar and the frequency of bees collecting pollen. A third area (Jarinu – SP) was used to add information about nectar production in different cultivars ('Campinas' and 'Osogrande') and under different culture practices. It was verified that: a) *Apis mellifera* and stingless bees were the main strawberry flowers visitors at the two sampling areas and at the studied cultivars; b) the abundance and richness of stingless bees visiting strawberry flowers were greater at Atibaia than at Valinhos, even with the intensive use of culture defensives in the first area; c) in relation to the cultivars, 'Dover' at Atibaia and 'Toionoka' at Valinhos presented a greater number of bees per sampling than Campinas in these same areas; d) at Atibaia, *T. spinipes* and *A. mellifera* were the most abundant species in 'Dover' and *Geotrigona* sp in 'Campinas', whereas *A. mellifera* was worthnoting in both cultivars at Valinhos, being more sampled in 'Toionoka' cultivar; e) flower production was greater in 'Dover' cultivar; f) more attractive blossoms in the neighbouring reduced the number of certain bee species visiting strawberry flowers; g) different kind of defensives increased or decreased the number of bees foraging on strawberry flowers; h) the type of irrigation modified nectar production and its concentration; i) the secondary wood strip favoured a greater number of bees and of species in Atibaia; j) 'Toionoka' cultivar produced more nectar than 'Campinas' at the same place; k) although there was a low variation in nectar concentration of the several cultivars in both areas, those with lower concentration were obtained at Jarinu and those with higher in flowers of 'Toionoka' cultivar; l) at the two study areas the bee species more abundant in each variety were also the main pollen collectors. In a same area the amount and the quality of available resources from different cultivars influenced the abundance and distribution of bee species among them. The knowledge of these factors allow the handling of them for pollination, pollinators' conservancy and commercial production.

Index terms: *Apis mellifera*, *Geotrigona* sp, *Trigona spinipes*, foraging.

[3972] THE ADAPTATION AND CONTRIBUTION OF DIFFERENT SPECIES OF STINGLESS BEES IN STRAWBERRY PRODUCTION WITHIN GREENHOUSE AT ATIBAIA COUNTY – SP

K. S. Malagodi-Braga[1] & A. M. P. Kleinert[1], [1]Bee Laboratory, Dept. of General Ecology, Univ. of São Paulo, Rua do Matão, 321, Travessa 14, CEP 05508-900, São Paulo, Brazil.

During May and June 1999, two plastic greenhouses of 200m^2 each (8m x 25m), laterally closed with anti-aphid woven, were built in a strawberry culture area at Atibaia county, one with 'Osogrande' cultivar and the other with 'Sweet Charlie'. To choose which bee species would be used on controlled pollination tests, the most frequent visitors of strawberry flowers under open culture were first observed. They were: *Apis mellifera, Geotrigona* sp, *Schwarziana quadripunctata, Tetragonisca angustula* and *Trigona spinipes.* Colonies of *S. quadripunctata* and *T. angustula* were introduced in the two greenhouses on June 10th, placed on individual supports at their corners or sides and inspected every 20 days when syrup, water, pollen and honey from *A. mellifera* were given to them. The bees flight behaviour was observed soon after the opening of the hives. *T. angustula* bees left their colonies flying at the nest height (around 1m from soil), with some individuals rising up to the greenhouse roof. All *S. quadripunctata* bees leaving the hive flew up, crashing against the roof or the greenhouse side, where they finally died. Some workers of *T. angustula* died too. In the fifth day after the hives opening the first foragers of *T. angustula* were observed visiting the strawberry flowers in the greenhouse with 'Sweet Charlie'. For defensive application the hives were taken off from the greenhouses and 7 days after they were replaced *T. angustula* foragers were observed visiting the strawberry flowers in both cultivars. Colonies of *S. quadripunctata* were removed from the study area because their workers were not observed foraging on strawberry flowers. A natural hive of *T. spinipes* was introduced in 'Sweet Charlie' cultivar greenhouse. The bees flight behaviour was similar to that observed for *T. angustula.* After 4 hours foragers from *T. spinipes* colony were already visiting the strawberry flowers. After 10 days *T. spinipes* bees were observed collecting and transporting ripe strawberry pulps on the corbicula, destroying several fruits. This kind of behaviour was never observed before under open field conditions. The strawberry production within greenhouses needs bees presence to pollination: before the beginning of foraging activity of the *T. angustula* around 90% of the produced fruits were deformed and could not be commercialised as "table fruit". After the beginning of foraging more than 90% of the cropped fruits were normally commercialised showing a great potential of this specie for strawberry pollination and for the handling in controlled pollination under greenhouse conditions due to their adaptation ability to close areas of small size.

Index terms: *Tetragonisca angustula, Schwarziana quadripunctata, Trigona spinipes, Fragaria x ananassa*, pollination.

[3973] EFFICACY OF TRANSGENIC BT COTTON - RELATING BIOASSAY AND ELIZA TECHNIQUES

C.L. Mares & G.P. Fitt, Australian Cotton Co-operative Research Centre, CSIRO Entomology, P.O. Box 59, Narrabri NSW 2390, Australia. Email: cheryl.mares@ento.csiro.au.

Efficacy of cotton plants engineered to express the endotoxin, Cry1Ac, from *Bacillus thuringiensis* (Bt) is not consistent but has been shown to decline during plant development, particularly from flowering onwards. Efficacy also differs among plant tissues and there are indications that short-term changes in efficacy against the main target, *Helicoverpa armigera*, may follow particular environmental stresses. Changing efficacy during plant growth has consequences for pest management and may exacerbate selection for Bt resistance and so compromise resistance management strategies designed to minimise the risk of resistance. Patterns of efficacy in Bt cotton plants have been identified by whole leaf bioassays, by quantitative diet incorporation bioassays and by ELIZA techniques. In order to fully interpret these patterns it is important that bioassays reliably indicate changes in underlying levels of Bt protein. Here we describe studies to validate our bioassay techniques and derive relationships between bioassays and quantitative ELIZAs, which will allow more rapid and repeatable assessment of efficacy in future.

[3974] ACTIVITY OF THE INSECTICIDE/MITICIDE, PYRIDABEN, IN THE CONTROL OF SILVERLEAF WITHEFLY COMPLEX (*BEMISIA TABACI* - BIOTYPES "A" AND "B") IN SOME MAIN BRAZILIAN CROPS

L. A. Martins[1], J. M. Felippe[1] & E. Begliomini[1], [1] BASF S.A. – Dept Research and Development, C Postal 42, Santo Antonio de Posse, Sao Paulo, 13830-000, Brazil, E-mail: martinsl@basf-sa.com.br

Bemisia tabaci complex biotypes "a" and "b", the silverleaf withefly, hosted a very large number of crops, affecting seriously the crops, directly by sucking or/and indirectly transmitting virus. In Brazil in the most part of year the high temperature and low precipitation, they are favorable for a fast growth of the population of the insect, attacking drastically the crops. In order to evaluate the activity of insecticide/miticide, Pyridaben on silverleaf whitefly, were conducted three trials on tomato, common bean and sweet peppers in Northeast of Brazil. In all trials a randomized block design was used, with 4 replications, using a knapsack sprayer to apply the treatments at 3 Bar. Pyridaben was tested at rates of 150, 200, 250 and 300 g ai (active ingredient)/ha in comparison to the standards, Dimethoate, Acephate and Methamidophos at the rate of 280, 750 and 600 g ai/ha respectively, and untreated. In all treatments were added Assist® (mineral oil) at 0,5 l/ha. The evaluations were done at 1, 3, 10 and 13 days after application (DAT) counting the numbers of alive adults on 25 leaves in the inferior third of the plant. Pyridaben controlled whitefly since at 150 g ai/ha, showing the same activity than the standards, but the best control was achieved at 300 g ai/ha. All treatments were fully selective at the tested rates.

Index terms: silverleaf withefly, *Bemisia tabaci*, sucking insect, Pyridaben

[3975] RECENT TREND IN INSECT FAUNA DETECTED AT THE PLANT QUARANTINE OF JAPAN

M. Masumoto, Laboratory of Insect Systematics, National Institute of Agro-Environmental Sciences, Kannondai 3-1-1, Tsukuba, Ibaraki 305- 8604 Japan, E-mail thrips@niaes.affrc.go.jp.

Trade of many materials, especially plants, is very important factor for invasion of exotic insects. Many kinds of the insects including crop pests have been expanding their distribution area with plants. Recent advance in transportation means, for example, keeping- cool container or cargo airplane, may give more opportunity in which insects can expand their distribution. In many countries, the plant quarantine plays a great role in intercepting insect pests at shoreline. In Japan, many kinds of foodstuffs are imported from various countries. In the present study, the author summarize the annual and quantitative trend in imported plants and insect fauna detected with such plants, based on the statistics of the Plant Protection Station of Japan. This analysis will provide a fundamental information to prevent invasion of pests. In the Plant Protection Station of Japan, imported plants are broadly divided into 12 categories according to kinds and use. Of these, grains, legumes, feeds, and timbers were imported in large quantities. In the plant quarantine, the following five orders were principally detected from imported plants: Coleoptera from fruits, grains and timbers, Diptera from vegetables, Hemiptera from fruits and vegetables, Lepidoptera from fruits and grains, and Thysanoptera from cutflowers, fruits and vegetables. During the 1989- 1998, import quantities of fresh plants (flowers, fruits, vegetables and nursery stocks) have increased, while those of grains, legumes, feeds have been almost constant, and those of timbers decreased. In terms of frequency of detected insects, Coleoptera which had been most frequently discovered from grains, legumes, feeds and timbers, tended to be less detected for the last ten years. Diptera and Thysanoptera were much more detected from fresh plants in accordance with increase in import quantity, although frequency of detection was still less than that of Coleoptera. These results suggest that in future, insects from imported fresh plants, for example, Hemiptera, Thysanoptera and Diptera, may much more frequently invade than the insects from stored grains or timbers.

Index terms: trade, invasion, plant quarantine

[3976] A CENTROMERE-SPECIFIC CLONE IN THE MEDFLY, *CERATITIS CAPITATA*

K. D. Mathiopoulos, E. Stratikopoulos, A. Augustinos, A. Gariou-Papalexiou & A. Zacharopoulou, Dept of Biology, University of Patras, Rion 26500, Greece, e-mail: kmath@upatras.gr

A 1.2 kb clone from medfly *Ceratitis capitata* has been isolated that is localized exclusively at the centromeres of the four out of the six chromosomes. This clone is comprised of multiple copies of a 48-bp repeat. The basic repeat unit is highly conserved presenting very small nucleotide variation among repeat units. *In situ* hybridization of this clone on polytene and mitotic chromosomes showed that labeling is much stronger in mitotic compared to polytene chromosomes suggesting that this centromeric sequence is under-replicated during polytenization. Two of the chromosomes, namely chromosomes 6 and Y do not show a clear hybridization signal. This can be explained by the absence or by the low number of repeats of this sequence, being thus undetectable on these two chromosomes. Studies in various systems have indicated that centromeres are of two types regarding their structure, those occupying a very small region (~200bp) of chromosomal DNA and those spanning larger regions (from 40kb to several Mb). The latter, called regional centromeres, are often characterized by extensive amounts of repeated DNA sequences and are distributed in several genera from fungi to mammals. In some cases as in *D. melanogaster* such sequences are not localized exclusively at the centromere and also are not present at all centromeres. These features of regional centromeres are similar to the characteristics of the medfly clone, suggesting that this clone constitutes a putative centromeric DNA sequence of the species. Data on the molecular analysis of this clone as well as its possible distribution among several species within and outside the *Tephritidae* family will be presented.

Acknowledgements: This work is being supported by a European Union Return Grant to KDM No ERBFMBICT983067 and by a grant of the General Secretariat of Research and Technology, Hellas, No 97EA 17

[3977] ESTABLISHING A SUSTAINABLE MANAGEMENT PROGRAM FOR DIAMONDBACK MOTH

R.F.L. Mau & L. Gusukuma Minuto, Dept of Entomology, Univ. of Hawaii at Manoa, 3050 Maile Way, Honolulu, HI 96822, USA. E-mail maur@avax.ctahr.hawaii.edu.

Diamondback moth (DBM), *Plutella xylostella*, is a serious pest in Hawaii due its prolific nature and propensity for developing resistance to pesticides. It is the key caterpillar pest of cruciferous crops. Farm placement and growing practices are ideal for perpetuating high populations of DBM. The mild climate and market conditions assure that cabbage, broccoli, cauliflower and oriental leafy *Brassica* varieties are cropped every week of the year. Until recently, large tracts of quality farmlands were scarce. Economic conditions did not allow most of the growers to fallow their fields. The intensive cropping practices and the need for remedial insecticide treatments assures the appropriate ingredients for selection of genetic resistance to insecticides in DBM populations. Hawaiian DBM populations in the major cabbage growing regions have high levels of resistance to organochlorine, carbamate, and pyrethroid insecticides. Our goal is to develop a sustainable management program for DBM using a combination of practices that include host tolerance, mating disruption pheromones, cultural practices, and remedial insecticides. Identification of suitable insecticides and attaining regulatory approvals has been completed. Evaluation of sprayable formulations of DBM pheromones is near completion. Effective cultural practices were evaluated. The relevance of these findings to a sustainable management program will be discussed.
Index terms: *Plutella xylostella*, DBM, Lepidoptera.

[3978] *CERATITIS CAPITATA* OVERWINTERING IN MEDITERRANEAN CLIMATE

P.G. Mavrikakis[1], A.P. Economopoulos[1,2], J.R. Carey[3], [1] Institute of Molecular Biology and Biotechnology, P.O. Box 1527, Heraklion 71110, Crete, Greece; [2] Department of Biology, University of Crete, P.O. Box 2208, Heraklion 71409, Crete, Greece, E-mail economop@imbb.forth.gr; [3] Department of Entomology, University of California, Davis, California 95616, USA.

In citrus plantations of Heraklion, Crete (35.5° north latitude) the Mediterranean fruit fly, *Ceratitis capitata* (Wiedemann) (Diptera, Tephritidae) continues reproduction and growth during winter (absolute minimum and maximum air temperatures 1-4,5 and 20-22°C, respectively, during Jan.-March of 1995-98). Adults have been trapped in trimedlure or food lure traps but at very low rates throughout winter- spring. When kept in cages in the field with food and water they survived an average period of 4 months, with some females surviving up to 6 months (December- May). Both larval and pupal stages lasted about 2 months each during winter. Infested Navel, Valencia or bitter oranges could be found throughout winter -spring.
Index terms: *Ceratitis capitata*, Mediterranean fruit fly, overwintering.

[3979] IPM PROGRAM IN COTTON IN AUSTRALIA BASED ON BENEFICIAL INSECTS, STRIP-CROPPING AND PROVISION OF SUPPLEMENTARY FOOD

R.K Mensah & A. Singleton, NSW Agriculture, Australian Cotton Research Institute, Locked Bag 1000, Narrabri, NSW, 2390, Australia, E-mail: Robert.Mensah@agric.nsw.gov.au

Commercial cotton crops in Australia are heavily attacked by a wide range of insects, the major ones being *Helicoverpa* spp., green mirids (*Creontiades dilutus*) and two-spotted mites (*Tetranychus urticae*). The management of these pests almost exclusively depends on repeated applications of synthetic insecticides. The major focus of the cotton industry is to reduce its dependence on synthetic insecticides and maximise the long term sustainability of the industry. This can be achieved through the development of alternative pest control strategies which minimise insecticide use and place much more emphasis on the role of beneficial insects. We have conducted studies since 1992 using strip intercropping and Envirofeast® (food) sprays in commercial cotton farms to conserve and utilise beneficial insects in an IPM program in cotton. In addition, we have developed a predator to prey ratio as a threshold to incorporate the activity of predators into pest management decisions to control *Helicoverpa* spp. in cotton. The application of Envirofeast® (food) sprays to cotton crops attract, arrest and conserve predatory insects, especially early in the season to manage *Helicoverpa* spp. However, for food sprays to attract predators effectively into cotton farms, there need to be a source within or close to the cotton farm where the insects can be attracted. Interplanting lucerne crop in cotton fields as strips can conserve and increase the densities of predatory insects of *Helicoverpa* spp. in cotton. The interplanted lucerne crop acted as a refugia and a source of the predators to the cotton crop. The integration of food sprays and strip cropping with lucerne within commercial cotton system has enabled the development of an IPM system in cotton based on beneficial insects. The IPM program has so far reduced synthetic insecticide use in some commercial farms by 40-50% without any yield loss. The relevance of these studies to other IPM programs worldwide will be discussed.
Index terms: *Creontiades dilutus, Tetranychus urticae*, Envirofeast®.

[3980] MAPPING, TAGGING, MARKER-ASSISTED SELECTION AND MAP-BASED GENE CLONING OF GALL MIDGE RESISTANCE GENES IN RICE

M. Mohan, K. R. Rajyashri, S. Behura & S. Nair, Plant Resistance Group, International Centre for Genetic Engineering and Biotechnology (ICGEB), Aruna Asaf Ali Road, New Delhi-110067, India, E-mail MOHANM@DEL2.VSNL.NET.IN.

We are studying the molecular mechanisms for insect resistance in rice, with emphasis on resistance to gall midge. Gall midge (*Orseolia oryzae*) is a major dipteran pest of rice and though its infestation does not kill the plant, the crop yield is considerably reduced. This pest is a problem in India, China, Africa and Southeast Asia. Five biotypes of this pest have been identified in India. It has been established that the resistance to gall midge in rice is governed by a single dominant gene. However, the exact nature of the gene and its product(s) are still unknown. Our aim is to identify, map and clone the resistance gene(s) that confer resistance to the different biotypes of gall midge by using the information available through genetic studies on gall midge resistance. We have mapped and tagged two gall midge resistance genes *Gm2* and *Gm4t* using RFLPs and RAPDs. The tagging information has been used for developing a marker-assisted selection system for these two gall midge resistance genes. Pyramiding of these genes is being carried out using the molecular markers linked to these genes. We have also developed molecular markers to differentiate gall midge biotypes that are otherwise morphologically indistinguishable.
Index terms: *Orseolia oryzae*, *Oryza sativa*, molecular markers, insect resistance genes.

[3981] THREAT ON THE GREEN BELT AT COMPANHIA SIDERÚRGICA DE TUBARÃO – CST

E. Mugrábi-Oliveira[1] & E.J. Agrizzi[1], Companhia Siderúrgica de Tubarão – CST. Ave. Brig. Eduardo Gomes, s/n – Jd. Limoeiro. Serra – ES – Brasil. Zip Code 29164-280. E-mail: (ambiente.gaz@zaz.com.br)

Between 1996 and 1997 was registered a decimation of about 80% of the population of *Leucaena leucocephalla* (Leguminosae), of 370 thousand specimens, occupying an area of 700 hectares, among approximately 1,5 million trees, which form the Green Belt of the CST, a steel-producing industry located in southeast Brazil. The decimation of *L. leucocephalla* possireduced the efficiency of the green belt relative to the retention of dust from industrial activities, increased the action of winds on raw materials yards, affected noise control and the preservation of the fauna and the flora, in addition to sensibly harming the environmental landscape. Initially, the main causes of decimation of the trees were attributed to local industry pollution, lack of water, low fertility and high acidity of the soil during the plantation. After a detailed study, we conclued that the damages caused to *L. leucocephalla* were mainly due to the attack of *Heteropsylla cubana* (Homoptera, Psylidae). The first record of outbreak of *H. cubana* in *L. leucocephalla* was in Hawaii in 1984. In South America an outbreak was registered in 1987, for Argentina, Peru and Chile. The symptoms of the attack of the cicada on *L. Leucocephalla* are similar to those reported in other locations. Orange eggs are placed in group of 50 to 200 in soft tree foliage, growing buds, petioles and young pods. Nymphs of different stages were found in those areas, while adults were also present in the oldest portions of the plants. The result of feeding the cicadas on the leucaenas is the development of small located dark stain, with posterior drying of the branches and trunks, and finally, the fall of the tree. Due to the easy budding and the discharges rates of leucaena germination, as well as the substitution of the dead plants for other species, the green belt now has been totally established.

Index terms: Outbreak; *Heteropsylla cubana*; *Leucaena leucocephalla*.

[3982] PEST RISK ASSESSMENT TO MANGO CROP IN BRAZIL

D. Navia[1], S. V. Paula[1] & M. R. V. Oliveira[1], [1] Lab. Quarentena Vegetal, Embrapa Recursos Genéticos e Biotecnologia, PqEB- Final W 3 Norte, Cx. Postal 02372, CEP 70.849-970 Brasília, DF, Brasil, E-mail navia@cenargen.embrapa.br

Over the last ten years, irrigated fruitculture, in northeastern Brazil, has become an important sector of Brazilian agriculture, revealing a great potential of development, due to climate conditions and a high value export-products. Mango is originated from southeast Asia, although, nowadays widely cultivated in tropical areas, being the most consumed fruit worldwide. In Brazil, this fruit that has been introduced in XVI century, will have greater socio-economic potential if only high quality products free from pests are available in the international market. Therefore, it is extremely important to protect this culture against exotic pests that com lead to a high cost production and export restrictions. People and goods arriving in Brazil from overseas may bring diseases and pests with them. Ilegal imports, either through smuggling or as undeclared items at airports and seaports (usually tourists), also pose risks. Specific international guidelines to protect agriculture has been developed by the International Plant Protection Convention (IPPC) and other groups. In order to protect mango crop in Brazil, according to the international decisions and requirements, Pest Risk Analysis (PRA) has been realised, through the identification and characterisation of pests of quarantine importance to this crop. This approach involves gathering data base on bioecology, geographical distribution, host plants, economic impact, control and inspection methods of the main pests that are a threat to mango production in Brazil. A study was conducted using PRA and a number of 99 species of insect and mites were found to be exotic to Brazil. The most important species belonged to Hemiptera (29%), Lepidoptera (26%), Diptera (20%) and Coleoptera (15%). Among these groups, fruit flies (*Bactrocera* and *Ceratitis*), softscales (*Ceroplastes, Pseudococcus* and *Rastrococcus*), weevils (*Sternochetus*), thrips (*Scirtothrips*) and mango hoppers (*Idioscopus*) are the most importants. From these groups, 36 species were taken priority, in order to established quarantine procedures to the country, so as to protect this culture.

Index terms: Plant Protection, Quarantine, *Mangifera indica*.

[3983] GIS, GEOSTATISTICS AND MEDFLY: ECOLOGY AND CONTROL

D. Nestel & Z. Mendel, Institute of Plant Protection, The Volcani Center, Agricultural Research Organization, Ministry of Agriculture, P.O. Box 6, Beit-Dagan 50250, Israel.E-mail: nestel@netvision.net.il.

During the last years Geographic Information Systems and Geostatistics have become important tools in the study of the ecology of insects and in the development of Integrated Management Systems for pest control. The present talk will show the results of two projects on Medfly ecology and control in which GIS technology and spatial analysis were implemented. These case studies demonstrate the usefulness of GIS and geostatistics in unveiling ecological processes of insect pest populations and in devising control strategies for pests. These case studies also highlight the need of a spatial approach in the investigation of insect ecology and pest control.

[3984] ACCELERATING ADOPTION OF AGRICULTURAL RECOMMENDATIONS THROUGH PARTNERSHIPS BETWEEN GOs, NGOs, And POs

G. P. Ojha, V. R. Cardenas, R. T. Raab & S. G. Lumbo, E-mail: ojhasirkutane@hotmail.com

A high rate of adoption of improved agricultural technologies takes place when the state (GO), nongovernment (NGO), and private (PO) sectors form partnerships and extend agricultural technologies to farmers. This was revealed through the result of a 21-month research in east Chitwan, Nepal while comparing seven technology dissemination patterns. This paper (1) describes the partnership building process, and (2) compares effectiveness of partnerships. In the process of partnership building, analysis of context, selection of technology, identification and selection of partner agencies, division of responsibilities, training of agents, and selection of sites was done using a participatory approach. Guided by the farmer-identified needs, availability of technology and interests of agencies, components of technology such as crop variety, seed rate, sowing space, fertilizing, insect management (IPM), disease control, irrigation, drying, storage management, and marketing related to farmer preferred rice varieties, hybrid maize and sunflower were selected for the extension. To compare the effectiveness of extension patterns, the research was conducted with a quasi-experiment design and information collected using both qualitative and quantitative methods. Information from 123 farmers and 17 agency personnel indicated that partnerships are more effective than individual efforts in extending agricultural technologies to farmers. Among the partnership patterns, GO+PO and GO+NGO were more effective than others. Under GO+NGO partnership, more farmers were motivated and more technical components adopted. A similar trend was observed with the GO+PO partnership. While theoretically the partnership between the GO, NGO, and PO was expected to be the most effective, data showed otherwise. This occurred as partners failed to respond to their agreed upon responsibilities. The effectiveness of partnership is found to be technology and farm size-specific. Adoption of imported high-cost technologies took place under GO+PO partnership. With GO+NGO partnership, low- cost and locally available technologies were adopted. Similarly, partnerships were specific to farmer circumstances. GO+PO partnership was most effective in reaching large landholders while GO+NGO partnership was most effective in reaching small farmers. Two major conditionalities for the effective functioning of partnerships were identified. The partnerships were effective only when partners fulfilled the agreed upon responsibilities. The partners fulfilled the responsibilities only when fulfilling the responsibilities was mutually beneficial to each other. Drawing lessons from the findings, this paper argues that situation-specific partnerships could improve technology dissemination, help increase agricultural productivity, insure food security, and reduce poverty without damaging environment.

[3985] PLURALITY OF SPECIES, ECOLOGICAL GUILDS, SINGLE SPECIES AS BIOINDICATORS TO ASSESS RURAL LANDSCAPES: PROBLEMS AND TOOLS

M.G. Paoletti, Department of Biology, Padova University, 35100 Padova, Italy, E-mail paoletti@civ.bio.unipd.it.

Species number, abundance, ecology, physiology are among the key factors that permit bioindication. Developing an appropriate selection of organisms to assess landscape quality is the target of any project aimed at improving environmental quality and environmental health. The strategy is linked to the personal knowledge and sensibility, the available information and training. Adopting just a few specie or adopting many larger taxa, using ecological guilds, microcosms or directly study in the field is linked, in most cases, to personal sensibility and skill. Appropriate identification tools and good or good taxonomic expertise can make the adoption of plurality of species as target instrument of assessment. Morphotype sorting can be a very interesting tool especially in situation in which taxonomists and taxonomy tools are not easily available, this is the case for most areas to be assessed in the tropics. Ecological guilds can be appropriate in some cases where environmental impacts are very high. Making preliminary assessment in most cases can offer the best mix of ideas to properly operate. Discussion and practical considerations will be made regarding: on different input orchards and a power plant in Italy, of rural landscapes in China and forest-savanna cline in Amazonas, Venezuela. Comparison among different portions of the target landscape are the simplest way to work. Seasonal variability and spacial uncertainity make important the personal sensibility in planning and developing the project.

[3986] DATA BASE OF QUARANTINE PESTS TO BRAZIL

S. V. Paula[1], D. Navia[1], F. Pinheiro[1], F.G. Alvarenga[1], E.A. dos Santos[1] & M. R. V. Oliveira[1], [1]Lab. Quarentena Vegetal, Embrapa Recursos Genéticos e Biotecnologia, PqEB- Final W 3 Norte, Cx. Postal 02372, CEP 70.849-970 Brasília, DF, Brasil. E-mail: vilarin@cenargen.embrapa.br

The World Trade Organization (WTO) Agreement among countries, including Brazil, has led to the Application of Sanitary and Phytosanitary Measures (SPS Agreement) and to the Agreement on Technical Barriers to Trade (TBT Agreement), in order to protect humans, animals and plants. The SPS Agreement encourages country members to base their national SPS measures on relevant international standards, guidelines and recommendations. Brazil, following this pathway, is also a member of "Comitê de Sanidade Vegetal dos Países do Cone Sul" (COSAVE), which includes Argentina, Paraguay, Uruguay and Chile. COSAVE regulates animal and plant quarantine whitin those countries. On the other hand, Brazil itself has its own internal regulations to protect its plant and animal health against the entry and establishment of unwanted pests and diseases based on the standards, guideliness and recommendations established by the relevant international organisations. In that context, the Plant Quarantine Laboratory of "Embrapa Genetic Resources and Biotecnology" has elaborated a software on quarantine pests (insects and mites) to Brazil. In the first part of the programme a list of 84 organisms have been set up according to COSAVE (Pests A1). The data base has gathered information on nomenclature and common names, bioecology, morphology and anatomy, geographical distribution, host range, symptons and signs, movement and dispersal, damage and losses, detection, identification and diagnosis and quarantine aspects of these organims. Fifteen crops habe been priorized for the acomplishment of the data, potato, wheat, corn, rice, cotton, grape, rose, peach, plum, nectarine, barley and grass. The software will be available to extensionists, farmers, students, universities, and public in general, involved with importation of goods to the country. This is the first software being elaborated in the country with special interest in protection of brazilian agriculture.
Index terms: Quarantine, plants, software, pests, insects, mites.

[3987] USE OF GAMMA RADIATION AS QUARENTENARY TREATMENT TO CONTROL THE MOTH *OPOGONA SACCHARI* (BOJER, 1856) (LEPIDOPTERA : TINEIDAE) IN BANANA (*MUSA* SP.) AND *DRACAENA FRAGANS*

M.R. Potenza[1], V. Arthur[2], V. de J. Pereira[1], [1]. Instituto Biológico, SP. Av. Cons. Rodrigues Alves, 1252, CEP 04014-002 - São Paulo, SP, BR. E-mail: potenza@biologico.gov.br. 2. CENA/USP, CP 96, CEP 13400-970, Piracicaba, SP, BR.

This research had the aim at evaluating the physical treatment by gamma radiation as an alternative method to disinfestation bananas and *Dracaena fragans* stalks without roots, to exportation, infested with the moth *Opogona sacchari*. The moth rearing was initiated from infested *D. fragans* originated from Juquiá, state of São Paulo. Gammacell 220 with cobalt (Co60) with activity of 530,00 Ci was used as an irradiator. Tests on artificial diet, bananas variety Nanicão and *D. fragans* stalks without roots were done, with doses varying form 5,0 to 500,0 Gy. The doses of 140,0; 240,0 and 450,0 Gy fitted the rules of absence of adults emergency, affecting eggs with seven days old, twenty two days old larvae and eleven days old pupae, irradiated on artificial diet, respectively. The dose to disinfestation twenty two days old *O. sacchari* infesting *D. fragans* stalk sheaves without roots and bananas in bunch, used to exportation, was 300,0 Gy and to eleven days old pupae, in the some conditions, was of 450,0 Gy. The dose of gamma radiation from 50,0 to 500,0 Gy affected sprouting.
Index terms: gamma radiation, disinfestation, *Dracaena fragans*, banana, *Opogona sacchari*

[3988] FLY FREE ZONES - TECHNOLOGY, APPLICABILITY AND LIMITATIONS (THE ISRAELI EXPERIENCE)

Y. Rossler, The "Israel Cohen" Inst. for Biological Control, Citrus Marketing Board of Israel, P.O.Box 80, Bet-Dagan 50250, Israel.

Quarantine regulations imposed by importing countries such as the USA, Japan, Korea etc. limit the free export of fresh fruit and certain vegetable cultivars from Israel. The Mediterranean fruit fly (*Ceratitis capitata* Wied.) is the major restrictive quarantine pest. Two approaches can be applied to circumvent such restrictions: 1. Efficient control of the pest in the field followed by quarantine treatments in the harvested produce or; 2. establishing "Fly Free Zones" through the eradication of the pest and preventing re-entrance to the Fly Free Zone through intra-country or inter-country quarantine measures. The first approach has been applied for almost 30 years now in the citrus industry where, country-wide control programs under the "Plant Protection Law" result in an extremely low medfly infestation in the orchard. The fruit destined to restricted markets undergoes additional quarantine treatment prior to export. However, post-harvest quarantine treatments can be applied to a narrow range of agricultural crops, excluding such crops as tomatoes, peppers etc. Hence the concept of establishing a Fly Free Zones has gained interest in the last decade. The basic requirement for the Fly Free Zones is to posses sound geographical isolation from other producing zones (ecological island).
Index terms: Mediterranean fruit fly, *Ceratitis capitata*, quarantine

[3989] RESPONSE OF TRANSGENIC PEAS CONTAINING A SEED SPECIFIC α-AMYLASE INHIBITOR GENE TO HEAT AND WATER STRESSES

M. J. de Sousa Major[1,2], N. C. Turner[3], D. C. Hardie[2], R. Morton[4], H. E. Schroeder[4] & T. J. V. Higgins[4], [1]School of Environmental Biology, Curtin Univ. of Technology, Perth, WA 6845; [2]Agriculture WA, South Perth, WA 6151; [3]CSIRO Plant Industry, Private Bag No. 5, WA 6913; [4]CSIRO Plant Industry, GPO Box 1600, Canberra, ACT 2601, Australia.

A gene for α-amylase inhibitor 1 (α-AI-1) has been inserted into field peas (*Pisum sativum*). Trials have shown that this gene confers protection against the pea weevil (*Bruchus pisorum*), a pest of field peas in Australia. As part of environmental and pest management, the transgenic pea lines were evaluated under glasshouse conditions to quantify the level of α-AI-1 when the peas were subjected to heat and water stresses during pod filling, both of which are features of the Australian field environment. Transgenic and non-transgenic peas were subjected to heat or water stress treatment beginning one week after the first pods were formed. The heat stress experiments were carried out in growth cabinets, under control, (27/22°C day/night temperatures), at 1.3 kPa vapour pressure deficit (VPD) both night and day, and heat stress (32/27°C day/night temperatures), at 1.3 kPa VPD both night and day, conditions. The water stress experiment was conducted in a PC2 glasshouse where peas were grown at 29°C maximum temperature during the day and 11°C minimum during the night and 68% RH. The water supply to selected pots was stopped to create the stress condition, and plastic beads were placed on the soil to reduce evaporation during subsequent maturation. Individual pods were tagged under heat and water stresses for 9 and 12 days, respectively. Seeds were collected separately from pods harvested at maturity, (46 - 63 days after the start of heat or water stress period), weighed and grouped in to: a) pods initiated before the stress was imposed, b) pods initiated within 2-3 days of the start of stress imposition, and c) pods initiated later than 3-4 days after the start of stress imposition. Heat and water stressed plants produced 27% and 79% fewer seeds than control, respectively. Although heat stress had no effect on seed size, water stressed plants produced smaller seeds. The content of α-AI-1 was measured in both treatments. The level of α-AI-1 was not influenced by water stress. However, the level of α-AI-1 in peas subjected to heat stress was reduced by an average of 33% when compared to unstressed plants. No significant difference was found in the level of α-AI-1 in pea seeds from the three different pod groups. The implications of these results will be assessed in future experiments. Peas grown under heat stress in growth cabinets will be inoculated with pea weevil eggs to evaluate whether the reduction in expression of the α-AI-1 in the transgenic pea seed will reduce the efficacy of the α-amylase inhibitor.

Index terms: α-AI-1, *Pisum sativum, Bruchus pisor*

[3990] INTEGRATION OF GLOBAL CHANGE IMPACTS

R. W. Sutherst, G.F. Maywald & B. L. Russell, CSIRO Entomology, Long Pocket Laboratories, 120 Meiers Rd, Indooroopilly, Queensland, Australia 4068. Email R.Sutherst@ento.csiro.au

Global change presents humanity's greatest challenge. In this symposium on *'global change and sustainable IPM of crops'* we are concerned with identifying the risks and opportunities presented by a range of drivers of global change. We also explore management options to respond to those changes. A combination of the impacts of climate change and adaptation measures is incorporated into the Intergovernmental Panel on Climate Change (IPCC) concept of 'vulnerability'. Activity 3.2 of the Global Change and Terrestrial Ecosystems core project of the International Geosphere and Biosphere Programme (IGBP-GCTE) is currently focussed on addressing the vulnerability of agriculture to insect pests and plant pathogens. The demand for integrated risk assessments for industries and regions and the need for holistic solutions that aim to create truly sustainable crop production systems calls for a re-invigorated, systems approach to IPM. In the context of global change this poses enormous challenges, given that IPM is still largely practised at the level of single species. While some of the environmental changes are global phenomena, we need first to understand the physiological and demographic responses of crops and their pests at the local level. Regional scale models then need to capture system responses while avoiding the errors that arise from over-specification of plot-scale models. The issues addressed in this symposium will require visionary planning to prepare crop managers for the future decades of rapidly changing global environment. IPM practices must be robust enough to remain effective when environmental conditions, many of which we have taken as constant in the past, are changing. This needs global monitoring datasets, experimentation aimed at defining the relationships between biological processes and environmental variables, and modular modelling tools to ease the task of forming collaborative research networks. With global change being ubiquitous, resources at a premium and the need for regional approaches so apparent, it is essential that the global scientific community collaborate to ensure the sustainability of IPM. IGBP-GCTE is an ideal vehicle through which to pursue that goal in partnership with international agencies.

Index words: Pest risk, modelling, climate change, land use change, networks

[3991] REPRODUCTION AND SURVIVAL RATE OF THE KANZAWA SPIDER MITE ON THE DIFFERENT VARIETIES OF TEA PLANTS

M. Takeda, Lab. of Entomology, National Research Institute of Vegetables, Ornamental Plants and Tea. 2769, Kanaya, Shizuoka 428-0089, Japan, E-mail takedada@tea.affrc.go.jp.

The kanzawa spider mite, *Tetranychus kanzawai*, is one of the important pests of tea plants in Japan. The varietal differences of tea plants in the infestation of the spider mite are well known in the tea fields. The general method usually adopted to measure the level of resistance is by means of visual screening of the tea plants, which requires large fields and incurs a large amount of inputs for establishing a good perennial crop to serve the purpose. My main aim here in this report is to apply the laboratory method for evaluating the level of susceptibility of the different tea varieties. Adults of the kanzawa spider mite were collected in the tea (varieties, "Yabukita" and "Shunmei") fields and the laboratory colonies were established using tea leaves of "Yabukita". For analyzing the reproduction and the survival rate on the different varieties, leaves of 39 tea varieties were collected in the field. The center on the undersurface of each leaf was enclosed with a rectangle (2.0 cm × 3.0 cm) by an adhesive (Fuji tangle®) and 8 female adults were placed in the enclosure using the fine brush. These adults were reared under L15:D9 at 24°C. After 3 days of rearing female adults were counted and removed, and then eggs laid on the leaf were counted and reared on the same conditions. The survival rates of the offspring on the different varieties were checked at 7 (most eggs hatched out in to the larval stage) and 14 (most individuals reached the adult stage) days after the rearing of eggs. The number of eggs laid and the survival rates of the varieties were compared with those on the "Yabukita", which is susceptible against the spider mite and the most popular variety in Japan. The mean number of eggs laid on a leaf in the "Yabukita" was about 56 (2.34 eggs/female/day). The number of eggs in the variety "Natsumidori" was statistically lower than that in the "Yabukita". The numbers of larvae (first 7 days) and adults in "Natsumidori" and "Samidori" were significantly lower than those in the "Yabukita". Another 7 varieties were lower in the survival rates than in the "Yabukita", however there was no significant difference in the number of adults after 14 days between them. The measure of the number of eggs and survival rates of the kanzawa spider mite on different varieties are good indicator for evaluating the varietal resistance.

Index terms: *Tetranychus kanzawai*, Varietal resistance, Tea plants.

[3992] DAILY ACTIVITY OF THE FRUIT FLIES (*BACTROCERA DORSALIS* COMPLEX) AND ITS PARASITOID (*BIOSTERES VANDENBOSCHI*) IN CARAMBOLA TREE, WEST JAVA INDONESIA

S. S. Tati Subahar[1] & I. P. Artayasa[2], [1]Dept. of Biology, Institut Teknologi Bandung, Ganesa 10 Bandung 40132 Indonesia, E-mail tati@bi.itb.ac.id; [2] University of Mataram, Jalan Pemuda Mataram 83125 NTB-Indonesia.

Daily activity of fruit flies (*Bactrocera dorsalis* complex) and its parasitoid (*Biosteres vandenboschi*) under natural conditions have been observed on carambola fruit (*Averrhoa carambolae*). Observation were done by recording the fruit fly and its parasitoid on the carambola fruit. Daily observation were done every 30 minutes from 07.00 to 18.00. During all the observations period 68% of fruit flies visited the carambola fruits was the females. The occurrence of its parasitoid on carambola fruit was also dominated by the females (94%). Three kinds of activities on carambola fruit were note that is moving; resting and ovipositioning. Most of the female fruit flies (65%) oviposited their eggs at the period of 11.00 to14.00 pm, however the females of *B. vandenboschi* showed no different significant in the time of oviposition.

Index terms: *Bactrocera carambolae, Biosteres vandenboschi, Averrhoa carambola*, daily activity, ecology, behavior.

[3993] CORRELATION OF TERMINALIA LENGTH BETWEEN MALES AND FEMALES OF *BACTROCERA CARAMBOLAE* (DIPTERA: TEPHRITIDAE) FROM WESTJAVA, INDONESIA

S.S. Tati-Subahar & I Durahman, Dept. of Biology, Institut Teknologi Bandung. Ganesa 10 Bandung 40132 Indonesia, E-mail tati@bi.itb.ac.id.

Bactrocera carambolae is one among the 20 species of the *Bactrocera dorsalis* complex in Indonesia that is attracted to methyl eugenol lure. However, difficulties still encountered in identifying *B. carambolae* from natural populations. Iwaizumi et al. (1997) proposed that measurement of aedaegus is strongly correlated with aculeus of the same *Bactrocera* species or population. To test their hypothesis we measured the length of aedeagus and aculeus of *Bactrocera carambolae* population originating from Subang - West Java-Indonesia. A total of 216 individuals (132 males and 84 females) originating from *Averrhoa carambolae* were reared until metamorphosis. The length of the aedeagus and aculeus were measured using the same methods as those of Iwaizumi. From 31 mating pairs we found a significant linear correlation between the length of aedeagus and the length of the aculeus. The same method of measurements has been done for two hundred of males *Bactrocera* species caught by methyl eugenol traps from the same locality. The lengths of aedeagus from natural population varies between 2.8 to 4.2mm. However, success pairs have the following measurements: the length of aedeagus varies between 2.9mm to 3.7mm and the length of aculeus varies between 3.3mm to 3.6mm. Outside this range, there is no mating, suggesting that those with extreme length of aedaegus or aculeus belong to a different taxon.

Index terms: *Bactrocera dorsalis complex, B. carambolae, Averrhoa carambola*, methyl eugenol, terminalia, aedeagus, aculeus.

[3994] MODEL ORGANISM GENETICS AND GENOMICS: TOOLS FOR TARGET DEVELOPMENT IN PEST CONTROL

S. Thibault & J. Margolis, Exelixis, Inc. 260 Littlefield Ave. South San Francisco, CA USA, E-mail thibault@exelixis.com;

The pharmaceutical and agricultural industries are moving increasingly toward target based screening as their primary discovery engine for novel bioactive small molecules. Screening, of course, requires new targets and confidence that altering the activity of these targets in vivo will have the desired outcome, be it curing a disease or controlling a crop pest. Exelixis utilizes the power of genetic, genomic, and informatic technologies to rapidly identify and validate novel targets by using modulation of gene activity as a surrogate for chemical inhibition or activation of protein function. Transposon technology is one of the foundations of Exelixis' technology platform, providing a rapid method to deliver transgenes and modify the genome of both laboratory models and pest species. The power of *Drosophila* and *C. elegans* genetics makes them a fascile system for insecticide target discovery. Ideal targets are essential for viability, selective and specific to pest species, dosage sensitive, and lead to rapid knockdown when disrupted. Genes that kill an organism when knocked out or overexpressed represent first-stage validated targets for pesticide development. Historically, P element screens have tagged approximately 10% of lethal loci in *Drosophila*. Efforts are ongoing at Exelixis to saturate the number of transposon-tagged genes in *Drosophila* using P. Screens underway with second generation transposons may uncover a complementary set of loci. Exelixis is also committed to develop representative non-drosophilid insects and plant pathogenic nematodes as additional model genetic systems. Increasingly reverse genetic tools such as EST projects, large insert genomic libraries and RNA-mediated gene interference are enabling genetic entry points in species that lack a history of classical genetic analysis. Development of biotechnology tools used in target discovery for Lepidoptera, Coleoptera, and nematodes will be discussed.

[3995] INSECT POPULATION CONTROL USING A DOMINANT, REPRESSIBLE, LETHAL GENETIC SYSTEM

D. D. Thomas[1], C. A. Donnelly[2] & L. S. Alphey[3], [1,3]Dept. of Zoology, Univ. of Oxford, South Parks Road, Oxford OX1 3PS, UK; [2]Wellcome Centre for the Epidemiology of Infectious Disease, Dept. of Zoology, Univ. of Oxford, South Parks Road, Oxford OX1 3PS, UK. Email: Luke.Alphey@zoo.ox.ac.uk.

The sterile insect technique (SIT) is a species-specific and environmentally non-polluting method of insect control that relies on the mass rearing, sterilisation and release of large numbers of insects [1, 2]. These sterile males mate with wild females, reducing their reproductive potential. If enough males are released for sufficient time, this can lead to the total eradication of the pest population. Area-wide SIT programs have been conducted with great success against several insect species, most notably the screwworm fly *Cochliomyia hominivorax* [2]. We propose a variant of SIT in which the released insects carry a dominant lethal gene or genetic system [3]. Clearly, this lethality has to be repressible in laboratory culture for the stock to be viable. We call this system "Release of Insects carrying a Dominant Lethal" (RIDL) rather than SIT as the released insects are not, strictly speaking, sterile. Appropriate construction and control of the lethal system can lead to the automatic sex-separation and induced lethality in the progeny of matings with wild females, all without any labour-intensive technically demanding or hazardous steps such as mechanical sex-separation or sterilisation by radiation. We have analysed the performance of several variants of RIDL under various conditions by mathematical modelling. We have also demonstrated the feasibility of this system by constructing the required repressible dominant lethal genetic system in *Drosophila melanogaster*.

Index terms: *Drosophila melanogaster*, SIT, RIDL, Transgenic

[3996] INTEGRATED MEASURES FOR CONTROLLING THE DIAMONDBACK MOTH (DBM) IN SOUTHERN CHINA*

M. Y. TIAN[1], L. ZENG[1], P. S. ZHONG[2], G. W. LIANG[1] & X. F. PANG[1], [1]Lab. of Insect Ecology, Faculty of Natural Resources & Environment, South China Agri. Univ., Guangzhou, 510642, China, E-mail mytian@scau.edu.cn; [2]Center for Urban Pest Control, Guangzhou, 510000, China

Integrated techniques including cultural (i. e. inter-cropping, rotation, phytosanitation), biological (i. e. *Trichogramma confusum*, Granulosis Virus (PxGV), *Bacillus thuringiensis* (Bt.), sex pheromone, and neem oils) and chemical (i. e. Abamectin) measures were developed for controlling DBM, the most serious insect pest on cruciferous vegetables in Dongguan, Guangdong Province of South China from 1997 to 1998. The main results were described as follow: (1) Cultural control measures played an effective role on reducing the densities of DBM. Damage of DBM was significantly decreased when cruciferous vegetables inter-cropped with other vegetables such as spring onion, tomatoes and/or kidney bean; Rotation model of "radish-towel-cruciferous" was found the most effective on suppressing the population densities of DBM. (2) Egg parasitism of DBM reached 52.94, 86.67 and 62.50%, respectively, by releasing *T. confusum* in the methods of 56 spots (500 individuals/spot), 15 spots (1,000 individuals/spot) and 7 spots (2,000 individuals/spot) per 667 m^2. (3) Mortality lead by sex pheromone ranged from 27.32 to 50.60% and the effects of the pheromone lasted as long as 20 days. (4) Combined efficacy of two or more measures mentioned above in controlling DBM was also evaluated in the light of life table methods in order to obtain a series of ideal technical complex which available in practice. The most effective complex measures were successfully developed as "sex pheromone + *T. confusum* + Bt. + neem oils + Abamectin", with the I-value (index of population trend) of DBM as 1.03, much lower than that of the control (I-value of DBM as 70.37). (5) It was also shown that the complex measures were acceptable in practice.

Index terms: *Plutella xylostella*, IPM, vegetable.

* Sponsored by the Key Project of Ministry of Agriculture (No. 98Z03-3), National Natural Science Foundation (No. 39870441, 39930120), and Guangdong Natural Science Foundation (No. 980135) of China.

[3997] AN EXPERIMENTAL COURSE ON INSECTS IN A MEDITERRANEAN SECONDARY SCHOOL

A. J. Velázquez de Castro[1,2] & F. R. Dorado[1], [1]Dept. of Entomology, Univ. Complutense, 28040 Madrid, Spain; [2]Instituto de Enseñanza Secundaria La Senia, 46200 Paiporta, Valencia, Spain.

A subject focused on insects was offered in our school in Paiporta, near Valencia, Spain. The aim was to teach not only about theoretical aspects of entomology but mainly about insect life (ecology and life cycles) and natural environment. We also wanted to find suitable arthropods species for teaching students in the Mediterranean, as most part of available educational resources in the literature does not applies to this zone. The vegetable gardens outside the school and their surroundings were explored, searching for local fauna specimens. They were carried to the school Science Laboratory and we tried to rear them inside terrariums. Three beetle insects could be fed by pupils and reared from larva to adult: *Chrysolina bankii* (Chrysomelidae) which fed on *Marrubium* plants, *Ocypus olens* (Staphylinidae) which fed on diverse soil insects, and *Licinus punctatulus* (Carabidae) which fed on snails. These species were an important tool to learn about life cycles and interspecific relationships. The course also included a visit to the local Natural History Museum, the "Museo del Medio Ambiente", which offers several insect exhibitions for children. Finally, pupils of the insect course collaborate in making a small exhibition inside the school, called "mini-zoo", open to other pupils and also teachers. This minizoo included garden insects and also some attractive dune invertebrates as ant-lions (*Myrmeleon* sp.) and scorpions, and it was visited by more than one hundred people of the school community. The results of the course indicated that autochthonous insects are the best kind of animals to be used in introducing pupils to the natural environment. Moreover, it was verified the necessity of protecting the fertile region of Valencia ("la Huerta") and their natural surroundings for its didactic value. Unfortunately they are disappearing due to the pressure of the urban development.
Index terms: *Chrysolina bankii*, *Licinus punctatulus*, *Ocypus olens*, education

[3998] INSECT DIVERSITY OCCURRING ON CAGAITA IN SAVANNAS OF GOIÁS, BRAZIL

V.R.S. Veloso[1], G.A. Ferreira[1] & R.V. Naves[1], [1] Escola de Agronomia/Universidade Federal de Goiás. Campus II, Rod. Goiânia/Nova Veneza, km 0, Caixa Postal 131, CEP. 74001-970 Goiânia, Goiás E-mail: vveloso@agro.ufg.br.

Among plant species present in the savannas, the fruit trees are very important. The cagaita tree is a typical perennial plant from this area with ornamental potential. The tree reaches 4 to 10m high, presenting subery tortuous trunk and branches, both with thick bark. Fruits are juicy, yellowish, thin-skinned, delicate, with good taste and slightly acid. They can be ingested "in natura" or as juices, sweets, jams, liquor or ice cream. If fermented, fruits produce alcohol and vinegar. However, this tree suffers attack of a number of insect pests, mainly the fruit fly, which frequently ruins the yield. The objective of this study was to identify insects associated to cagaita tree and to evaluate damages caused by insect pests. The study was conduced from 08/94 to 12/99 at 25 cities in Goiás State savannas. Fruits and parts of plants attacked by insects were collected, counted, weighed and the insect attack was identified and described at the Escola the Agronomia of the Universidade Federal de Goiás. Fruit fly pupes were collected and transferred to appropriate recipients that allowed adult emergence. Flies were counted and fixed in alcohol 70% for posterior identification. Insects associated to cagaita tree are: 1) fruit flies (*Anastrepha* and *Ceratitis capitata*), which are considered the main cagaita pest. Six fly species were identified. The predominant, *A obliqua*, and *A sororcula, C. capitata, A fraterculus, A distincta* and *A zenildae* (Diptera, Tephritidae). 2).*Neosilba* spp., (Diptera, Lonchaeidae). 3) *Atherigona orientalis* (Diptera, Muscidae). 4) Beatles (Costalimaita ferruginea vulgata - Coleoptera, Scarabaeidae). 5) Parasitoids (*Doryctobracon areolatus, Azobara nastrephae* - Hymenoptera, Braconidae, *Aganaspis nordlanderi, Aganaspis pelleranoi, Lopheucoila nastrephae* - Hymenoptera, Eucoilidae and *Pachycrepoideus vindemiae, Spalangia ensius* - Hymenoptera, Pteromalidae).
Index terms: Fruit fly, Savannas, Cagaita

[3999] ECOLOGICAL STUDIES ACCOMPANYING THE CULTIVATION OF TRANSGENIC RAPE AND MAIZE IN THURINGIA (GERMANY)

Ch. Volkmar[1], Th. Wetzel[2], L. Luebke-Al Hussein[1], Th. Kreuter[1], K. Schmutzler[3], D. Jany[1] & L. Richter[1], [1]Inst. for Plant Breeding and Plant Protection, Martin-Luther-Univ. Halle-Wittenberg, Ludwig-Wucherer-Str. 2, D-06108 Halle (Germany), [2]Steinbeis-Transfer Center Integrated Plant Protection and Ecosystems, Untere Kirchstr. 6, D-07952 Pausa/Vogtl. (Germany), [3]Hoechst Schering AgrEvo GmbH, Pflanzenschutz Deutschland, D-40549 Duesseldorf (Germany)

From 1994 to 1996 ecological studies were carried out on plots with transgenic rape (*Brassica napus L.*) and trangenic maize (*Zea mays L.*). Both hybrids were equipped with a gene of a *Streptomyces*-species, causing tolerance of the herbicide 'Liberty' (Glufosinat), which was employed for pest control. The transgenic cultures were grown in a release test at the outdoor site of Friemar, Thuringia (Germany). For comparison, conventional plants cultivated on a huge commercial field as well as on the buffer strips surrounding the release test site were used. The research focused on epigeous predatory arthropods belonging to the taxonomic groups of *Araneae, Carabidae*, and *Staphylinidae*. These are known to be reliable indicators, reacting highly sensitive and without delay to negative influences on the ecosystem. Within the three-year period of research, no shifts or defects of the epigeal fauna in the trangenic test cultures could be established. Neither the species composition nor the pattern of density and activity gave any hints to a significant alteration of the ecological structure. The spectrum of species contained more than 300 species of the three said arthropod groups. Moreover, a total of 26 red-data-book species was recorded, consisting of 9 Araneae spiders and 17 carabids listed in the red-data-books of Thuringia and Germany. Among the carabids, for instance, 11 individuals of the species *Calathus cinctus Motsch.* could be determined. This species, however, was already rated as extincted in the red-data-book of Thuringia. Additionally, some species listed as utterly endangered as *Argenna subnigra* (*O.P.-Cambridge*), *Amara curta Dej.*, *Amara littorea Thoms.*, *Amara sabulosa Serv.*, and *Harpalus zabroides Dej.* were found. Thus, in both transgenic cultures the number of red-data-book species and individuals even exceeded the numbers established for the conventional control variants. Summarizing the findings, the growing of transgenic rape and maize plants with application of the herbicide 'Liberty' has not led to any recordable changes of the ecological structure of the arthopod fauna close to the ground.
Index terms: *Araneae, Carabidae, Staphylinidae*, red-data-book species, Transgenenic Plants, release tests

[4000] UNIVERSAL TRANSFORMATION SYSTEM FOR TRANSGENIC ARTHROPODS

E. A. Wimmer[1], A. J. Berghammer[2], C. Horn[1] & M. Klingler[2], [1]Lehrstuhl Genetik, Univ. Bayreuth, Universitatsstrasse 30, NW I, 95447 Bayreuth, Germany, E-mail: ernst.wimmer@uni-bayreuth.de; [2]Zoologisches Inst., Univ. Munich, Luisenstrasse 14, 80333 Munich, Germany.

Genetic manipulation of arthropods is a highly desirable goal for the development of better control strategies to fight agricultural pest and disease vector species. One major obstacle has been the difficulty to obtain marker genes that allow easy and reliable identification of transgenic animals. Here we present a universal marker system based on an artificial promoter containing three Pax-6 homodimer binding sites in front of a TATA box. This promoter drives strong expression of enhanced green fluorescent protein (EGFP) variants in larval, pupal, and adult eyes of insects. Moreover, by using this marker in combination with promiscuous transposable elements we could generate and identify both transgenic flies, *Drosophila melanogaster*, and beetles, *Tribolium castaneum*. This demonstrates the wide range applicability of the system. Nine vectors based on *Hermes*, *piggyBac*, and *mariner* transposons, each carrying either EGFP, ECFP, or EYFP were constructed. Using specific filter sets, ECFP and EYFP represent a distinguishable marker pair that can be used to develop universal transposon mutagenesis systems. Due to the promiscuity of the applied transposon vectors and the evolutionary conserved "master regulatory" function of Pax-6 in eye development, this system will permit the study of biologically relevant questions in almost any species, and not only in established model organisms. Since the very same system can be used in a series of different organisms, it will become a vital tool for the field of evolutionary developmental biology and be of particular interest for pest management programs.
Index terms: *Drosophila melanogaster*, marker, transgenesis, transposon, *Tribolium castaneum*

[4001] EFFECTS OF INTEGRATED MEASURES FOR CONTROLLING THE DIAMONBACK MOTH (DBM) ON ARTHROPOD DIVERSITIES IN VEGETABLE PLANTATIONS*

L. Zeng[1], M. Y. Tian[1], P. S. Zhong[2], G. W. Liang[1] & X. F. Pang[1], [1]Lab. of Insect Ecology, Faculty of Natural Resources & Environment, South China Agri. Univ., Guangzhou, 510642, China, E-mail mytian@scau.edu.cn; [2]Center for Urban Pest Control, Guangzhou, 510000, China, * Sponsored by the Key Project of Ministry of Agriculture (No. 98Z03-3), National Natural Science Foundation (No. 39870441, 39930120), and Guangdong Natural Science Foundation (No. 980135) of China.

From October of 1997 to October of 1999, investigations on the fauna of arthropods (insect mite and spiders) were carried out on cruciferous vegetable crops where the integrated techniques for controlling the diamondback moth (DBM), *Plutella xylostella*, were applied in a vegetable farm in Dongguan, Guangdong Province of China. Using of Sex pheromone, *Trichogramma confusum*, *Bacillus thuringiensis* (Bt.), neem oils and Abamectin were included in the system of the complex techniques. Totally 146 species of arthropods, i. e. 34 species of insect pests, 15 of parasitoids, 51 of predacious insects, 16 of spiders, and 2 of mites, were collected in the plantations. The results showed that the diversities of arthropods were different between the treatment(s) and the control(s) where the complex techniques and chemical pesticides applied, respectively. In the plantations of treatment(s), the richness and diversity indices of arthropods increased, while both decreased in the control(s). For example, on mustard, the diversity indices of insect pests and natural enemies were 1.7915 and 3.1844, respectively, in the treatment of complex measures, while 2.1931 and 2.3377, respectively, in the control. Furthermore, both species and densities of natural enemies increased in the treatment, but decreased in the control. Similar conclusions were also shown on other vegetables such as "Caixin" cabbage, wild cabbage and radish. Comparing with the case of the controls, the densities of spiders increased 66.70% on "Caixin", and 12.51% on mustard, respectively, in the treatments of the complex measures.

Index terms: *Plutella xylostella*, IPM, vegetable, arthropods, diversities.

[4002] THE ROLE OF INSECT PHEROMONES IN STORED PRODUCT PROTECTION

P. Trematerra & C. Reichmuth.

ABSTRACT NOT RECEIVED

[4003] WHEAT KERNELS STATUS AND HOST SELECTION IN SOME STORED PRODUCT INSECTS

P. Trematerra[1] , A. Sciarretta[1], [1] Department of Animal, Plant and Environmental Science, University of Molise, Via De Sanctis, I-86100 Campobasso, Italy, E-mail: trema@hpsrv.unimol.it.

The behavioural activity of *Sitophilus oryzae* towards intact and damaged kernels of 5 types of cereals - *Triticum aestivum*, *T. durum*, *T.dicoccum*, *T.monococcum* and *T.spelta* - was examined. The cereals are attractive in various ways; naturally dehulled and hulled cereals release volatile substances once artificially dehulled or split. However, dehulling and splitting the kernels affects the behaviour of *S.oryzae* in different ways. The substances released from different parts of the kernel act independently to one another. The pericarp layers may prevent these volatile substances from being released; in hulled cereals, the chaff increases the protection against their release. Once removed, volatile substances are released but only in small amounts compared to the case in which kernels are split. The release mechanism was identical for all cereals examined. Thus, in order of decreasing attraction are: the germ part, the kernel endosperm without the germ, the kernel pericarp layers, the whole kernel without the chaff, the whole kernel with the chaff, and lastly the chaff. Behavioural activity involved in the host selection by secondary pests of stored grains, *Oryzaephilus surinamensis*, *Tribolium castaneum* and *T.confusum*, with respect to intact and mechanically or naturally damaged kernels are also observed. Our results indicate that the attraction of secondary pests is facilitated by broken grain kernels, which resulted from either mechanical damage during harvesting and/or binning procedures, or the feeding activity of primary insect pests. Insect damaged kernels were more attractive to *O.surinamensis*, *T.castaneum* and *T.confusum* than whole kernels; in addition insect damaged kernels elicit more attractiveness than mechanically split kernels. The damage caused by primary pests, such as *Rhyzopertha dominica* and *S.oryzae*, on whole kernels may facilitate colonization by secondary pests, which continue damaging the cereals. *O.surinamensis*, *T.castaneum* and *T.confusum* utilize the grain volatile odours to distinguish whether the grain kernels of the stored cereals are damaged mechanically or by insects.

Index terms: Stored product insects, kernels status, host selection

[4004] STATUS OF PEST CONTROL IN CENTRAL EUROPE

R. Pospischil, Bayer AG, Animal Health, R & D, Clinical Development, 51368 Leverkusen, Germany

The living standard has changed dramatically since the middle of the 20th century in Central Europe with increasing prosperity and progress. Modern buildings with central heating, carpet floors and insulation are responsible for a constantly warm temperature conditions. Extensive food production areas and an intensive world trade are also responsable for the establishment of tropical pests in the temperate zones. Hygiene pests were introduced to Europe with man thousands of years ago. However, due to the cold temperatures in winter time most species could not easily establish. Modern life style with constantly convenient temperatures indoors even in winter gave many tropical and subtropical species a chance to survive after their introduction to Europe. Disease transmission grew to a severe problem especially in sensitive areas like the food processing industry and in hospitals. Allergic reactions to indoor pests (eg cockroaches, house dust mites) have become more and more important over the last thirty years. Due to their high reproduction rate and fast development some hygiene pest have become resistant to commonly used insecticides (eg *Musca domestica*). Modern pest control has to recognize this situation and to keep an eye on new invadors. In the past the pest control operator had to focus on pest control only – now his task is to manage pest problems according to the rules of integrated pest management. His main task should be to prevent pest problems with monitoring, sanitation and physical systems. When control is required, the PCO has to develop a strategy, which does not harm the environment, e.g. in sensitive areas like hospitals or food processing industry. Control strategies are discussed using the example of cockroaches, which have become an immense problem on the European continent. Modern pest control strategies against these species include products which were especially developed for sensitive areas. Such areas include restaurants, supermarkets, hospitals, nursing homes, schools, hotels, food processing industry, aircraft and others. The sprays which were used in the last decades are now being replaced more and more by cockroach gels, cockroach baits which are offered in special bait boxes, and larvicides. Cockroach gels allow a very targeted application close to the cockroach population. Very little active ingredient needs to be applied to achieve an amazing result. Modern gels have a residual efficacy which lasts up to one year or longer. Pest management will continue to be an important task with prevention being the most important aspect. PCO's should be aware of the fact that introduction and establishment of new species may occur at any time. Pest control should be carried out with an appropriate formulation which was developed for the pest species and situation. Mallis A (1997): Handbook of pestcontrol, 8th edition, Mallis Handbook & Technical Training Company, 1456pp; Pospischil R (1998): Einschleppung von Schädlingen nach Mitteleuropa. Pest Control

[4005] EFFECT OF PHOTOPERIOD AND TEMPERATURE CHANGES ON THE REPRODUCTIVE BEHAVIOR OF MALE *BLATTELLA GERMANICA* LINN. (BLATTOIDEA : BLATTELLIDAE)

S. C. Pathak[1] & Rita Bhandari[2], [1]Department of Post-graduate Studies and Research in Biological Sciences, Rani Durgavati University, JABALPUR (MP) 482001. INDIA. E-mail : pathaksc@hotmail.com. [2]Department of Zoology, Government Autonomous Science College, JABALPUR (MP) 482001. INDIA.

Blattella germanica males were exposed to changes in photoperiod as well as temperature, before being paired with normal females of suitable age to study the effect, both separate as well as synergic, on their reproductive behavior, as shown by observational averages in terms of per cent time spent on such behavior. Comparison of these observational averages of control and experimental insects revealed that exposure to experimental conditions in nymphal instars had no effect on the sexual behavior of male adults. Adults maintained at low temperature (16^0 C $\pm$ 2^0 C) showed reproductive behavior only at normal (L/D cycle 14/10 h) or near normal Light / Dark cycles, but no such behavior at other L/D cycles. Insects kept at moderate temperature (25^0 C $\pm$ 2^0 C) showed much higher observational averages at all L/D cycles except total darkness. Experimental adult males derived from culture maintained at high temperature (36^0 C $\pm$ 2^0 C) showed no reproductive behavior in conditions of total darkness as well as total illumination, but the behavior was more or less unaffected at other L/D Cycles. Qualitative changes in the intensity of sexual behavior due to these experimental exposures were also noted. The effects were generally reversible although it took more time in insects maintained at low temperatures to revert to normal averages as compared to insects kept at higher temperatures.

Index terms : Photoperiod, Temperature, Sexual behavior, Observational averages.

[4006] FLEAS (*SIPHONAPTERA*) – BIOLOGY AND CONTROL

R. Pospischil, O. Hansen & D. Stanneck, Bayer AG, Animal Health, R & D, Clinical Development, 51368 Leverkusen, Germany

Fleas (*Siphonaptera*) play an important role worldwide as ectoparasites. More than 3500 flea species are known, however, only a few species (eg cat flea *Ctenocephalides felis*) develop in human residences. The cat flea, as a rule, is brought into the human environment by pets. However the species is also able to use human hosts, especially when cats or dogs are not available. The ancestors of fleas developed in burrows where they found convenient temperature and humidity conditions and food. Later the adult fleas turned to ectoparasitic life. Fleas can be subdivided into two life forms. The simpler nest fleas live in the burrows of their primary and secondary hosts (eg human flea *Pulex irritans* and rat flea *Xenopsylla cheopis*). The more developed fur fleas stay in the fur of their hosts as adults. They produce high quantities of blood containing faeces which serve as food for the larvae which develop at the resting places of the hosts. The cat flea belongs to this group. According to IPM (integrated pest management) flea control is a 5 step process which includes 1. The identification of the flea species and the location in which the larvae develop; 2. The treatment of the pets against the adult fleas; 3. Insecticidal treatment of the resting areas to break the flea life cycle; 4. Large scale treatment of the site, if the source of infestation can no longer be localized and 5. Preventive treatment of the pets against reinfestation with fleas (eg spot-on formulations). The use of a spot-on formulation based on the chloronicotinyl compound imidacloprid gives a good and about one month lasting control on animals. The flea life cycle should be interrupted preferrably by inhibition of the larval development. This can be easily achieved by treatment of the animal or the environment with a potent Insect Growth Regulator. The Juvenile Hormone Analogue pyriproxyfen has shown a long lasting effect against the juvenile stages of the cat flea even in extremely low concentrations. The combination of both principles of action is the way to a safe, convenient and effective long term flea control. Dryden MW (1993): Biology of fleas of dogs and cats. Compend. Contin. Educ. Pract. Vet., 15 (4), 569-579; Rothschild M (1965): Fleas. – Scientific American, 213 (6), 44-53; Meola RW, Ready S & Meola SM (1993): Physiological effects of the juvenoid pyriproxyfen on adults, eggs and larvae of the cat flea. Proc. 1. Int. Conf. Ins. Pests in the Urban Environment, Cambridge UK, 30.06-03.07.93, 221-228.

[4007] DENSITY-DEPENDENT FLUCTUATIONS IN THE ANNUAL NUMBER OF NESTS OF THE HORNET *VESPA SIMILLIMA* DESTROYED IN AN URBAN AREA IN JAPAN

S. Makino, Insect Taxonomy and Ecology Lab., Forestry and Forest Products Research Inst., Kukizaki-machi, Ibaraki Pref., 305-8687, Japan, E-mail makino@ffpri.affrc.go.jp

It has long been noticed that abundance of vespine wasps greatly fluctuates from year to year. Some European and North American authors have noted the presence of "wasp years" when nests and/or flying adults of vespines are extremely abundant than normal years. However, long-term records of wasp abundance necessary to quantitatively analyze yearly fluctuations are very few in number. In Japan, vespine nests in residential or urban areas have become problems for these few decades because of accidental stings to humans. Then some local authorities have destroyed nests when requested by residents. The long-term records of the destroyed nests potentially provide us with fine data sets to examine the way vespine populations change through a long time. Unfortunately, many records of nest destruction do not separate the species, only showing the total number of vespine nests. Because populations of different species can vary in different ways, we need long-term records of single species. In this respect, a 25-year record of the number of nests of the hornet *Vespa simillima* destroyed in Otaru, a city in northern Japan, is of great value. *V. simillima* is one of the commonest vespine species in Japan, and has been increasing in number in some localities, especially in urban to subruban areas. The Otaru Public Health Center has been responsible for nest destruction since eary 1970's. Using two computer intensive methods to detect density dependence, we found that the change in the annual number of destroyed nests was not random but density-dependent. A correlogram analysis showed no clear cycles in the change unlike a few *Vespula* species in Europe or North America which have been reported to have 2-year cycles, although dumping 3- or 4- year cycles were suggested.

Index terms: eusocial wasp, population dynamics, cyclicity, vespine wasp, colony destruction

[4008] EFFICACY OF DIATOMACEOUS EARTHS AND HEAT TO CONTROL INSECT PESTS IN FLOUR MILLS

P. G. Fields.

ABSTRACT NOT RECEIVED

[4009] COMPARISON OF SOME DIATOMACEOUS EARTHS FOR INSECT PEST CONTROL IN STORED PRODUCT PROTECTION

Ch. Reichmuth, Federal Biological Research Centre for Agriculture and Forestry, Inst. for Stored Product Protection, Koenigin-Luise-Straße 19, 14195 Berlin, Germany, Email: c.reichmuth@bba.de

Inert dusts like ashes, oxides of metals and silica have been objects for the protection of harvested products for thousands of years. In the beginning of last century ZACHER investigated for the first time these alternative chemicals in detail. Modern methods of modifying these dusts into substances without pronounced human toxicological relevance and the public pressure on contact insecticides like organo phosphates, carbamates and pyrethroids have supported the trend for inert dusts as alternative insecticides. Meanwhile, several preparations are registered for this purpose and sold in various countries. The efficacy varies strongly as KORUNIC described in his paper on diatomaceous earths (DEs). The geographic place of origin, where the earth was found, and the added content of synthetic silica determines the degree of hydrophobic property, efficacy and also the price of the DE product. The sorption of parts of the epicuticle of the insects leads to severe losses of water and causes death within few days. Older larvae, immobile stages like pupae and hidden stages of insects developing within grains, are protected from these dusts. German (Silico Sec, Home Shield, Fossil Shield) and Australian (Dryacide) products were investigated. 4g/m² seem to be sufficient to protect grain surfaces from insect infestation and invasion. Even 2 g/t of all of the tested DEs did not achieve to suppress egg laying of the parental generation and surviving of the next generation of the granary weevil *Sitophilus granarius* in laboratory experiments with wheat of 14.5%mc at 25°C. At 11-12%mc the parents died much quicker but still progeny appeared later.

A severe problem for the introduction of these dusts into cereal grain protection is the change of quality properties like colour, flowability and hectolitre weight. For the grain traders, these substances fall under foreign material in grain which must not exceed certain percentage values. The grey colour is masking fungi and prevents inspection for good quality grain.

Korunic, Z. (1997): Rapid assessment of the insecticidal value of diatomaceous earths without conducting bioassays. Journal of Stored Products Research 33, 219-229.

[4010] DIATOMACEOUS EARTH TO CONTROL STORED-GRAIN INSECTS.

P. G. Fields[1] & Z. Korunic[2], [1]Cereal Research Centre, Agriculture and Agri-Food Canada, 195 Dafoe Rd. Winnipeg, MB, Canada, R3T 2M9, E-mail: pfields@em.agr.ca; [2]Hedley Technologies Inc., 14 Grenwich Dr., Guelph, ON, Canada, N1H 8B8, E-Mail: hedzk@attglobal.net.

There has been an increased interest in using diatomaceous earth on stored grain as an alternative to synthetic residual insecticides because of concerns with insecticide residues in grain, worker safety and resistant insect populations. DE is now registered as a grain protectant or for structural treatment in Australia, Canada, China, Croatia, Germany, USA and other Asian countries. The mode of action of DE is different from the synthetic insecticides used in grain. DE absorbs the insect's cuticular waxes, and insects die from dessication. The main advantages of using DE are its low mammalian toxicity and its stability. The main limitations are: reduction of the bulk density and flowablity of grain, dusty to apply, low efficacy against some insects and reduction in efficacy at high moisture contents. There can be a 20-fold difference in insecticidal activity between DEs of different geological sources. The commodity treated can also is a factor in determining the concentrations of DE required to obtain control, in decreasing order for the amount of diatomaceous earth needed to obtain control: milled rice < sunflower < maize< paddy rice < oats < barley < wheat < durum. Also different insects have different susceptibilties to DE: the most to the least susceptible being: *Cryptolestes* spp.,> *Oryzaephilus* spp.> *Sitophilus* spp.> *Rhyzopertha dominica* (F.) and *Tribolium* spp (Table 1). DE has been combined with other treatments: heat, cold and phosphine fumigation to control stored-product insect infestations in bulk grain and in food processing facilities. Resistance to insecticides is a major problem in the management of stored-product insects. Laboratory selection experiments with DE have shown that stored-product insect populations increase their tolerance to DE when exposed to DE for several generations.
Index terms: *Sitophilus, Tribolium, Rhyzopertha*, DE, dessication

[4011] THE USE OF DIATOMACEOUS EARTH TO CONTROL INSECTS IN CORN STORED IN THE COB

P.R.V.S. Pereira[1] & F.A. Lazzari[2], [1] Depto de Fitotecnia e Fitossanidade, Univ. Est. de Ponta Grossa, Caixa Postal 992, 84100-970, Ponta Grossa, PR, e-mail: prvalle@netpar.com.br; [2] Depto de Zoologia, Univ. Fed. do Paraná, Caixa Postal 19020, 81531-970, Curitiba, PR.

The highest losses in stored corn occur when corn is stored in the cob in small farms. These losses are consequence of the low level of storage techniques and the inadequate control of insects. The increase in insect population is mainly attributed to the inadequate storage conditions. The insecticidal effect of inert dusts has been known and practiced by several communities for a long time, representing a secure and efficient alternative to control several stored-product insect species. The objective of this work was to test diatomaceous earth doses to reduce the percentage of grain damaged by insects, at small farm level. Eight doses were tested on cobs well covered, poorly covered by the husk and without husk, during 420 days. The results showed that the treatments of 1750 g/t and 2000 g/t were efficient in the three categories tested. However, the husk limited the action of the diatomaceous earth on insects that were previously infesting the corn. By the other hand, a higher grain protection was achieved by higher doses until the end of the storage period. This information is important to consider the use of diatomaceous earth to control insects in corn stored in small farms as a simple and useful technique.
Index terms: Physical control, stored products insects, diatomaceous earth

[4012] RADIATION DISINFESTATION OF GRAIN AND OTHER STORED PRODUCTS AS A TECHNOLOGY FOR METHYL BROMIDE SUBSTITUTION

S. Ignatowicz, Warsaw Agricultural University, Department of Applied Entomology, 166, Nowoursynowska St., 02-787 Warsaw, Poland.

Fumigation is a common disinfestation treatment but it does not on its own guarantee that products are free from insect and mite pests without leaving residues. However, fumigation is becoming threatened. A wide range of chemicals were available as fumigants for agricultural commodities in the 70s and 80s. Now, only phosphine (PH_3) and methyl bromide (MB) remain in widespread use. MB will be banned in most countries by 2010. The impending loss of MB as a fumigant has caused increased interest in radiation disinfestation of grain and other stored products. According to data of our studies, the general deteriorative effects of radiation on insects and mites are: lethality, „knock-down" (apparent lethality, followed by recovery), reduced longevity, delayed molting, sterility, reduction of egg hatch, delay of development, reduction of food consumption, respiration inhibition and locomotor inhibition. These effects occur at certain dose levels. Application of ionizing radiation to insect control problems appears promising in two ways: radiation can be applied in doses lethal to the population, or in doses which sterilize the irradiated pests. However, a long period between irradiation and death of insects
and mites is characteristic at low and moderate doses. Very high levels of radiation (>3 kGy) are required for immediate mortality, and ca. 2 kGy dose is required for 24-hour mortality. Sterility in stored product pests is induced by doses that are much lower than those required for quick mortality. Most insects and mites require a sterilizing dose of 0.3 kGy of gamma radiation, which is also suggested to provide quarantine security against all stages of quarantine pests. Sterility as an end point can be the consequence of inability to mate, aspermia, sperm inactivation, infecundity or dominant lethality. Large quantities of grain had been irradiated in Odessa, Ukraine. In the nearest future, the increase of the amount of irradiated agricultural products will be observed. The reasons for the increase include the clearance for consumption of many irradiated foodstuffs by over 40 countries, and the acceptance of food irradiation as a safe process by a Joint Expert Committee of the World Health Organization and the Food and Agriculture Organization.
Index terms: Irradiation, stored product pests, agricultural products.

[4013] EVALUATION OF GAMMA RADIATION (COBALT 60) ABOUT THE ARCELIN PROTEIN AND ITS INFLUENCE ON RESISTANCE TO BEAN WEEVIL

A. C. G. Botelho[1], B. F. Amaral Filho[2] & V. Arthur[3], [1]Dept° de Entomologia, FFCL/USP, Av. Dos Bandeirantes, 3900, CEP 14040-901, Ribeirão Preto, SP, Bolsista do CNPQ. E-mail: anabotelho@zipmail.com.br. [2]Dept° de Zoologia, UNICAMP, [3]Seção de Entomologia, CENA/USP, CP 96, CEP 13400-970, Piracicaba, SP. E-mail: vaarthur@pira.cena.usp.br.

The culture of *Phaseolus vulgaris L.* is attacked by many plagues, from the plantation to the storage. Among these we can distinguish the bean weevil *Acanthoscelides obtectus*, that has the capacity of attacking the grains either on the field and in storage. The present work has the objective of evaluating the effect of different doses of gamma radiation over the arcelin protein in the manifestation of resistance to this insect through confinement tests. The tests are being held in a climatized room inside the "Insect raising lab", Zoology Department, Unicamp, Campinas/SP. As an experimental essay, 25 seeds of four types of *P.vulgaris* (arcelin-1, arcelin-2, arcelin-3 and arcelin-4) where put inside glass bottles with cover type punched thread, where a steel screen of fine mesh was adapted to allow gas exchanges. Each type of seed received three doses of gamma radiation of Cobalt 60, plus the witness (dose 0); 0,5; 1,0 and 2,0 kGy. In each parcel there was the liberation of 10 insects randomly, which kept laying their eggs for 7 days. There are being analyzed the total number of eggs, number and weight of the emerged insects, evolutive cycle of egg to an adult, the insect life span, weight of the grains consumed by each insect and intensity of infestation. Until the present moment, conclusions have been made that the types arcelin-1 and 2 were the most resistant to "the plague", despite of the dose of radiation utilized. New tests are being held to confirm the obtained information in this previous experiment, though, with 5 repetitions to each type and dosage , in a total of 80 samples.
Index terms: Acanthoscelides obtectus, Phaseolus vulgaris, irradiation, stored grains.

[4014] FECUNDITY AND HOST FINDING ABILITY OF *LARIOPHAGUS DISTINGUENDUS* (HYMENOPTERA: PTEROMALIDAE), A POTENTIAL CANDIDATE TO CONTROL THE GRANARY WEEVIL *SITOPHILUS GRANARIUS* (COLEOPTERA: CURCULIONIDAE)

J. L. M. Steidle[1] & M. Schoeller[2], [1]FU Berlin, Inst. f. Biologie, Angew. Zoologie / Ökol. d. Tiere, Haderslebenerstr. 9, 12163 Berlin, Germany, E-mail steidle@zedat.fu-berlin.de; [2]Biologische Beratung BIp, Hosemannstr. 8, 10409 Berlin, Germany, E-mail bip@biologische-beratung.de

Fecundity and host finding ability in storage facilities were examined for *Lariophagus distinguendus* (Förster), a parasitoid of stored product pest beetles including the granary weevil, *Sitophilus granarius* (L.). A literature survey and own studies revealed that fecundity varies considerably with respect to host, rearing conditions, and geographical origin of the parasitoids. Host finding ability was examined in a silo-bin (20.5 t wheat grain), and a flat storage grain box (3,000 t rye). The number of hosts found by the parasitoids decreased with increasing distance from the release point. In the silo-bin and the commercial grain store, parasitoids were able to find and parasitize hosts located up to 4 m vertically and horizontally from the release point. The following may be deduced from our studies: (1) Different strains of *L. distinguendus* should be examined to identify those with the highest fecundity on the pest species in focus. (2) At a range of 4 m, a loss of about 75% of the parasitoids has to be taken into account (Fig. 1). (3) Release points on the grain surface should be no more than 4 m apart from each other. More information is needed, however, to develop the application for biological control of weevils.
Index terms: *Lariophagus distinguendus*, *Sitophilus granarius*, biological control, stored grain, host finding, fecundity

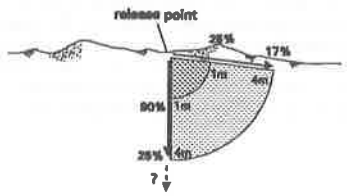


Fig. 1: Potential range of *L. distinguendus* in bulk grain

[4015] A SIMULATION MODEL FOR *LYCTOCORIS CAMPESTRIS*, A PREDATOR OF STORED-PRODUCT INSECT PESTS

J. E. Throne[1], M. N. Parajulee[2] & T. W. Phillips[3], [1]USDA-ARS Grain Marketing and Production Research Center, 1515 College Ave., Manhattan, KS 66502, USA, E-mail throne@usgmrl.ksu.edu; [2]Texas Agricultural Experiment Station, 11708 Highway 70 South, P. O. Box 1658, Vernon TX 76385, USA, E-mail megha@tamu.edu; [3]Oklahoma State University, Department of Entomology and Plant Pathology, 127 Noble Research Center, Stillwater OK 74078-0464, USA, E-mail tomp@okway.okstate.edu.

Insects cause millions of dollars of damage to stored grain and other stored products each year. New methods for controlling these pests must be developed because these insects are developing resistance to and regulatory restrictions are limiting the use of many of the currently used insecticides. A predator, the larger pirate bug, *Lyctocoris campestris* (Heteroptera: Anthocoridae), is a candidate for biological control of stored-product insect pests. We developed and validated a computer model for simulating the population dynamics of the larger pirate bug using data from the literature and newly collected data for adult longevity and fecundity. Immature development time and survival, adult longevity, fecundity, and cannibalism were simulated. The model was validated at ambient environmental conditions in a screened shed during three seasons in Wisconsin, USA. The model accurately simulated development of the larger pirate bug feeding on larvae of the Indianmeal moth, *Plodia interpunctella* (Lepidoptera: Pyralidae), in the validation studies. The model will be useful for optimizing mass rearing and augmentative releases of this predator for biological control of stored-product insect pests.
Index terms: biological control, bionomics, larger pirate bug, life history, validation

[4016] ENHANCING THE BIOCONTROL OF BRUCHIDS INFESTING STORED LEGUMES THROUGH THE COMBINED APPLICATION OF A PREDATORY BUG AND LARVAL PARASITOIDS

S. E. Sing[1], R. T. Arbogast[2] & D. K. Weaver[3], [1]Dept. of Land Resources & Environmental Sciences, Montana State Univ., Bozeman, MT 59717 USA E-mail sing@montana.edu; [2]Center for Medical, Agricultural and Veterinary Entomology, USDA-ARS, 1600/1700 SW 23rd Dr., Gainesville, FL 32608 USA; [3]Dept. of Entomology, Montana State Univ., Bozeman, MT 59717 USA.

Biological control of pest Bruchidae may provide an important management strategy against infestation of stored grain legumes, a key source of dietary protein throughout much of the world. The anthocorid, *Xylocoris flavipes*, exhibited a Type II density dependent functional response to five species of adult bruchids. The rate of kill of these larger prey was low but consistent. The larger female predators were more effective than males on adult bruchids. Of the species studied, only the eggs and neonate larvae of *Acanthoscelides obtectus* were accessible and predation on these stages was high. Population interaction studies evaluating predator density and time of introduction into infested commodity indicated that timing of predator introduction was more important than predator density for bruchid suppression. The levels of suppression achieved by *X. flavipes* were much higher than anticipated given the results of the functional response experiments. *A. obtectus* was almost entirely inhibited by the predator alone. The more fecund bruchid species with inaccessible immature stages continued to produce a large number of progeny. Combining the predator with larval parasitoids capable of utilizing the internally-developing stages of the bruchids enhanced suppression over that achieved by the predator alone. For the more fecund bruchid species suppression by the predator and parasitoids combined was greater than for the parasitoids alone.
Index terms: Biological control, *Xylocoris flavipes*, parasitic Hymenoptera, Bruchidae, stored-products.

[4017] BIOLOGICAL CONTROL OF *EPHESTIA ELUTELLA* IN BULK GRAIN

M. Schöller[1] & C. Reichmuth[2], [1]Biological Consulting, Berlin, Germany, bip@biologische-beratung.de [2]BBA, Institute for Stored-product Protection, Berlin, Germany, c.reichmuth@bba.de

The parasitoid wasps *Trichogramma evanescens* and *Habrobracon hebetor* were evaluated for the biological control of the warehouse moth *Ephestia elutella*. A combination of laboratory trials on the penetration ability and semi-field trials in a commercial warehouse under practical conditions of storage was realized. The impact of the parasitoid wasps on the development of the moths was studied in $1m^3$ experimental cages in bulk rye. The release of *T. evanescens* reduced the population of *E. elutella* by a mean ± SE of 31.4 ± 6.7 % compared to the untreated control. *H. hebetor* reduced the larvae by 34.3 ± 3.3%, and 84.6 ± 2.3% at a female parasitoid : host ratio of 1 : 5 and 1 : 1, respectively. In laboratory studies, the penetration ability of *T. evanescens* and *H. hebetor* in bulk grain was studied. The impact of grain dust on the host-finding of *T. evanescens* was shown.
index terms: *Trichogramma evanescens*, *Habrobracon hebetor*, stored products

[4018] ANALYSING THE IMPACT OF *TERETRIUS NIGRESCENS* ON *PROSTEPHANUS TRUNCATUS* IN MAIZE STORES IN WEST AFRICA

N. Holst[1], W. G. Meikle[2], C. Nansen[2] & R. H. Markham[2], [1]Danish Inst. of Agricultural Sciences, Flakkebjerg, 4200 Slagelse, Denmark, E-mail niels.holst@agrsci.dk; [2]International Inst. of Tropical Agriculture, 08 B. P. 0932 Tri-postal, Cotonou, Benin.

Since its accidental introduction into East and West Africa in the early 1980's the larger grain borer, *Prostephanus truncatus* (Col.: Bostrichidae), has been expanding its geographical range and is rapidly becoming the most serious pest on stored maize and cassava in the whole sub-Saharan region. In its wake, scientists and extension officers have been releasing the predator *Teretrius* (*Teretriosoma*) *nigrescens* (Col.: Histeridae) as a means of biological control. Based on results obtained in the early 1990's in the initial area of release in Togo and Benin, *T. nigrescens* has been described as a successful case of classical biological control. In this presentation we re-evaluate the impact of *T. nigrescens* based on current research on stored maize in Benin. We present results from maize store surveys, trapping networks, natural habitat studies, and pest and predator population dynamics studies. Simulation modelling was used as a tool to gain an understanding of the underlying biological processes and to generate scenarios of potential biocontrol strategies. The surveys showed that *P. truncatus* still causes regular outbreaks and as a consequence farmers still suffer severe losses to *P. truncatus*, although at a lower rate than before. Hence the introduction of *T. nigrescens* to Africa is not a good example of successful, classical biological control. Simulation modelling supported these findings, demonstrating that the life table characteristics of predator and prey is such that *T. nigrescens* density is unlikely to be high enough to prevent an outbreak of *P. truncatus* from building up in a store. *T. nigrescens* has been shown to lower the overall density of *P. truncatus* after its introduction to a new region, yet farmers are in need for effective control measures against pest outbreaks in their stores. Since *T. nigrescens* is apparently regulating the pest regionally, rather than controlling it locally, it lends itself easily to integration with control options, such as resistant cultivars, entomopathogens, and rational use of botanical and traditional pesticides.
Index terms: Biological control, integrated pest management, simulation modelling, pheromone traps

[4019] BIOLOGICAL CONTROL OF STORED GRAIN INSECTS DEMONSTRATED BY TIME-SERIES ANALYSIS

E. P. Wileyto, School of Veterinary Medicine, University of Pennsylvania, New Bolton Center, 382 W. Street Rd., Kennett Square, PA 19348 USA.

This paper reports results from a large-scale test of biological control in stored corn. Pest insects were introduced into 6 1000 bushel grain bins filled with stored corn in the fall of 1993, including the angoumois grain *Sitotroga cerealella*. Parasites were introduced into the grain bins the following winter, including the Angoumois parasite *Pteromalus cerealellae* and populations were monitored for the spring and summer of 1994. The pest Angoumois grain moth was monitored by recapture methods, allowing for reporting of either trap catch or estimated population. Dynamics within the bin were correlated, requiring the use of time-series or repeated measures techniques. Populations were significantly reduced when observing population estimates. The difference could not be seen using raw trap catch numbers.

[4020] NEAR-INFRARED SPECTROSCOPY APPLIED TO DETECTING PARASITOIDS AND HIDDEN INSECT LARVAE, IDENTIFYING COLEOPTERA, AND CHRONOLOGICAL AGE-GRADING

F. E. Dowell[1], J. E. Throne[1], A. B. Broce[2], R. A. Wirtz[3], J. Perez[1] & J. E. Baker[1], [1]USDA ARS Grain Marketing and Production Res. Center, 1515 College Ave., Manhattan, KS 66502, USA, E-mail fdowell@usgmrl.ksu.edu; [2]Dept. of Entomol., Kansas State Univ., Manhattan, KS 66506; [3]Entomol. Branch, Division of Parasitic Diseases, Centers for Disease Control and Prevention, Atlanta, GA 30341.

Near-infrared spectroscopy (NIRS) was used to detect parasitoids in insect-infested wheat kernels or parasitoids in house fly puparia, to detect hidden insects in grain, to identify stored-grain Coleoptera, and to age-grade Diptera. In tests to detect parasitized rice weevils, *Sitophilus oryzae* (L.), in wheat kernels, individual kernels containing immature rice weevils parasitized by *Anisopteromalus calandrae* could be separated from uninfested kernels and kernels that contained unparasitized weevils by using NIRS. When detecting viable parasitoids of the house fly, *Musca domestica* L., results showed that 80-90% of puparia containing parasitoids could be identified correctly. Detection of viable hymenopterous parasitoids within puparia could assist insectaries in delivering known quantities of parasitized puparia for use in biological control of pests and in rapidly determining levels of parasitization in the field. In tests to determine if NIRS could detect internally infested kernels, we collected spectra from single kernels infested with the rice weevil, the lesser grain borer, *Rhyzopertha dominica* (F.), and the Angoumois grain moth, *Sitotroga cerealella* (Olivier). For all 3 species, we were able to differentiate uninfested kernels from infested kernels. Larval size was a factor in the sensitivity of the system, with 3rd and 4th instar rice weevil larvae being detected with 95% confidence. This rapid, non-destructive system could be incorporated into the current grain inspection process and provide the grain industry with quantitative data on internal insect infestations. In tests using NIRS to identify insect species, we collected spectra from 11 species of stored-grain insects. We correctly identified >99% of insects as primary or secondary pests and correctly identified >95% of insects to genus. Evidence indicates that absorption characteristics of cuticular lipids may contribute to the classification of these species. To determine if NIRS could be used to determine the chronological age of insects, we collected spectra from house flies, *M. domestica*, stable flies, *Stomoxys calcitrans* (L.), and face flies, *Musca autumnalis* De Geer. Young and old age groups could readily be differentiated based on differences in their NIR absorption spectra. Accuracy of age classification rates were similar when analyzing NIR spectra obtained from whole flies, fresh heads, dried heads, or ethanol preserved heads. This NIRS procedure is simpler and faster than determining chronological age by measuring pterin levels.
Index terms: beetles, taxonomy, flies, biological control, wheat

[4021] TRICHOGRAMmA AND PARAsITIC MITE AS POTENTIAL AGENTS FOR STORED GRAIN INSECT CONTROL IN BRAZIL

J. P. Santos[1] and L. R. D'A. Faroni[2], [1]Embrapa Milho e Sorgo, C. Postal 151, 35701-970, Sete Lagoas, MG, Brazil, E-mail: jamilton@cnpms.embrapa.br; [2]Departamento de Engenharia Agrícola, U.F.V., Viçosa, MG, 36571-000. Brazil.

Maize and wheat are two very important cereals grown in Brazil. The annual production is around 36 and 3.5 million tons of maize and wheat, respectively. Maize, is stored under a wide range of technology. At least 40% of the maize production is stored on the husk by the small farmers, in well ventilated wood or wired screen made bins under very natural conditions, i.e., without the use of any insect control method. Consequently, the quantitative grain loss caused by insect is about 15% of the maize stored on the husk. Fumigation with phosphine and application of deltamethrin 0.2% dust are very efficient methods to control insects and preserve grain quality. However, it might not be safe to let farmers with low level of technology to manipulate phosphine tablets or contact insecticide. Therefore, some alternative insect control methods such as natural products from Eucaliptus tree leaves and biological control have been tested. *Sitophilus zeamais* and *Sitotroga cerealella* are the two most important pests of maize grain. For the first insect the *Anisopteromalus calandre* have been tested, although with some difficulties to obtain this parasitoid in large number for a field test. For the second some different species of Trichogramma have been tested on a large scale bin storage, since raising large amount of this parasitoid in not difficult. To raise Trichogramma is more productive to use eggs of *Anagasta kueniella* than *Sitotroga cerealela*. The species *Trichogramma atopovirilia* was more efficient parasitism of eggs than the *Trichogramma pretiosum*, in the laboratory. To control *Sitotroga cerealella* infestation in maize stored in wood bins, the more efficient procedure was to release newly emerged adults late in the afternoon. The release of parasitised eggs was not successful due to intense predation by ants. The efficacy of biological control method using Trichogramma was equivalent to the use of malathion or biphenthrin dust, and it was observed significantly less damage than in the control test. For the control of *Rhyzopertha dominica* in wheat grain the parasitic mite species *Acarophenax lacunatus* has shown great ability to suppress eggs, first instar larvae and adults. Mite densities of at least four individuals per 500 mL jar full of grains containing 50 adults of *R. dominica*, resulted in almost complete suppression of eggs, first instar larvae and adults after 45 days. This same range of mite densities led to reductions of wheat grain loss of 15 and 25% after 45 and 60 days, respectively.
Index terms: Biological control, *Sitophilus zeamais*, *Sitotroga cerealella*, *Rhyzopertha dominica*, parasitoids

[4022] JUVENOGENS - INSECT HORMONOGENIC COMPOUNDS

Z. Wimmer[1], J. Kuldova[1], L Hrdy[1], B. Bennettova[2] & M. Wimmerova[1], [1]Institute of Organic Chemistry and Biochemistry AS CR, Flemingovo namesti 2, CZ-16610 Prague 6, Czech Republic. E-mail hrdy@uochb.cas.cz; [2]Institute of Entomology AS CR, Branisovska 31, CZ-37005 Ceske Budejovice, Czech Republic. This research was funded through the project COST D10/0005/98 (D10.10) by the Ministry of Education of the Czech Republic, and through the project GACR 522/97/0126 by the Grant Agency of the Czech Republic.

Fatty acid esters represent a series of compounds present naturally in insect organism. The esters are naturally metabolized by the enzymatic system of insects. This mechanism has been taken as a basis of designing and developing of a series of hormonogen acid esters (juvenogens) derived from a series of insect juvenile hormone mimics. It has been generally supposed that a biologically active insect juvenile hormone mimic is liberated within the insect body during the introductory step(s) of the metabolic process. A series of 8 new juvenogens has been prepared, derived from the *cis*- and the *trans*-isomer of ethyl N-{2-{4-[(2-hydroxycyklohexyl)methyl]phenoxy}ethyl} carbamate, respectively, and from several organic (fatty) acids. The biological activity of the prepared juvenogens was tested on the blowfly *Neobellieria (Sarcophaga) bullata*, and on the moist-wood subterranean termite *Prorhinotermes simplex*. Blowfly: Adults were treated by the juvenogens to study the effect of these compounds on their reproduction. Differences in the activity values of the studied compounds were observed. Termite: When compared with methoprene, which was almost inactive at the given concentrations, the new compounds showed high biological activity at a 500 ppm treatment, causing a differentiation of a large proportion (39 - 94 %) of surviving pseudergates into soldiers in the force-feeding bioassay. The compounds are not toxic. An increased mortality, observed only exceptionally, occurred due to disorders during ecdysis. Three juvenogens displayed high efficacy and a low feeding deterrence, or even feeding stimulation in the choice bioassay. This is an important finding because of a potential application of these compounds in baits for the termite control.

Index terms: *Neobellieria (Sarcophaga) bullata*, *Prorhinotermes simplex*, juvenogen, juvenilizing effect, feeding stimulation, effect on reproduction

[4023] THE EFFICACY OF THE INSECT GROWTH REGULATOR, FLUFENOXURON, FOR THE CONTROL OF MITE AND INSECT PESTS IN STORED GRAIN

D. A. Collins, D. A. Cook, & A. Buckland, Central Science Laboratory, Sand Hutton, York, YO41 1LZ, U.K.

Alternatives to the use of organophosphorus compounds for the protection of stored grain against mite infestations were investigated. Preliminary experiments found the chitin synthesis inhibitor, flufenoxuron, to be effective at inhibiting populations of organophosphorus-susceptible strains of *Acarus siro*, *Lepidoglyphus destructor* and *Tyrophagus putrescentiae* on wheat stored at 15°C and 75% relative humidity (r.h.). Further experiments assessed the efficacy of a suspension concentrate formulation of flufenoxuron against susceptible and resistant strains of the mites and also against *Sitophilus granarius*, *Oryzaephilus surinamensis* and *Rhyzopertha dominica*, on wheat stored at 10°C and 25°C at 75% r.h., 1 day, 4 weeks and 12 weeks after treatment. Doses of 2, 1, 0.5 and 0.1 mg kg $^{-1}$ were applied. Mite population inhibition was assessed after periods long enough to include the passing of at least one generation. Insect adult mortality was assessed after 7 days with population inhibition assessed on wheat stored at 25°C. Against the mite species the compound appeared most effective against *L. destructor*. At 25°C, both strains were inhibited by >95% at 0.5, 1 and 2 mg kg $^{-1}$, whereas against *A. siro* and *T. putrescentiae* the highest dose inhibited the populations by approximately 88% and 66% respectively. At 10°C, both strains of *L. destructor* were inhibited by >91% following exposure to all doses throughout the experiment. With *A. siro*, >85% mean inhibition was recorded against the susceptible strain after exposure to 0.5, 1 and 2 mg kg $^{-1}$ at 1 day and 4 weeks, whereas against the resistant strain, the population was inhibited by >73% and 84% at the respective times after treatment. Low adult insect mortality (<14%) was recorded after 7 days exposure throughout the experiment on wheat stored at both temperatures. At 0.5, 1 and 2 mg kg $^{-1}$ the populations of both strains of *O. surinamensis* and *R. dominica* were inhibited by between 92-100% and 80-90% respectively. With *S. granarius*, the highest mean inhibition of approximately 50% was recorded against the resistant strain when exposed to 2 mg kg $^{-1}$, although the inhibition ranges were seen to overlap between all the doses. In conclusion, a minimum dose of 0.5 mg kg $^{-1}$ was seen to be effective against most of the pest populations. The results indicate the potential of flufenoxuron as a grain protectant and further work may prove it to be effective when applied as a surface treatment as part of an integrated management program.

Index terms : *Acarus siro, Lepidoglyphus destructor, Tyrophagus putrescentiae, Sitophilus granarius, Oryzaephilus surinamensis, Rhyzopertha dominica*

[4024] PROBLEMS ASSOCIATED WITH USE OF INSECT PHEROMONES IN INTEGRATED PEST MANAGEMENT OF STORED PRODUCTS

P. Trematerra[1], [1]Department of Animal, Plant and Environmental Science, University of Molise, Via De Sanctis, I-86100 Campobasso, Italy, E-mail: trema@hpsrv.unimol.it.

In recent years, considerable progress has been made in monitoring and control of stored-product insects by using mass trapping, mating disruption and attracticide methods. In spite of these achievements, progress in the application of pheromones has been rather slow, and technology is still in its infancy. Different tolerance thresholds should be established for the various groups of insects depending on their economic impact and on where they are found. If a limited number of insects can be tolerated at times in a storehouse containing raw materials, in food-processing plants and storehouses containing finished products the threshold must necessarily be zero. Pheromones, and indeed all semiochemicals, will play a major role in future Integrated Pest Management programs than they do at present. However, we must obtain a sound ecological understanding to accompany the advances in the fields of chemistry, biochemistry, physiology and genetics. Semiochemicals are shadowed with the expectations asked of conventional pest control materials. These products need to compete with chemicals in registration requirements, efficacy standards, cost structure and ease of application. Industrial standards are needed to assure quality control of pheromones in pest management. Dispensers can be characterized by release rates of active ingredients as a function of temperature and other environmental conditions, as well as by the change of these release characteristics as a function of time. Lures presently on the market are found to vary greatly in efficacy, mostly due to varying degree of purity of the starting materials. In order to assure a continuous supply of lures of comparable quality and to allow comparisons between lures of different origin Arn et al. (1997) propose to adopt the procedure of batch certification. It consists of two principles: any chemical or blend prepared for insect monitoring is given a batch number which is carried over to all dispensers made from it; each batch is field-tested by experts and the results made publicly available.

Index terms: Monitoring, control, lures.

[4025] DETECTION OF STORED PRODUCT PEST INSECT

J. Wright.

ABSTRACT NOT RECEIVED

[4026] BAITING TECHNOLOGY FOR CONTROLLING SUBTERRANEAN TERMITES IN URBAN ENVIRONMENT

S. T. Kamble, Dept. of Entomology, Univ. of Nebraska, Lincoln, NE 68583-0816, USA, Email: skamble@unlnotes.unl.edu

With the advent of insecticides to control subterranean termites, the conventional treatment have been the creation of continuous insecticide barriers during and after the building construction. The reliance on insecticides (termiticides) and the resulting risks in certain sensitive environments, have proliferated interest in alternative technology. Baiting is not a new concept and it has been researched for many years. However, due to the increased awareness of soil and environmental contamination, there has been renewed interest in baiting technology. Termites are social insects and the colony members constantly groom each other. The concept of grooming behavior has been explored for selection of specific toxicants that can be spread throughout the colony members. The toxicant must be non-repellent, palatable and slow-acting. The delayed action allows time to transmit the toxicant to other colony members. Moreover, the bait must be attractive enough to ensure that termites prefer it, in spite of other competing food sources. Based on this concept, a hypothesis was evolved that all colony members will receive enough toxic dose to die. Currently available, four baits are: Sentricon®, Firstline®, Exterra® and Spectracide Terminate®. The Sentricon® Colony Elimination System is manufactured by Dow AgroSciences and the active ingredient is hexaflumuron at 0.1-0.5%. Sentricon system requires: 1) initial monitoring or detection of termite activity, 2) delivery of bait toxicant, and 3) follow-up monitoring for assuring of no further termite activity. It requires special training to use the Sentricon and it is available only to selected commercial structural pest control operators. Firstline® Termite Baiting Systems is developed by the FMC Corp. and the active ingredient is 100 ppm sulfluramid (metabolic inhibitor). The Firstline is marketed to PCOs as GT (below ground) and AG (above ground) bait stations. The sulfluramid is a slow-acting, stomach poison interfering with termite metabolic process. According to FMC corp., Firstline bait is one of the components of Systematic Termite Control program that includes inspection, moisture management, food source management, and selective use of liquid termiticides. Exterra®, Termite Control System is marketed by the Ensystex Inc. as Labyrinth and active ingredient is diflubenzuron (chitin synthesis inhibitor). Not enough research data are available to document the field performance of Labyrinth to control subterranean termites. The Spectracide Terminate®, Termite Home Defense System is sold through the local discount stores to homeowners. The active ingredient is sulfluramid. It is a Do-It-Yourself Bait system and not enough data are available on field performance of this product.

Index terms: Subterranean termite, bait, hexaflumuron, sulfluramid, diflubenzuron.

[4027] INTRODUCTION TO SESSION 23, SYMPOSIUM 6, FUMIGATION MODIFIED ATMOSPHERES FOR URBAN USE AND STORED PRODUCT PROTECTION

K.A. Mills, Central Science Laboratory (CSL), Sand Hutton, York, YO41 1LZ, United Kingdom. E-mail: k.mills@csl.gov.uk.

Those who are involved in the uses of gases as a means of disinfestation for stored products, both researchers, managers and practical operatives, live in interesting times. An old technology continues to challenge us. The unavoidable big issue still is the loss of methyl bromide and the associated costs. This will occur for most uses in the developed countries by 2005 and in the developing countries by 2015 though many, e.g. Brazil, are aiming for a much earlier phaseout. There is a consensus that phosphine is the most likely replacement fumigant in many situations. In many developing countries, there is already a phosphine resistance problem and this is likely to become worse as the use increases. There is also evidence that resistant strains now occur in developed counties either through trade or local practice. This problem requires serious thought and attention with the need for good efficacy training to be recognised by governments and NGOs. Locally, managers must be made aware of the need to maintain the strictest adherence to sealing standards and dosage schedules. Resistance will necessitate longer exposure periods and, in some cases, higher doses. This threat comes at a time when environmental protection agencies are considering actions to limit the use of this important fumigant through regulation. There may be a direct conflict on the horizon for this vitally important fumigant. For some uses of methyl bromide, we have alternatives such as sulphuryl fluoride for space treatments. There continues to be much international interest in the use of modified atmospheres even though for full efficacy and economy they require the most rigorous sealing standards. Phosphine will be the treatment of choice for a considerable time for economic reasons though advances in the production of low oxygen atmospheres are occurring. Already, both carbon dioxide and low oxygen atmospheres have a niche role in the production of 'bio' or completely pesticide-free food, in the conservation of artefacts and specialist public health areas. Cheap sources of carbon dioxide allow its use even in some developing countries for the treatment of some commodities. Predictably, the use of these methods will not increase substantially unless we can modify storages for their use and design build new storages. I am sure that we will continue to respond to the challenges which the pests and the legislators continue to present us with.

Index terms: fumigation, modified atmospheres, regulation, training.

[4028] CAN DERMESTIDS BE CONTROLLED WITH MODIFIED ATMOSPHERES?

A. C. Sá Fischer and Ch. Reichmuth, Federal Biological Research Centre for Agriculture and Forestry, Inst. for Stored Product Protection, Koenigin-Luise-Str. 19, 14195 Berlin, Germany, E-mail: a.c.sa-fischer@bba.de

Dermestids belong to the most important pests on dried products of animal origin like leather, furs, dried meat and fish. Artefacts, insect collections, mummies and other valuable goods in museums become often infested by these pests and are destroyed. In poultry farms, larvae and even the adults occur on chickens, old and weak animals and feedstuff. The long larval hairs break easily and can cause severe allergic effects. Various hypoxic modified atmospheres were tested under laboratory conditions (25-27 °C / 65-70 % r.h.) against adults, pupae and larve of four species of dermestids: the hide beetle *Dermestes maculatus* DE GEER, 1774, the carpet beetle *Anthrenus verbasci* (LINNÉ, 1767), *Trogoderma angustum* (SOLIER, 1849-51) and the cabinet beetle *Attagenus piceus* OLIVIER, 1790. Using an atmosphere of pure nitrogen or pure carbon dioxide, respectively, complete control of all stages in experimental glass bottles could be achieved within 48 h at 25 ° C and 65-70 % r.h.. The same effect was obtained with an atmosphere of 98 vol.-% N_2 and 2 vol.-% O_2.

The exposure in a gas mixture with 40 vol.-% CO_2, 44 vol.-% N_2 and 16 vol.-% O_2 or 60 vol.-% CO_2 in air at 25 °C was sufficient to control all tested stages within 96 h. The application of these atmospheres enables residue free disinfestation of products as well as museum artefacts in a rather short time (25-27 °C). In the latter situation the dry gas can be humidified with destilled water to about 55 % rel. humidity to prevent damage of precious goods.

Index terms: *Dermestes maculatus*, *Anthrenus verbasci*, *Trogoderma angustum*, *Attagenus piceus*, carbon dioxide, nitrogen

[4029] MODIFIED ATMOSPHERES FOR PYRALID MOTH CONTROL AT LOW TEMPERATURES

C. Adler, [1]Federal Biological Research Centre for Agriculture and Forestry, Inst. for Stored Product Protection, Koenigin-Luise-Str. 19, 14195 Berlin, Germany, E-mail: c.adler@bba.de

Modified and controlled atmospheres are an alternative to synthetic, residue building agents in stored product protection. They are safer in use than most other fumigants and could gain importance with the phase out of methyl bromide and stiffer regulations on the emission of toxic agents from a treated structure. Modified atmospheres require highly gas-tight storage structures in order to be economically feasible. In temperate climates modified atmospheres have the additional disadvantage that at temperatures around 20°C or less, treatment times are considerably longer than if a fumigant like phosphine is used. On the other hand, the gas-tightness of a structure may prevent the re-infestation after a treatment, and during the absence of oxygen, product quality remains better than during storage in air. Another difficulty of using fumigants in temperate climates is the fact that with reducing day length and temperature, arthropods may develop overwintering stages that could be more tolerant to a treatment than other individuals. Diapausing larvae of the Indianmeal moth *Plodia interpunctella* were tested for their tolerance to various mixtures of nitrogen, oxygen and carbon dioxide. While normal larvae from a culture at 25°C could be controlled at 10°C within 3 weeks with 60 vol.-% or 90 vol.-% of carbon dioxide in air, diapausing larvae from a culture at 10°C needed 6 or 4 weeks, respectively, for 100 % control. A mixture of 98 % nitrogen and 2 % oxygen controlled normal larvae within 4 weeks and diapausing larvae within 5 weeks of exposure provided they were not older than 6 months. It became clear that the tolerance to this hypoxic atmosphere increased with the duration of diapause. Diapausing larvae kept for more than one year at 10°C were able to survive up to 7 weeks of exposure and developed into adults. After 9 weeks of treatment, 12 larvae were found alive, out of which one larvae was still able to pupate but died subsequently. Thus, diapausing stages of stored product pests may be difficult to control with a CO_2-free modified atmosphere.

Index terms: MA, CA, nitrogen, carbon dioxide, diapause, *Plodia*, stored products.

[4030] EFFICACY OF CONTROLLED ATMOSPHERES ON *CIMEX LECTULARIUS* (HET., CIMICIDAE) AND *ARGAS REFLEXUS* (ACARI, ARGASIDAE)

J. Herrmann[1], **C. Adler**[2], **G. Hoffmann**[1], **C. Reichmuth**[2], [1]Federal Environmental Agency, Inst. for Water-, Soil- and Air-Hygiene, Corrensplatz 1, 14195 Berlin, Germany, Jutta.Herrmann@uba.de. [2]Federal Biological Research Centre for Agriculture and Forestry, Inst. for Stored Product Protection, Koenigin-Luise-Str. 19, 14195 Berlin, Germany, Email: C.Adler@bba.de

The control of bedbugs (*Cimex lectularius*) as well as pigeon ticks (*Argas reflexus*) in the dwelling-environment of men is usually carried out by a treatment with residual insecticides/acaricides. As the hiding places of bed bugs and pigeon ticks can be spread all over an apartment or throughout a house (e.g. behind wallpaper, in furniture, pictures or books), there are potential undesirable chemical or physical reactions of insecticides on surfaces. Furthermore, the decreasing public acceptance of chemical pest control methods forces private and governmental agencies to look for alternative measures for eradication of arthropod pests. Controlled atmospheres are already used as residue-free alternatives to control insect pests in stored products or in valuable artefacts. No systematic investigation has been conducted concerning the lethal exposure time, concentration, temperature and pressure needed for the control of acari of hygiene impact. The presented results comprise data on the response of three different stages of *Cimex lectularius* (eggs, nymphal stages and adults) and two different stages of *Argas reflexus* (males and first nymphal stages) to carbon dioxide (CO_2) and nitrogen (N_2) at normal pressure and 20° C. The experiments with *Cimex lectularius* were carried out with mixtures containing 60, 90, 98 vol.-% CO_2 in air, and with 100 vol.-% CO_2. The exposure period ranged between 3, 6, 9, 12, 24, 48 and 96 hours, respectively. The treatment with 100 vol.-% CO_2 controlled all stages completely within 3 hours. The air-mixture with 60 vol.-% CO_2 produced the same effect within 24 hours. Exposure of all stages to a mixture of 98 vol.-% N_2 and 2 vol.-% oxygen achieved only 10 - 20 % mortality after exposure of up to 72 hours. The experiments with *Argas reflexus* were carried out with 90 % CO_2. Exposure times up to 4 days resulted in low kill rates. Even after 8 days of exposure, only 60 % mortality were obtained. 8 days of exposure to 98 vol.-% N_2 of the examined individuals did not show any pronounced lethal effect. The results indicate a practical possibility to treat infested materials against all stages of bed bugs in an acceptable short time of 24 hours. However, the difficulties of controlling pigeon ticks by this method were confirmed.

[4031] PHOSPHINE FUMIGATION IN GERMANY

Ch. Reichmuth, Federal Biological Research Centre for Agriculture and Forestry, Inst. for Stored Product Protection, Koenigin-Luise-Straße 19, 14195 Berlin, Germany, Email: c.reichmuth@bba.de

In 1935, phosphine releasing formulations were invented by Freyberg in Germany. These materials have been further developed and are today used world widely, especially for the disinfestation of stored bulk products, namely grain, and against rodents in the soil. During these 65 years, all together very few problems have occurred. Emissions from treated premises have lead to the strengthening of gas tightness requirements for those objects prior to fumigation. Dosage schedules, being still fairly high in Germany, have been reduced. The increase of speed of even distribution of the phosphine throughout the infested product is performed by use of carbon dioxide as carrier gas as well as the release of a mixture of nitrogen and phosphine from gas cylinders. As releasing formulations pellets, tablets, sachets (bags), bag blankets, plates and strips have access to the market. Aluminium phosphide, magnesium phosphide and zinc phosphide are registered phosphides.

Table: Some German registrations for the disinfestation of stored products with Aluminium phosphide formulations (dose, location, exposure time)

	Formulation			
Product	Bags	Bags	Bags	Bag blankets
Grain	50g/t, in gas tight silo bins, 14 days	50g/t, in granaries, 21 days	34g/t, in gas tight silo bins with recirculation, 4 days	1 with 100 bags (à 34 g)/40t, in granaries, 14 days
	Bags	Bags	Bags	Pellets
Grain	51g/t, in gas tight silo bins, 5 days	5,1g/m³, in empty silo ins, 4 days	51g/t, in bag stacks under gas proof sheets, in gas tight rooms, 5 days	30 (à 0.6g)/t, in gas tight silo bins, 14 days
	Tablets	Tablets	Tablets	Tablets
Grain	36g/t in gas tight silo bins, 21 days	45g/t, in ships and barges, 4 days	45g/t, in gastight silo bins, 4 days	30g/t, in gas tight silo bins, 5 days
	Expeller: 18g/m³, in ships and barges, 3 days	Products except grain, drugs, expeller: 15g/m³, under gas proof sheets, 10 days		Semolina: 6g/m³, in gas tight vessels, 3 days

[4032] THE USE OF RESEARCH RESULTS IN CONJUNCTION WITH PRACTICAL EXPERTISE TO OVERCOME THE PROBLEM OF PHOSPHINE RESISTANCE IN STORED PRODUCT INSECT PESTS

K.A. Mills, Central Science Laboratory (CSL), Sand Hutton, York, YO41 1LZ, United Kingdom. E-mail: k.mills@csl.gov.uk. Symposium 5, Session 23.

The threat posed by resistance to the disinfestation of durable stored commodities from insect pests by phosphine is well documented. The resistance has been known since 1969 and is known in 11 species. In fumigations where insects with genes for resistance are present, survival of immature stages is often not detected and the problem is passed down the trading chain to cause extra costs and, often, further selection. The inattention to agreed fumigation standards, to the quality of workmanship with respect to dosing and sealing and the lack of uptake of new technology has caused an increase in the problem over time. The allocation of resources to tackle the problem has not kept pace. However, with the eventual virtual loss of methyl bromide as a fumigant and a lack of other alternatives, we can predict a growing reliance on phosphine with a corresponding increase in poor quality fumigations, both of bagged and bulk commodities. The, often unintentional, counter-selection pressure from the use of methyl bromide will decrease dramatically. The FAO Global Resistance Survey in 1972-73 found the resistance in 10% of strains and national surveys have since found a significant incidence of resistant strains. Unfortunately, national and international agencies have largely ignored these warnings. The quantification of resistance levels in immature stages of some species has not alerted policy makers to the problem and the need to invest in the training of fumigation personnel. The development of rapid detection tests and studies on the genetics of the resistance offer a pro-active solution to the problem without a residue concern. This knowledge goes largely unused. Much publicly-funded research effort will be de-valued unless our knowledge of the resistance is quickly put to better use. It is surprising that commercial companies, particularly the multinationals, do not accept this threat to their business. The reason may be the relatively low value of some commodities and a misguided lack of concern about infestation. We are seeing an increase in trading standards, quality premiums and competition for markets in some commodities. Where an industry relies on the use of phosphine for disinfestation of a high value commodity, such as tobacco, the resistance problem is taken seriously and research is commissioned to address the problem. It is the responsibility of researchers to alert policy makers in government and industry to the wider problem so that research and training is initiated to reverse the trend and maintain confidence in phosphine fumigation. Data from studies at CSL and from other institutes is given to illustrate the problem and its solution. Index. terms: fumigation, strategy, costs

[4033] PHOSPHINE RESISTANCE – A THREAT FOR EUROPEAN STORED PRODUCT PROTECTION?

Ch. Reichmuth, Federal Biological Research Centre for Agriculture and Forestry, Inst. for Stored Product Protection, Koenigin-Luise-Str. 19, 14195 Berlin, Germany, Email: c.reichmuth@bba.de

The number of possible fumigants against stored product pest insects in bulk stored produce is becoming scarce. Apart from the search for alternative substances and methods for disinfestation, the maintenance of phosphine as one of the very effective gases is of paramount importance. In any case, it is advisable to ensure a choice of substances for individual cases of applications. Since the new registration of a compound for plant and stored product protection purpose is very costly and time consuming the approach of keeping a registered fumigant in the market is convincing except facts become obvious which forbid to do so. Phosphine brings along the problem of the development of resistance in insects, if they and their progeny are repeatedly exposed to sublethal conditions like too low concentrations or too short exposure periods at too low temperatures. If phosphine fumigations with recommended dosage schedules which are derived from susceptible strains fail to control pest insects the European grain trade is put at risk. Also other products like cocoa beans, which require frequently quick moth and beetle control measures, will fall under areas of pest control without feasible methods for disinfestation. The presentation comments on this situation and suggests how to handle this threat: 1) dosage schedules have to be revised and gas tightness test methods have to be introduced obligatorily prior to phosphine use, 2) a quarantine has to be built up to avoid the importation of resistant strains into Europe, a quick test is available and presented.

Index terms: Fumigation, pest control, quarantine

[4034] EFFICACY OF PHOSPHINE TO CONTROL *Sitophilus oryzae, S. zeamais* (COLEOPTERA: CURCULIONIDAE), *Rhyzopertha dominica* (COL: BOSTRICHIDAE) AND *Oryzaephilus surinamensis* (COL: SILVANIDAE) IN THE FUMIGATION OF STORED SOY BRAN

A. R. Pinto Jr. [1], R. S. Furiatti[2] & P.R.V.S. Pereira[2], [1]Agrius Capac. e Análises Agronômicas, Curitiba, PR, e-mail: arpinto@netpar.com.br; [2] Depto de Fitotecnia e Fitossanidade, Univ. Est. de Ponta Grossa, Caixa Postal 992, 84100-970, Ponta Grossa, PR, e-mail: furiatti@centerline.com.br, prvalle@netpar.com.br.

The efficacy of phosphine was determined against *Sitophilus oryzae* (L.), *S. zeamais* (Mots.)(Coleoptera: Curculionidae), *Rhyzopertha dominica* (Fab.)(Col: Bostrichidae) and *Oryzaephilus surinamensis* (L.)(Col: Silvanidae) exposed to treated soy bran. The experiment was conducted in a warehouse simulating storage conditions. Each treatment, replicated 4 times, was composed by barrels with 100 kg of soy bran and the doses tested, during a period of 240 hours, were 1, 2, 3, 4 and 5 g of phosphine/m3. To evaluate the efficacy of phosphine, 5 small cages/replicate, containing 200 g of soy bran and 10 adults of each species tested, were inserted into the soy bran mass. Barrels were hermetically closed and 240 hours after treatment all cages were removed from the soy bran and dead insects counted. The results showed that all doses of phosphine tested achieved 100% of mortality after 240 hours.
Index terms: Phosphine, fumigation, stored products insects

[4035] EFFICACY OF PHOSPHINE AND CARBON DIOXIDE TO CONTROL DIFFERENT STAGES OF *RHYZOPERTHA DOMINICA*

D. S. Santos[1], J. T. Jorge[2] & J. P. Santos[1], [1]Embrapa Milho e Sorgo, C. Postal 151, 35701-970, Sete Lagoas, MG, Brazil, E-mail: jamilton@cnpms.embrapa.br; [2]FEAGRI, Cidade Universitária Zeferino Vaz. UNICAMP, C. Postal 6011. 13081-970. Campinas, SP. Brazil.

Rhyzopertha dominica is the most important pest of stored wheat and rice grain in Brazil. The climate condition favors field infestation multiplication of many generations a year during storage. Development of insect populations carrying resistance to contact insecticides and phosphine (PH^3), inadequate structure and poor sealing during fumigation are the great concern. To overcome these constraints some tests using a mixture of PH^3 and carbon dioxide (CO_2) were performed aiming to control all life stages of *R. dominica*. Fumigation chambers measuring 25 cm high x 30 cm diameter were built with PVC tubes. Valves for injection and exhaustion of gases were mounted low on the side and on top, respectively. The experimental chambers were filled with wheat grain at 13.5% moisture and infested samples with all developmental life stages (eggs, 1st, 2nd, 3rd, 4th, pupa and adults insects) were individually involved in soft cloth and placed inside the chambers. Fumigation tests were conducted for 48, 72 and 96 hours under a combination of 100, 200, 400 and 600 ppm PH^3 in an atmosphere saturated with 10, 20, 30 and 40% CO_2 First the natural atmosphere, in each test chamber, was substituted for the respective CO_2 concentration from cylinders . Following, PH^3 was transferred from a phosphine release apparatus using an industrial gas syringe at the correct doses. Complete control of eggs was obtained only at the fumigation time of 72 and 96 hours under all doses of PH^3 in combination either with 30 or 40 % CO_2. Phosphine and CO_2 alone, even at the highest doses were not effective. The 1st instar larva little more susceptible to PH^3 and CO_2 than eggs, because a complete control was obtained under 72 and 96 fumigation time when 30 or 40% CO_2 were combined with all doses of PH^3. Doses of 10 or 20% CO_2 mixed with 400 or 600 ppm PH^3 also provided control above 99% of 1st instar larva. The efficacy of the mixture of PH^3 and CO_2 to control the 2nd, instar larva followed basically the same pattern for the 1st instar larva; however the 3rd and 4th were more tolerant. The pupa was distinctively more resistant stage. Only the combination of 30 or 40% CO_2 with 600 ppm PH^3 under 96 hours fumigation time killed them all. Adults were easier to control in all fumigation time tested. CO_2 alone provided more than 99% control at 30 and 40% concentration and under 72 and 96 hours fumigation time. It can be concluded that the mixture of PH^3 and CO_2 can be used to control all life stage of *R. dominica* and a synergistic effect of CO_2 was observed.
Index terms: Lesser grain borer, fumigation, controlled atmosphere, stored grain

[4036] MODELLING A NEW AND EFFECTIVE TOOL IN STORED PRODUCT PEST CONTROL

P. W. Flinn & B. C. Longstaff.

ABSTRACT NOT RECEIVED

[4037] MODELLING AS A TOOL FOR INTEGRATED PEST MANAGEMENT IN THE RURAL MAIZE STORE ECOSYSTEM

W. G. Meikle[1], N. Holst[2] & R. H. Markham[1], [1]International Inst. of Tropical Agriculture, 08 B. P. 0932 Tri-postal, Cotonou, Benin, E-mail w.meikle@cgiar.org; [2]Danish Inst. of Agricultural Sciences, Flakkebjerg, 4200 Slagelse, Denmark.Symposium 7: Modelling of Stored-Grain Ecosystems, Expert Systems.
23 August 13:45h, 30 min.

Models simulating the interaction between stored maize, insect pests (*Prostephanus truncatus* and *Sitophilus zeamais*), biocontrol agents (*Teretriosoma nigrescens*) and measures of farmer intervention are valuable tools for organizing scientific research, for optimizing control strategies and for anticipating the effects of various Integrated Pest Management (IPM) strategies. Using agro-climatological data to drive the models, different IPM scenarios can be visualized on regional scale and thus used to help direct IPM resources, such as resistant varieties, biological control agents or grain treatment technology, to where they are most needed and are expected to work most efficiently. A farmer may use IPM strategies to achieve different goals: One goal of an effective IPM strategy could be simply to diminish the rate of grain damage or pesticide use, and another could involve maximizing the economic outcome. Decision rules to opt for one strategy or the other can be derived from expected insect population growth, given clearly-defined assumptions, which are integrated with maize market price dynamics. These decision rules can be used to develop and refine store-monitoring procedures, which farmers can use to gauge the current pest status and make decisions about pest management.
Index terms: maize, economics, *Prostephanus truncatus, Sitophilus zeamais*, sampling, simulation modelling, *Teretriosoma nigrescens.*

[4038] GRAIN QUALITY MAINTENANCE: USING QUALITATIVE REASONING IN GRAIN PEST MANAGEMENT

A. Ndiaye, S. M. Ndiaye & F. Fleurat-Lessard, INRA, Laboratoire des Insectes des Denrées Stockées, BP 81, F 33883 Villenave d'Ornon, France, E-mail: an@bordeaux.inra.fr.

A grain bulk is the natural environment of specialised insects, mites, and micro-organisms. These pests, which are *biotic* variables, induce a degradation of stored grain quality in a natural and irreversible process. They interact with *abiotic variables* (temperature, moisture content, impurities, atmospheric composition) which are influenced by the environmental conditions of the storage location. Stored grain ecosystem is a dynamic system based on heterogeneous variables. Additionally, the knowledge required to maintain stored grain quality is fragmented and applied in different ways, with varying success. The qualitative reasoning enables to cope with incompletely known dynamic system using heterogeneous data and the reasoning on these data does not necessarily require the use of quantitative relations. The qualitative approach completes the quantitative one by allowing the modelling of human experts qualitative knowledge, but does not intend to replace it in a well-known numerical problem space. The use of qualitative reasoning improves significantly the computerised decision support systems for the management of grain pests in: i/ the integration in the same calculus space of all the characteristics of stored grain pests; ii/ the representation of human experts reasoning based on scientific results, common sense and job experience. For instance, insects detection by official methods uses a sample of grain (1 to 2 kg); only the free insects are measured and the sample is not necessarily representative of the infestation of the whole. The hazard represented by the growing up of insects population is evaluated using simulation models from the measured number of free living of each insect species; although the sensitiveness of the measurement is at best 0.5 free living or dead individual per kilogram. In qualitative reasoning the number of measured free dead insects can be taken into account for the evaluation of the level of the population of hidden form of insects; then a low and high hypothesis can be done on the hazard represented by the growing up of insect population. If any free insect is measured, a qualitative reasoning can be done on the risk of development of insects from temperature and moisture content of grain, atmospheric composition in the bin used (or that will be used), pesticide used (or not) and time. The qualitative reasoning in grain pest management is based on two causal relations between variables: *influences* and *gives-information-on*. The X *influences* Y relation is used to indicate that X is one of the causes of the state of Y, and the X *gives-information-on* Y relation is used to indicate that the state of X gives a qualitative information on the state of Y. The structural model of the causal relationships between the variables is represented as a simple static oriented causal graph, where each link represents a decision rule or a mathematical model.

Index terms: grain pest management, qualitative reasoning, decision support system

[4039] STORED GRAIN ADVISOR PRO: A DECISION SUPPORT SYSTEM FOR INSECT MANAGEMENT IN COMMERCIAL GRAIN STORES

P. W. Flinn & D. W. Hagstrum, USDA, ARS, Grain Marketing & Production Research Center, 1515 College Ave, Manhattan, KS 66502, USA, E-mail flinn@usgmrl.ksu.edu.

Stored Grain Advisor Pro (SGA Pro) is a decision support system targeted for commercial grain storage. SGA Pro uses a spatial bin model that can predict seasonal changes in grain temperature, moisture, and insect density for any region in a bin. The user selects weather data files for their location and inputs information about bin size, bin wall material, type of grain, aeration fan size, type of aeration controller, initial grain temperature, grain moisture, storage date and expected ship date. The simulation model in SGA Pro will predict insect densities for five species of stored grain insects, as well as the number of insect damaged kernels (IDK). It will also predict the effects of various control methods on insect populations, such as, phosphine fumigation, controlled atmospheres, aeration, and contact insecticides. SGA Pro provides the user with graphs showing predicted temperatures and insect densities. The graphs are interpreted by a knowledge base that provides remedial and preventative advice. The economic consequences of various management options are also presented to the user. SGA Pro is a key component of the area-wide integrated pest management (IPM) project that is starting its second year in the USA. This area-wide IPM program is a combined research effort by the Grain Marketing and Production Research Center, Kansas State University, and Oklahoma State University. This project is based on the idea that grain can be better managed using a systems approach that allows for optimal management of grain as it moves from farm, to local elevator, to terminal. SGA Pro will allow grain managers to predict bins that insect problems are likely to occur, and initiate control measures to prevent insects from reaching economic levels.

Index terms: IPM, Stored grain, expert system, decision support, model.

[4040] THE INFORMATION NETWORK ON POST HARVEST OPERATIONS, INPHO AND THE DISSEMINATION OF INFORMATION ON TRADITIONAL AND CURRENT STORED OF AGRICULTURAL PRODUCTS AT THE RURAL LEVEL

E. Mazaud.

ABSTRACT NOT RECEIVED

[4041] CANADIAN GRAIN STORAGE CD-ROM

P. G. Fields[1], N.D.G. White[1], S. Mani[2], D. S. Jayas[2], D. D. Mann[2] & W.E. Muir[2], [1]Cereal Research Centre, Agriculture and Agri-Food Canada, 195 Dafoe Rd. Winnipeg, MB, Canada, R3T 2M9, E-mail: pfields@em.agr.ca; [2]Dept. of Biosystems Engineering, 438 Engineering Bldg, University of Manitoba, Winnipeg, MB, Canada, R3T 5V6.

The Storage Group at the Cereal Research Centre (Agriculture and Agri-Food Canada) the Department of Biosystems Engineering (University of Manitoba) and the Canadian Grain Commission are collaborating to publish a CD-ROM containing information on stored products. Most of this information will also be available on the world wide web at http://res2.agr.ca/winnipeg/ It will include: CanStor: an expert system to assist in grain storage. Phosphine Corrosion Calculator: program modeling copper corrosion by phosphine. Publications: methyl bromide alternative publications produced by this group and UN. Images: approximately 150 images of insects, moulds, storage structures. Insecticide labels for stored products. Reference database: approximately 20,000 references on stored products

Index terms: expert systems, extension, stored-products

[4042] INTEGRATED PEST MANAGEMENT IN STORED PRODUCT PROTECTION - OUTLOOK

Ch. Reichmuth, Federal Biological Research Centre for Agriculture and Forestry, Inst. for Stored Product Protection, Koenigin-Luise-Straße 19, 14195 Berlin, Germany, Email: c.reichmuth @bba.de

The expression 'Integrated pest management, IPM' has found its way into the special field of stored product protection. Integration in this context comprises 1) all reasonable and feasible methods and approaches for the control of pests and 2) the reduction of the use of chemicals to the necessary and unavoidable extent. Still, chemical substances, including synthetic but also natural ones, are subject of the integrated approach. This modern term tries to express the public demand for food and feed with low artificial chemical residues but still of high quality. To some extent, pest control is back to a situation without access to organo phosphates and carbamates as insecticides. The changes occur in using 'old' ideas like the application of heat, cold, hermetic storage and the inert gases nitrogen and carbon dioxide, as well as inert dusts. To reduce the problem in a whole, special dedication goes into the direction of traps and lures, to detect the pests as early as possible and apply the appropriate strategies for the extermination of low density populations. Biological control, e.g. with *Trichogramma* and other wasps, has been propagated already in the early 1920-ies and is back in focus. Together with new insulation materials and know how, physical lethal factors, like extreme temperatures, can be installed in buildings and products to control the pests. The design of food and feed factories and store rooms is adapted to the requirements to install pest free zones implementing the thorough knowledge of the pest organisms. Package protection offers ways to prevent insect invasion during the transport of food and feed from the factory to the final consumer. Especially scientists of the third world countries are intensely looking for insecticidal, repellent and attracting properties of natural substances in extracts of plants to implement them in the system of integrated stored product protection.

[4043] STATUS OF CONTROLLED ATMOSPHERES AS INTEGRATED STORAGE INSECT CONTROL

S. Navarro, Department of Stored Products, Institute for Technology and Storage of Agricultural Products, Agricultural Research Organization, Bet Dagan, POB 6, 50-250, Israel, e-mail: snavarro@qnis.net

The potential harmful influence of pesticide residues in food and on the environment has led to the development of alternative pest control methods. The phase-out of methyl bromide (MB), as one of the chemicals in ozone depletion of the atmosphere has increased the urgency to search for new technologies. Among the non-chemical alternatives, physical control methods play an important role. These include the use of controlled atmospheres (CAs) and sealed storage that makes use of biogenerated modified atmospheres (Mas) an environmentally sound method. Treatment with CA based on carbon dioxide and nitrogen has gained much attention. This is the only potential alternative that retains the special capacity of fumigation to treat stored commodities in-situ. A study was undertaken to investigate the effect of MB in combination with CO_2 with the objective of reducing MB dosages to minimum effective levels, and consequently minimizing MB emissions. In addition, a combination of CO_2 with heat as an alternative treatment to MB was investigated. In this review the status of CA as integrated insect control methods with potential physical, non-chemical and environmentally sound storage-insect control methods is discussed. Physical means such as cooling and heating have the capacity to eliminate infestations. Different levels of cooling can be applied either to suppress insect development or obtain rapid control. Aeration using ambient air and refrigerated air aeration for suppressing insect activity and quality preservation of grain is widely in use. Application of CA as integrated with cooling or heating for insect control is discussed.

[4044] LEVELS OF GASTIGHTNESS AND CONTAINMENT OF FUMIGANTS – CONSEQUENCES FOR ARTHROPOD PEST CONTROL

Ch. Reichmuth[1], S. Navarro[2], [1]Federal Biological Research Centre for Agriculture and Forestry, Inst. for Stored Product Protection, Koenigin-Luise-Straße 19, 14195 Berlin, Germany, Email: c.reichmuth@bba.de, [2]Agricultural Research Organization, The Volcani Center, P. O. Box 6, Bet Dagan, Israel, E-mail: vtshlo@netvision.net.il

Gaseous treatments using phosphine, methyl bromide, hydrogen cyanide, suphuryl fluoride as well as modified atmospheres of carbon dioxide and nitrogen with low content of oxygen require gastight enclosures to be effective in pest control. This aspect of gas tightness received attention due to the development of resistance by insects as well as environmental pollution aspects. Successful insect control can only be achieved when a gas concentration can be maintained for a sufficient time. Fumigation carried out in leaky structures cause gas loss that has to be replaced in order to ensure that appropriate gas concentrations be held for the scheduled time. Gastightness test methods have been developed to evaluate the suitability of structures for retaining fumigants used for insect disinfestation. These tests can be applied to large silos for grain storage as well to warehouses, for tarpaulin covered stacks of bags, cartons or other commodities stored on pallets, and also to fumigation chambers. Following each test sealing of the structure may be improved until the desired degree of gas-tightness is obtained. Mathematical models that describe the necessary amount of gas to be initially introduced in a structure to achieve complete control in a given time, at a given temperature and given gas tightness level, exist. These models enable the calculation of necessary gas to be added when the gas concentration falls below a certain minimum. In addition, the gastightness tests can be used to evaluate the efficiency of a treatment to ensure that the premises surrounding the treated area do not contain levels of fumigants that will endanger people, animals and plants, and will conform with regulatory requirements. The presentation will comment on the various aspects of this concept, including dosage schedules, gas loss, economical and environmental implications.

Index terms: Fumigation, pest control, pressure test

[4045] IPM: A COMMON SENSE APPROACH

Bennett, G. W, Center of Urban & Industrial Pest Management, Purdue University, West Lafayette.

A research has confirmed that German cockroach nymphs are most active during the night (dark) hours each day. A new finding was that for each stage of a nymph's life, most of the nymph's movement was during the first half of the instar period. In fact, for fifth instar nymphs, there was little movement from the day eight until molting to an adult on the day 12. The fact that German cockroach nymphs spend approximately one-half of their lives continuously hiding with no food or water consumption is very important. These behavioral research findings for German cockroach stages point out the importance of using an integrated approach to control that should include: sanitation, mechanical alteration, proper insecticide placement, etc. Baits, traps, and insect growth regulators (IGRs) are examples of developing technologies provided by research that enable the delivery of more environmentally sensitive pest control programs. Baits consist in one or more food materials combined with a selective pesticide to kill pests. Traps are usually non-chemical, escape-proof devices that capture highly mobile and active pests. Often stick traps can be baited with commercial lures (pheromones and food attractants) to enhance the trap catch. They are not effective in reducing populations unless the pest population is isolated or confined to a small area. IGRs will continue their growing role in pests' management. They present minimal danger to humans compared to more traditional insecticides, because they act by interfering with biological process that are specific to insects. In some pests' situations, IGRs must be used with a traditional insecticide, but the amount of insecticide used, and/or the number of treatments needed, are reduced substantially. The future of IGRs is bright because new compounds with growth regulating properties are being developed, as are new uses for existing IGRs. Extensive research has been conducted recently to develop IGRs for use in termite baits. Thus, this technology continues to advance as research illuminates new opportunities for technicians to implement IRGs into their service routines.

Index terms: research, German cockroach nymphs, insect growth regulators (IGRs), traditional insecticide, technology

[4046] INTEGRATED HOUSE FLY MANNAGEMENT IN COSTA RICA

H. Camacho V, Escuela de Biología, Universidad de Costa Rica, email: hernanc@biologia.ucr.ac.cr

The house fly Musca domestica (Diptera: Muscidae) is an important pest in Costa Rica because the chicken, hen and pig excrements, the use of organic fertilizer and the garbage are special substrates to its population development. The experiment to control the density of the population was made in various hen egg granges, coffee industries and organic fertilizer fields. It uses the releasing of the pupae parasitoid *Pachyprepoidues vindenmiae* (Hynm.: Pteromalidae) because it is cheaper and easier to mass reared in the lab, resistant to a wide range of weather changes, its spread range is short, long life and efficient to puts eggs in the house fly pupae. It can be reared in medfly *Ceratitis capitata* (Diptera: Tephritidae) and in house fly pupaes. We get 35.82% of house fly pupaes parasitoidism (n=3400). It born more females (Average = 19.24; S.Desv.= 9.88) than males (Average 17.66; S.desv.= 6,42). We use a very cheap pig diet how sustrat to oviposition and larvae development. Besides, it uses a semiochemical, an adult food attractant, to capture the adults, measure the relative density of the population and its changes. With this control strategies it was possible to reduce the density of the population from a 360 Fly per Trap per Day Index in 1997 to 36 FPD Index in 1998 in Santa Martha egg hen grange. We eliminate the spread of insecticides and its environmental and health effects. One trap captures until 6000 flies per week. The utilization of these strategies reduces the cost of the pest control in 52%, compared with the pesticide use. The food attractant was used to determinate the relative density of the population of the house fly in a big organic fertilizer production field and a toxic attractant to capture adults and reduce the population.
Key words: House fly, IPM, Biological control, Semiochemical.

[4047] SIMPLE EVALUATION PROCEDURES AS IPM TOOLS FOR STORED MAIZE IN WEST AFRICA

W. G. Meikle[1], N. Holst[2] & R. H. Markham[1], [1]International Inst. of Tropical Agriculture, 08 B. P. 0932 Tri-postal, Cotonou, Benin, E-mail w.meikle@cgiar.org; [2]Danish Inst. of Agricultural Sciences, Flakkebjerg, 4200 Slagelse, Denmark.

A computer-based decision-support tool has been developed to provide extension agents and policy makers with a means to evaluate and improve maize store management strategies. The tool consists of population simulation models of insect pests (*Prostephanus truncatus* and *Sitophilus zeamais*), a biocontrol agent (*Teretrius nigrescens*), and sampling plans. The weather-driven population models simulate pest densities in stores given a particular weather regime and an initial density. The daily grain damage rate per beetle for the two most important pests, *P. truncatus* and *S. zeamais*, calculated from many field data sets, links pest density with damage and weight loss. The models are then used to estimate the density at which the pests would be a problem. The density curves are used to establish thresholds well in advance of serious grain loss. Since determining pest density requires sampling maize in the store, and since sampling consumes scarce resources, sequential sampling plans were developed that minimise the time and number of cobs needed for assessment. By adjusting the threshold density and other parameters and timing the sampling appropriately, sampling for the most serious pest, *P. truncatus*, will need to be implemented only once or twice, a few months into the storage season. Information gathered from the sampling can help a farmer make a sound decision about the current and future status of a pest before appreciable economic loss has occurred.
Index terms: *Prostephanus truncatus*, *Sitophilus zeamais*, sampling, simulation modelling.

[4048] THE INFORMATION OF URBAN MEDICAL INSECTS MANAGEMENT SYSTEM

T. Zhao[1], H.Guo[2], J. Zhang[3], H. Zhao[3], Y.Dong[1], Y.Guo[2] & B. Lu[1], [1]The Institute of Microbiology and Epidemiology, 20 Dongdajie, Fengtai, Beijing, P. R. China, 100071, zty@public.bta.net.cn , [2]Office of National Patriotic Health Movement Committee of Fuzhou, 128 Industry Road. Fuzhou , Fujian, P. R. China, 350004 , [3] 28(B)Fengguan Road, Fengyiyuan hotel, Fengtai, Beijing, China, 100071, Beijing Timing Science & Information Technology Co., Ltd)

An information management system software of urban medical insects were constructed, The user is municipal administration in a city, it aim at control of three species, including of mosquitoes, flies and cockroaches, which is a part of the program of "Four-Pest Control" organized by the National Patriotic Health Movement (NPHM) of China, aimed at the elimination of the pestiferous species, in addition to the disease vector. There are several parts of the software, general situation of a city, principle of medical insect control (IPM), management, schedule of medical insects control of one year, medical insects control program, inspection.

[4049] APPLICATION OF GASTIGHT STORAGE IN THE TROPICS

S. Navarro, E. Donahaye, M. Rindner, A. Azrieli & R. Dias, Department of Stored Products, Agricultural Research Organization, The Volcani Center, P.O.Box 6, Bet Dagan 50 250, Israel, e-mail: vtshlo@netvision.net.il

Gastight sealed structures for storage of cereal grains in the open, under modified atmospheres, in tropical and subtropical climates were investigated. The essential advantage of sealed storage lies in the generation of an oxygen-depleted and carbon dioxide enriched intergranular atmosphere of the storage ecosystem to arrest insect development. The three types of structures were: a) weld-mesh walled silos with a capacity of 60 to 1,000-tonnes; b) frameless flexible envelopes for bagged grain (Volcani Cubes) of 5 to 150 tonnes; and c) a granary (GrainSafe) to hold 540 kg of cereal grain. Under tropical conditions, when grain is stored in the open with no shade, ambient diurnal temperature fluctuations, can create temperature gradients within the stack that cause convection currents to carry moisture to the upper layers of grain. The granary has a protective roof to diminish the effect of temperature gradients. To overcome this effect in the silos and the flexible envelopes, an upper insulating layer of bags containing straw or husks was employed. Under tropical climates this solution enables safe storage of maize and paddy for periods of up to three months, while for more extended periods the top moistened layer of husks should be replaced with dry material. In a search to develop an alternative inexpensive and convenient method of insulating the stack from diurnal temperature fluctuations, the use of a shade screen placed above the cube was investigated. This material described as a knitted thermal screen is formed from aluminum coated high-density polyethylene threads. Trials conducted with all three types of structures in tropical and subtropical climates showed that grain is protected under sealed storage by maintaining the number of live insects below the threshold of economic damage without the need for pesticides.

[4050] INSECT AND FUNGUS MANAGEMENT TO REDUCE MYCOTOXIN PRODUCTION IN STORED GRAIN

F. A. Lazzari[1,2] & S. M. N. Lazzari[2], [1] Lazzari Consulting, Rua João A. Prosdócimo, 495, 81560-020 Curitiba, PR, Brazil; 2 Depto. de Zoologia, Univ. Federal do Paraná, 81531-990 Curitiba, PR, Brazil. E-mail lazzari@bio.ufpr.br.

Mycotoxins are compounds produced by fungi growing in seeds and grains during plant development in the field, before drying or in storage. Fungus toxins such as zearalenone, fumonisins, deoxynivalenol, aflatoxins and ochratoxin A, are of great concern for human and animal health. These toxins are frequently found in cereals and cereal products (corn, corn meal, wheat, wheat flour, sorghum, barley, foods and feeds) in several places around the world. The fungi that produce mycotoxins are usually associated with several kinds of insects in the field and in storage. In the field during plant development, insects (corn ear worm, nitidulid beetles) can damage kernels and spread the fungus. By controlling insects during plant development (insecticide application or transgenic plants) it is possible to reduce mycotoxin production in the field. When extensive kernel damage is caused by the combine during harvesting, or grain with high moisture is kept on trucks or grain wagons waiting at the grain elevator to unload, or still if the grain is not properly dried, it is possible to have the production of one or more kinds of mycotoxins. A safe moisture level is crucial for preventing mycotoxin (mainly aflatoxins) during the period between harvesting and grain drying. Contamination by mycotoxins varies according to the geographic area, crop season and kind of management that is given to the grain, thus it is very important to know how to buy quality grain. In storage, fungi and insects can produce heat that will cause moisture migration and grain spoilage. These organisms can be managed by controlling the environment, mainly grain moisture and temperature. Suppression of inoculum by removing fines, dockage, broken kernels and keeping the grain temperature by aeration below 15 °C will reduce problems with insects and moulds during storage. A great reduction of the level of mycotoxins and insects is obtained by screening the grain that will be stored or processed for food or animal feed. Knowing the insect-fungus relationship in stored grain and the appropriate conditions for their development it will allow us to take preventive measures to reduce the presence of mycotoxins in the food chain.

Index terms: fungi, insects, mycotoxins, grain management, food and feed quality.

[4051] USE OF PHYTOCHEMICALS IN INTEGRATED STORED PRODUCT PROTECTION

C. Adler, [1]Federal Biological Research Centre for Agriculture and Forestry, Inst. for Stored Product Protection, Koenigin-Luise-Str. 19, 14195 Berlin, Germany, E-mail: c.adler@bba.de

In the search for new, biodegradable and less toxic alternatives to synthetic agents, plant extracts and plant parts are intensively studied at present for their potential utilisation in stored product protection. Plant parts and extracts have been used since ancient times and their implementation can still be witnessed in many traditional storages. It is worthwhile to study the composition of a given plant, the quality and quantity of its pure compounds, even though this needs a well equipped laboratory with extraction units, gas chromatography and mass spectrometry, as well as pure compounds for reference. To do experiments with a plant extract without an exact biochemical analysis of its composition is like a shot in the dark, because in a plant, the quality and quantity of pure compounds produced may depend on factors like plant species and variety, climate, soil, maturity at the time of harvest, and storage conditions before extraction. In laboratory studies on the efficacy of plant extracts, it may be desirable to start testing a pure compound before trying to understand the mode of action of binary, tertiary, ore more complicated mixtures of compounds. The term botanicals may sound comforting but during co-evolution with insects, plants developed strategies to keep away potential pests by the production of toxic compounds that may prove quite toxic to man, as well. Thus, in studying a plant extract, equal precaution should be used like in analysing an unknown synthetic chemical. Once removed from its natural context, a phytochemical may be described as a biodegradable chemical with the same risks of application as in the use of any other chemical including the risk of resistance development of pests. Nevertheless, phytochemicals are definitely worth studying because they play an important role in the interaction between plants and insects. In integrated stored product protection, phytochemicals may be used to repel pests from premises of storage or food production. It could make sense to plant lemon trees, carnations or *Ocimum* bushes close to a grain store or flower mill because the insect repellent odours of these plants could mask the attractive smell of stored goods. Phytochemicals may also be used on or around packed food stuffs to repel insects. If this did not succeed, other compounds may attract them to a trap for early pest detection, and toxic compounds may be used for pest control. Today, with probably more scientific knowledge than ever before, man may analyse and utilise the ongoing "arms-race" between plants and insects for his own benefits. Thus, phytochemicals may have a bright future in stored product protection.

Index terms: botanical, repellent, attractant, control, IPM, stored products.

[4052] EFFECT OF POWDERS FROM VEGETAL SPECIES ON *ZABROTES SUBFASCIATUS* (COLEOPTERA: BRUCHIDAE) IN STORED BEAN

F. Mazzonetto[1] and J.D. Vendramim[1], [1]Department of Entomology, Plant Pathology and Agricultural Zoology, ESALQ, University of São Paulo, 13418-900, Piracicaba, São Paulo, Brazil.

The objective of this research was to evaluate the insecticide activity of the powders from 18 vegetal species for controlling the Mexican bean weevil *Zabrotes subfasciatus*. The plants were dried and ground into fine powder with a laboratory mill. Each powder was mixed bean grains and kept in plastic boxes (6 cm diameter). The repellency was evaluated using an arena with five circular plastic boxes, being the central box interlinked to the others with plastic tubes, in the diagonal disposition. Samples treated with powder (0,3 g per 10 g of bean) and untreated samples (check) were distributed in symmetrical recipients. Ten couples of Z *subfasciatus* (1-day old) were put in the central box. The number of insects in each recipient was counted after 24 h of insect release. The experiment was replicated 10 times for each plant. An Index of Preference was then calculated for determining the attractive, neutral or repellent effect of each plant. The survival and reproduction were determined by infesting 10 couples (1-day old) of the insect per box (0,3 g of powder per 10 g of bean). Boxes containing only beans were used a check. The number of live insects was evaluated daily up the 5th day. Then, the survivors insects were eliminated and the number of fertile and non-fertile eggs was evaluated. The number of emerged adults were evaluated daily and with these data the duration and the viability of the immature phase were calculated. According to the results we concluded that powder of *Chenopodium ambrosioides* (cv. 2) presented the highest activity against *Z. subfasciatus* causing repellency and mortality of adults. Other repellent species were *C. ambrosioides* (cv. 1), *Eucaliptus citriodora, Laurus nobilis, Mentha pulegium, Ocimum basilicum, O. minimum, Ruta graveolens, Citrus reticulata* (cv. Murcote) and *C. sinensis* (cv. Pera). *M. pulegium, O. basilicum* and *R. graveolens* also reduced the survival time of the insect. *O. minimum* did not present any effect in the survival, however, it affected the reproduction of the insect, by reducing the viability of immature stages.

[4053] EFFICACY OF *CHENOPODIUM AMBROSIOIDES, PIPER GUINENSE,* AND *XYLOPIA AETHIOPICA* AS GRAIN PROTECTANTS AGAINST STORED PRODUCT PESTS

C. Adler[1], P.C. Ojimelukwe[2], T.A. Leon[3] and Ch. Reichmuth[1], [1]Federal Biological Research Centre for Agriculture and Forestry, Inst. for Stored Product Protection, Koenigin-Luise-Str. 19, 14195 Berlin, Germany, E-mail: c.adler@bba.de; [2]Dept. of Food Science and Tech., Federal Univ. of Agriculture, Umudike, P.M.B. 7267 Umuahia, Abia State, Nigeria; [3]Laboratory of Environmental and Applied Chemistry, Dschang Univ., P. O. Box 183, Dschang, Cameroon

Phytochemicals are used in traditional stored product protection in many cultures. These agents have the advantage of being available, cheap and often well known to the local farmers. Some farmers in the Western highlands of Cameroon store their harvested grain with dry leaves of *Chenopodium ambrosioides*. Seeds of *Piper guinense* and ground sundried fruits of *Xylopia aethiopica* are used as medicine or spice in Nigeria. Ground sun-dried leaves of *Chenopodium ambrosioides* from Cameroon, as well as ground seeds of *Piper guinense* and ground sun-dried fruits of *Xylopia aethiopica* from Nigeria were admixed to grain and tested in the laboratory at 25±1°C and 75±5% r.h. for their insecticidal properties to various adult stored product pests. 0.2 % admixture of *Chenopodium ambrosioides* to peas (wt/wt) was sufficient to control the cowpea weevil *Callosobruchus chinensis* (Col., Bruchidae) within 48 h of exposure. Only the highest content of 6.4 % led to complete control of the quite tolerant granary weevil *Sitophilus granarius* (Col., Curculionidae) in wheat grains at similar exposure times. 1.6 % proved sufficient to prevent any offspring development and gave complete mortality of adults after 10 days. *Piper guinense* at a content of 0.5 % led to a 95 % control of *Callosobruchus chinensis* within 48 h of exposure and the suppression of reproduction, while 2.2 % would have been needed to control 95 % of *Sitophilus granarius* in this time. A content of 1% of *Piper guinense* was sufficient to prevent offspring development. The powder made of ground fruits of *X. aethiopica* was least effective with only 66 % mortality of adult *Callosobruchus chinensis* after 8 days of exposure. Thus, it seems possible to protect stored grains from insect infestation by admixture of powdered *Chenopodium ambrosioides* or *Piper guinense*.

Index terms: *Callosobruchus chinensis, Sitophilus granarius*, phytochemicals.

[4054] NATURAL PRODUCT REPELLANTS OR ATTRACTANTS: PART OF A SOLUTION TO CONTROL STORED-PRODUCT INSECTS

S. Mohan[1] & P. G. Fields[2]. [1]Dept. of Agricultural Entomology, Centre for Plant Protection Studies Tamil Nadu Agricultural University, Coimbatore, Tamilnadu 641 003, India, E-mail: sarmamohan@hotmail.com; [2]Cereal Research Centre, Agriculture and Agri-Food Canada, 195 Dafoe Rd. Winnipeg, MB, Canada, R3T 2M9, E-mail: pfields@em.agr.ca.

Natural products have been used to control stored product insect pests since the dawn of agriculture, but they usual require high doses or do not provide sufficient control. In addition to being toxic to stored-grain insects, many natural products are also repellant. We have developed a simple and rapid technique to determine if natural products are repellant or attractive to stored-product insects. Three natural product repellants were tested; diatomaceous earth (DE, Protect-It®), powdered peas (*Pisum sativum*) and protein-rich pea flour. Three adult insects were tested: the rice weevil, *Sitophilus oryzae*, red flour beetle, *Tribolium castaneum* and rusty grain beetle, *Cryptolestes ferrugineus*. This device has a perforated cup (2 mm perforation size), and holds 200 g of wheat. A petri dish and cup collect the insects as they leave the wheat. The insects are released into the centre of the grain in the container through a long stemmed funnel. The container has a lid at the top to prevent the escape of flying insects. DE was repellant to all three stored-product insects tested, ground pea was repellant to *C. ferrugineus* and *S. oryzae* and pea protein was repellant to *C. ferrugineus*. Experiments were also conducted using *Rhyzopertha dominica*, the lesser grain borer, pheromone outside the grain. After one day, 47% of *R. dominica* adults had left the grain in the pheromone treatment, compared to 5% in the untreated controls. This bioassay mimics field conditions (bin storage) better than current bioassays that use filter paper treated with repellants/attractants. These repellants will be tested in insect removal bins to determine if this method with increase immigration out of bins, and hence reduce damage due to stored-product insects.
Index terms: DE, pea, pheromone, *Sitophilus, Rhyzopertha*

[4055] LABORATORY TRIALS ON THE USE OF THREE SPECIES OF *USCANA* FOR THE CONTROL OF STORE BRUCHIDS (BRUCHIDAE; COLEOPTERA)

H.R. Pajni[1] & P.K. Tewari[1], [1]Department of Zoology, Panjab University, Chandigarh–160 014, India, E–mail : ptewari@usa.net.

Three species of *Uscana* viz., U. mukerjii, *U. femoralis* and *Uscana* sp. have been studied for their efficacy in suppressing the populations of *Callosobruchus maculatus* in the laboratory. Studies on their biology have revealed that the normal fecundity of *U. mukerjii* of 54 eggs/female can be increased by 1.5 times when its adults are allowed to feed on undiluted honey. Likewise, the longevity of the adults increases from a normal of 2 days to 5 days when stored at 5°C and 10°C by causing only a slight loss in their fecundity. However, chilling of larvae and pupae increases the longevity of these stages upto 15 days. Release of parasitoids in the bruchid cultures in the ratio of 2:1 ensures almost complete suppression of the pest population. *Uscana femoralis* is a pest of field bruchids like *Conicobruchus albopubens* and *Bruchidius* spp. However, as the parasitoid could breed on the eggs of *C.maculatus* under captivity, we have reared it for a number of generations as a result of which it has fully adapted to the new host. The selected strain of *U. femoralis* is now capable of uninterrupted breeding on *C. maculatus* eggs. Its initial low fecundity has also increased greatly and the parasitoid can be fully exploited for biocontrol operations. The possibility of the rearing of third species of *Uscana* on the eggs of *C.maculatus* and other store bruchids and its subsequent use in biological control operations is being studied. The versatility of the *Uscana* species associated with the field bruchids attacking wild legumes and their acceptance of store bruchids as new host has opened up the possibility of exploiting them for control of bruchid pests of edible legumes.
Index terms : *Uscana mukerjii, Uscana femoralis, Callosobruchus maculatus,* parasitoids, biological control

[4056] CHANCES OF BOTANICAL CHEMICALS TO REPLACE CLASSICAL INSECTICIDES

E. Shaaya.

ABSTRACT NOT RECEIVED

[4057] DO THE PEOPLE KNOW ABOUT SUBTERRANEAN TERMITES?

E. B. Menezes, CIMP "CRG" / UFRRJ. BR 465, Km 7, Caixa Postal 74538, Seropedica, RJ 23851-970, Brazil, E-mail ebmen@zaz.com.br.

Throughout the world, one of the most feared insects is the termites. As common as termites, most people know very little about them, and perhaps it is the element of the unknown that causes such great anxiety. Historically termites play a fundamental role in the nature, where they are considered a useful organism. They serve their place in the balance of nature by reducing fallen timbers and dead roots in the ground. However, when the men became sedentary, they started to cultivate and build their dwellings. Only because people have placed the wood of their dwellings in situations accessible to termites, they became so destructives. Termites are injurious because of damage to wood and wooden products. The natural history of termites is quite variable. The so-called dry wood termites colonize in homes and buildings without soil or moisture connection, and frequently cause damage to the dry, seasoned wood. They are a serious destroyer of wood in historical patrimony in Brazil. Subterranean termites, which normally colonize in the ground and move upward into buildings, are most important, and most common in the urban areas of Brazil. The Asian subterranean *Coptotermes havilandi* (Isoptera: Rhinotermitidae) was introduced in Brazil between 1915 and 1923. Actually, it is the most serious pest in urban areas in Brazil, mainly in its metropolises, such as São Paulo and Rio de Janeiro. *C. havilandi* have spread throughout the littoral regions of Brazil where the warm temperature and high relative humidity make an ideal environment for the development of this species, occurring with high incidence of infestation in these regions. Subterranean termites, those that colonize in the ground and extend their activities from such focal points, may attack wood in homes and buildings by finding protected passage from the soil to the source of food (wood) or by making connecting earthen tubes. The principal economic damage done by these insects is the weakening of structural timbers in homes and buildings. The activity of a strong colony may be considerable, causing severe damage to foundation plates, joints, wall supports, and flooring. Because warm temperature accelerates development, extensive damage occurs when there are extended periods of warmth. Probably, it is the reason why they are so destructive in the southeast and north regions of Brazil. People seemingly build their homes for termites. For example, foundations are usually hollow, permitting undetected passage of termites from the soil to wood. Combine this "better living" with the cryptobiotic nature of the termites, and it is little wonder that undetected damage may occur to harass the homeowner. Because the long residual effect termiticides (e.g. aldrin) were banished forever, the best control method of subterranean termites is the preventive treatment.
Index terms: Isoptera, *Coptotermes havilandi*, damage, cryptobiotic nature.

[4058] NEW TOOLS IN MOSQUITO CONTROL MANAGEMENT

E. Moreira, Zeneca Public Health. Gainesville, FL, USA. Email: Eduardo.Moreira@agna.zeneca.com

Mosquito borne diseases remain a major problem around the world despite of the advances in technology and knowledge of mosquito biology and the diseases they transmit. New tools and control methodologies such as GIS, genetic ID, sprayers, drugs, insecticides, formulations and information network are available today and can be used to reduce diseases such as Malaria, Dengue and Encephalitis. The human factor remains the weak link requiring trained mosquito control personnel to recognize the problems and choose the best control options available. Prevention over remediation requires a firm long-term political and technical decision. Proper mosquito control management needs people capable and resources available when action is needed. These new tools and how they can be used in mosquito control is discussed.
Index terms: *Mosquito control, technology, insecticide, management*

[4059] STORED GRAIN PESTS RESISTANCE TO PESTICIDES IN BRAZIL: EVOLUTION AND FUTURE

I. Lorini [1] & **R. N. C. Guedes** [2], [1] Brazilian Agency of Agriculture Research – EMBRAPA National Wheat Research Center. Rodovia BR 285, km 174, P.O. Box 451, 99001-970, Passo Fundo, RS, Brazil. E-mail: ilorini@cnpt.embrapa.br. [2] Department of Animal Biology - Federal University of Viçosa, Viçosa, MG 36571-000, Brazil. E-mail: guedes@mail.uv.br.

Pests cause significant damage in stored grain in Brazil and losses have been estimated to be about 10 % of total grain stored each year. The evolution of pests resistance to pesticides in stored grain is one of the main reasons for those losses. The resistance problem is increasing because the pesticides used to control stored grain pests are quite old in the market in a such way that the selection pressure is quite predictable in that environment. The evolution of resistance in Brazil was shown by the first FAO survey done by Champ & Dyte (1976) carried out in 1972/73 where resistance to malathion was detected in Brazilian strains of *Rhyzopertha dominica*, *Tribolium castaneum*, *T. confusum* and *Oryzaephilus surinamensis*. The work done by Pacheco *et al.* (1990; 1993; 1994), Sartori *et al.* (1990; 1996), Sartori (1993), Guedes *et al.* (1993; 1994; 1995; 1996; 1997; 1998), Lorini (1992; 1997), Lorini & Scheneider (1993; 1994), Lorini & Galley (1996; 1997; 1998; 1999; 2000) showed resistance to malathion, phosphine, deltamethrin, permethrin, fenitrothion, pirimiphos-methyl, chlorpyrifos-methyl. Up to date resistant strains of *R. dominica*, *Sitophilus oryzae*, *S. zeamays*, *T. Castaneum*, *T. confusum*, *Cryptolestes ferrugineus and O. surinamensis* have been detected in Brazil. The evolution of the problem of resistance of stored grain pests to the current active ingredients used for control of those pests depends on the urgent use of an integrated management program in stored grain environment in order to prevent grain damage while providing high quality food for the Brazilian population.
Index terms: Stored grain entomology, pesticide resistance, organophosphates, pyrethroids, phosphine, resistance update

[4060] PLANT EXTRACTS AS POTENTIAL INSECTICIDE TO CONTROL STORED GRAIN PESTS

H.T. Prates[1] **& J.P. Santos**[1], [1] Embrapa Milho e Sorgo. Caixa Postal 151, 35701-970, Sete Lagoas, MG, Brazil. E-mail: htprates@cnpms.embrapa.br.

The damage caused by stored grain insects in Brazil is estimated to be around 8 % of production. Insects responsible for such loss are among others *Sitophilus zeamais, Sitophilus oryzae, Rhyzopertha dominica* and *Tribolium castaneum*. Synthetic insecticides are the conventional way to control these insect pests. However, natural products from plants have been studied as an ecologically more effective alternative in protecting stored grains. A screening program of plant substances extracted from Brazilian flora was initiated against those insects. Bioassays to determine the insecticide activity consisted of tests for fumigation, contact, and contact and/or ingestion. In all assays, twenty individual adults of each insect were used in each of three replicate assays. A control test was prepared the same way but no impregnating substance was used. All tests were carried out at the temperature of 26±1 °C *Azadirachta indica* and *Annona squamosa*, respectively. Observations on the survival rate of insects were made 24 h after contact and efficacy (%) was calculated using Abbott procedure. Results have shown that cineole, limonene and *Eucalyptus globulus* and *E. camaldulensis* essential oils showed toxic effect to all insects through cuticle (contact test) and/or by ingestion (contact and or ingestion test) and fumigation activity. *S. zeamais* revealed preference for grains without the presence of essential oil or leaves of *E. citriodora*. Finally, plant extracts obtained from *Annona crassiflora*, *A. squamosa*, *A. indica*, *Piptadenia colubrina*, *Baccharis genistelloides* were also tested against *S. zeamais*. The observations on the survival rate of insects has shown mortality variyng from 46.66% to 96.66% with *A. indica* and *A. squamosa*, respectively. Surviving insects (13 females and 2 males) from the most active extracts were evaluated for the biological potential. The average number of F1 generation *A. indica* and *A. squamosa*, respectively insects per surviving female was 0.7 (insects/female) and 3.0 for *A. indica* and *A. squamosa*, respectively. Results confirmed the insecticide activity.
Index terms: *Sitophilus zeamais, S. oryzae, Rhyzopertha dominica, Tribolium castaneum*, biocides

[4061] *RETICULITERMES LUCIFUGUS* IN URBAN HOUSEHOLDS IN URUGUAY

A. Aber [1] **, M. Beltrami** [2], [1] Dept. of Entomology, Fac. of Sciences, Universidad de la República; Dirección Iguá 4225 & Dirección Nacional de Medio Ambiente (MVOTMA), Rincón 422 3er.p., 11000, Montevideo, Uruguay,; [2] Instituto Nacional de Estadística, Río Negro 1520, 11100 Montevideo, Uruguay.

Reticulitermes lucifugus is a xylophagous species with socioeconomic and environmental importance in Uruguay. The objective of this paper is to provide information about (1) the present distribution of this plague in the South- Southeast of Uruguay, (2) its relation with ecosystems, and (3) the advance of these "plague insects", including the diagnosis of damaged materials. Data were obtained by means of a questionnaire applied to national companies which work in termite control, and from results of field work dealing with this species. *R lucifugus* has an appreciable distribution in Montevideo, capital of the country, and a lesser degree in the department of Canelones. In locations with high density of diagnosis of presence of the plague, the existing relationship between the appearance and multiplication of the plague and soil structure permits one to conclude that *R. lucifugus* installs itself principally in buildings resting upon light or medium soils, or soils associated with light or very meteorized subsoils. These types of soils provide little resistance to the construction of tunnels which makes possible the dispersion of the species. In places with less infestation the soils are more differentiated: medium and eventually heavy. This permits one to determine that probable arrival of the species to the place was by transport and not by the extension of the pest itself. The occurrence of attacks associated with high density of new constructions permits one to suppose the possibility of having brought in materials containing insects, discarding the idea of a vegetative or natural infestation. The damaged materials observed were wood for openings, cellulose derivatives, elements used in building construction, as well as eucalyptus and pine trees. Occasionally the construction of thin tunnels of earth material has been observed on the surface of the walls. In Punta del Este (Maldonado) there are ecosystems similar to the ones described here. This permits a forecast of future invasion, either by transport of materials or by multiplication. The characteristics of the infested areas or the attacked materials, permit recommendation that preventive measures be taken in areas with medium and light soils, especially in those cases where new building construction is projected.
Index terms: *Reticulitermes lucifugus*, soils, termite plague, Uruguay.

[4062] LABORATORY AND FIELD STUDIES ON LARVAL CONTROL OF *CULEX QUINQUEFASCIATUS* MOSQUITOES INHABITING URBAN AND SUBURBAN DHAKA, BANGLADESH

A. Ali[1], M. A. Chowdhury[2], M. I. Hossain[3], M. Ameen[3], D. B. Habiba[3] & A. F. M. Aslam[4], [1]Univ. of Florida, Inst. of Food & Agricultural Sciences, Mid-Florida Research & Education Center, 2725 Binion Rd., Apopka, FL 32703-8504, USA, E-mail: aali@gnv.ifas.ufl.edu; [2]Safeway Pest Control, UAE Moitree Complex, 4, Kemal Ataturk Ave., Banani, Dhaka 1213, Bangladesh, E-mail: safeway@bdmail.net; [3]Dept of Zool., Univ. of Dhaka, Dhaka, Bangladesh; [4]Bangladesh National Museum, Shahbag, Dhaka, Bangladesh.

Five organophosphates (OPs) (chlorpyrifos, chlorpyrifos methyl, fenthion, malathion, and temephos), 3 pyrethroids (bifenthrin, cypermethrin, and permethrin), 1 phenyl pyrazole (fipronil), 2 microbial pesticides (*Bacillus thuringiensis* serovar. *israelensis* [*B.t.i.*] and *Bacillus sphaericus*), and 3 insect growth regulators (IGRs) (diflubenzuron, methoprene and pyriproxyfen) were evaluated against field-collected *Culex quinquefasciatus* larvae from urban Dhaka, Bangladesh. The LC_{90} values of all OPs, except for temephos (LC_{90} = 0.0096 ppm) were high, ranging from 0.13 ppm (fenthion) to 2.882 ppm (chlorpyrifos methyl). Pyrethroid LC_{90} values were 0.021 ppm (bifenthrin), 0.00061 (cypermethrin) and 0.017 ppm (permethrin). Fipronil exhibited a superior activity with LC_{90} value of 0.000896 ppm. Technical powders of *B.t.i.* and *B. sphaericus* (VectoBac® TP and VectoLex® TP, respectively) were considered highly effective against *Cx. quinquefasciatus* larvae. The IGRs also were effective with pyriproxyfen (LC_{90} = 0.0011 ppm), being 3 times and 47 times more active than diflubenzuron (LC_{90} = 0.0034 ppm) and methoprene (LC_{90} = 0.052 ppm), respectively. In general, toxicity ranking of chemicals and microbials tested was phenyl pyrazole > IGRs > pyrethroids > microbials > OPs. In field trials in roadside ditches and polluted ponds, *B.t.i.* (VectoBac® G) at 11.2 and 22.4 kg / ha gave good larval control of *Cx. quinquefasciatus* for 3 days (76%) and 10 days (88%) posttreatment, respectively. *Bacillus sphaericus* (VectoLex® CG) at rates ranging from 5.6 to 22.4 kg / ha gave generally dose-related larval control of 58 – 100% for up to 5 weeks posttreatment.

Index terms: Bioassays, mosquito larvicides, *Bacillus thuringiensis* serovar. *israelensis*, *Bacillus sphaericus*, insect growth regulators, field control.

[4063] INTERATION BETWEEN CROPPING FACTORS AND ACTION OF INSECTS AND MOLDS IN THE DEPRECIATION OF THE NUTRITIONAL QUALITIES OF THE CORN BR 2121-QPM DURING THE STORAGE

R. J. Almeida[1], P. K. Chandra[2], J. P. Santos[3], E. C. Mantovani[3], [1]Trainee at CIMP "CRG"/UFRRJ, BR 465 km 07, 23851-970, Seropédica, RJ, Brazil. E-mail: rjimenezalmeida@yahoo.com; [2] Dept. Animal Science, "Univ. São Paulo", Pirassununga, SP, Brazil. E-mail: pchandra@abelha.zoot.usp.br. [3] Embrapa Milho e Sorgo, C. Postal 151, 35701-970, Sete Lagoas, MG, Brazil. E-mail jamilton@cnpms.embrapa.br, evandro@cnpms.embrapa.br.

Most of the corn genotypes contains an average of 9 to 10% of protein, however, the protein of corn with normal endosperm is poor in lysine and tryptophan, which are two essential amino acids. Researchers from Purdue University, IN, USA, reported the discovery of a mutant gene which was called Opaque$_2$ (O_2), that modifies the protein composition and increases the lysine and tryptophan content in the corn endosperm. Through advanced cycles of selection accomplished at the National Maize and Sorghum Research Center, Sete Lagoas/MG, was obtained, initially, the white color variety BR 451 and more recently the yellow color hybrid BR 2121, both QPM (Quality Protein Maize). This work had the objectives of evaluating the effects and the interactions between two types of harvesting-operations (manual and mechanical) on the mechanical damage to the grains of those varieties (at different grain moisture content) occurred during the harvest, and the action of the maize weevil (*Sitophilus zeamais*), red flour beetle (*Tribolium castaneum*) and molds in the depreciation of the nutritional qualities of the corn BR 2121-QPM, when compared to the BR 3123-Normal, during the storing period of their grains. Grains were analyzed with respect to mechanical damages, germination and vigor after the harvest and during the storage, moisture during storing period, development of the *S. zeamais* and *T. castaneum* in different infestation levels, sanity, and chemical composition on carbohidrates, lipids and proteins (lysine and tryptophan). It was observed that even though the grains of the corn QPM had been susceptible to the attack of molds and stored grain insects, mechanical damage, and loss of germination and vigor, it stood out for the maintenance of its chemical composition on lipids and proteins. However, it is important to point out that the corn QPM deserves larger attention and studies for improving of its technological characteristics in order to become more suitable to storing conditions, and to avoid significant depreciations to the nutritional quality of the corn grains QPM.

Index terms: QPM, mechanical damage, stored grain insects, molds, nutritional quality, storage.

[4064] EFFECTS OF THE NUTRITIONAL QUALITY OF THE CORN GRAINS ON THE INFESTATION STORED GRAIN INSECTS AND MOLDS DURING THE STORAGE

R. J. Almeida[1], J. P. Santos[2], [1]Trainee at CIMP "CRG"/UFRRJ, BR 465 km 07, 23851-970, Seropédica, RJ, Brazil. E-mail rjimenezalmeida@yahoo.com; [2] Embrapa Milho e Sorgo, C. Postal 151, 35701-970, Sete Lagoas, MG, Brazil. E-mail: jamilton@cnpms.embrapa.br.

Most of the corn genotypes contains an average of 9 to 10% of protein, however, the protein of corn with normal endosperm is poor in lysine and tryptophan, which are two essential amino acids. Researchers from Purdue University, IN, USA, reported the discovery of a mutant gene which was called Opaque$_2$ (O_2), that modifies the protein composition and increases the lysine and tryptophan content in the corn endosperm. Through advanced cycles of selection accomplished at the National Maize and Sorghum Research Center, Sete Lagoas/MG, was obtained, initially, the white color variety BR 451 and more recently the yellow color hybrid BR 2121, both QPM (Quality Protein Maize). The objective of this study was to evaluate the effects of the nutritional quality of the grains of the corn QPM (BR 2121) and Normal (BR 3123) on the development of the maize weevil, *Sitophilus zeamais* (COLEOPTERA, Curculionidae), red flour beetle, *Tribolium castaneum* (COLEOPTERA: Tenebrionidae) and molds. The insects were placed in a plastic container containing 3 kg of undamage and healthy corn grains and covered with organdy. Four level of infestations were used: 75, 150 and 300 couple of insects plus control (replicate 3 times for each corn variety). Evaluations of the numbers of insects and the infestation by fungi were done at 90 and 150 days after the introduction of the insects in the containers. The sanity analysis of the grains was made through the method of filter paper with freeze according to the rules for seed analysis. The corn-QPM (BR 2121) favored the increase of the population density of the insects, and the percentage of damage grains when compared to the corn-Normal (BR 3123). The corn-QPM also favored the growth of the fungi *Aspergilus*, *Fusarium moniliforme* and *Penicillium*. The results showed that corn-QPM deserves larger attention and studies for improving of its technological characteristics in order to became more suitable to actual storing technology.

Index terms: stored grain insects, fungi, nutritional quality, storage.

4065] THE HISTORY OF THE INSECTICIDE FENOXYCARB IN ITALY

A. Arzone & M. Dolci, Di.Va.P.R.A. Univ. of Torino, Via L. da Vinci 44, 10095 GRUGLIASCO (TO) Italy

Since its arrival in the Italian agriculture practice, in May 1988, to control the pests of apple orchards, fenoxycarb caused drastic losses to sericulture, above all in the northeastern part of this country, where both apple orchards and silkworms are commonly grown. Silkworms were increasing in hunger, size, and longevity, but were not able to spin their cocoons, and the breedings were destroyed. Under the pressure of the Silkgrowers' National Association and the results of the research on this phenomenon, namely the sensitivity of the silkworm to few fg/larva of fenoxycarb and the drift of this compound, the Italian Government year by year prohibited or permitted the use of this insecticide and the silk production showed a curious coming and going, as illustrated below, according with the prohibition or the permission to use fenoxycarb which, since 1995, has been employed only in the Province of Bolzano, near the Austrian border.

[4066] SMALL WILD MAMMALS SIPHONAPTERA FROM ITAPEVI COUNTY, STATE OF SÃO PAULO, BRAZIL

M. Arzua[1], D. M. Barros-Battesti[2], P. M. Linardi[3*] & M. Miretzki[1], [1]Museu de Hist. Nat. Capão da Imbuia, Dept. Zoo., PMCPR, R. Benedito Conceição, 407, 82810-080, Curitiba, PR, BR, E-mail arz@cwb.matrix.com.br; [2]Lab. Parasitologia, Inst. Butantan, Ave. Vital Brazil, 1500, 05503-900, São Paulo, SP, BR; [3*] Dept. Parasitol. ICB/Univ. Fed. Minas Gerais, 30161-970, Belo Horizonte, MG, BR, Fellowship of CNPq, E-mail linardi@mono.icb.ufmg.br. *Supported by FAPESP.

The aim of this work is to study the relationship between fleas and small wild mammals, in a fragment of Atlantic Forest, in the city of Itapevi, State of São Paulo. The study was carried out from January, 1995 to June, 1996 and from January 1999 to December 1999, in a total of 30 field stages. The mammals were captured by means of monthly trappings, of five consecutive days. After anesthesia, the animals were brushed in a white container and the fleas were maintained in alcohol 70% for posterior slide preparation and identification. During this period, 297 mammals were captured, of which 55% (N=163) were Didelphimorphia and 45% (N=134) were Rodentia. Of these 37% (110) were infested with 713 flea specimens from 4 families and 11 species. The Rodentia order was represented by *Akodon cursor*, *Bolomys lasiurus*, *Euryzygomatomys spinosus*, *Oryzomys angouya*, *Oligoryzomys nigripes*, *Oxymycterus hispidus*, *O. nasutus*, *Rattus rattus* and *Cavia aperea*. A hundred and one fleas were collected on rodents: Rhopalopsyllidae - *Polygenis atopus* (N=33; 32%), *P. axius* (N=3; 3%), *P. pradoi* (N=27; 27%), *P. rimatus* (N=25; 25%), *P. roberti* (N=2; 2%), *P. tripus* (N=1; 1%); Stephanocircidae - *Craneopsylla minerva* (1; 1%) e Pulicidae - *Ctenocephalides felis* (N=3; 3%). The most infested rodent was *B. lasiurus*, on which six different flea species were collected. The order Didelphimorphia was represented by *Didelphis aurita* and *Marmosops incanus*. Only *D. aurita* was found to be infested by 612 flea specimens: *P. atopus* (N=392; 64%), *P. occidentalis* (N=4; 0.6%), *P. pradoi* (N=12; 2%), *P. rimatus* (N=34; 6%), *P. tripus* (N=5; 0.8%), *Rhopalopsyllus lutzi* (N=24; 4%), *C. minerva* (N=3; 0.5%), *C. felis* (N=116; 19%) and Hystrichopsyllidae - *Adoratopsylla antiquorum* (N=19; 3%). *P. atopus* was the most frequent species found on both types of host and during both study periods (1995/1996 e 1999). Although, in 1999, there was a predominance of *P. rimatus* during the dry season (April to September) and of *P. atopus* and *P. pradoi* during the rainy season (October to March).This could be related to the uncommon climate changes that occurred in this particular region during the year of 1999. The temperatures were higher and there was less rain.
Index terms: fleas - rodents - marsupials

[4067] ENZYME LINKED IMMUNOASSAY TESTS FOR INSECT MYOSIN IN WHEAT: EFFECTS OF MYOSIN DEGRADATION

M. B. Atui[1], P. W. Flinn[2], F. A. Lázzari[3], [1]Univ. Federal do Paraná, P.O. Box 19020, 81.531-990 - Curitiba, Paraná, Brazil, E-mail: marcatui@hotmail.com; [2]Grain Marketing & Production Research Center, 1515 College Ave., Manhattan, KS 66502, USA, E-mail: flinn@usgmrl.ksu.edu; [3]Univ. Federal do Paraná, P.O. Box 19020, 81.531-990 - Curitiba, Paraná, Brazil, E-mail: lazzari@netpar.com.br.

Current tests for insect contamination of grain and milled grain products are based on insect fragment count. These tests suffer from subjectivity, are time consuming, and are relatively expensive. Recently, an ELISA immunoassay was developed for dection of insect muscle protein, myosin, in stored grain or flour. We wanted to determine if myosin degrades under typical storage conditions. Hard red winter wheat kernels were infested with *Rhyzopertha dominica* eggs. The infested kernels were placed into individual vials and held at 32°C and 65% RH for 20 days to allow them to develop to 4th instar. After 20 days, when they reached 4th instar, the larvae were killed by exposing them to phosphine gas for 24 h. Kernels containing dead 4th-instar *R. dominica* were held at 65% rh and 32°C for 0, 14, 28, and 56-days post-fumigation. The wheat samples were prepared by adding 2 infested kernels to 12.5g of unifested wheat kernels. The wheat samples were then processed in a blender with a buffer solution. Each treatment was replicated 5 times. Myosin was measured using a commercial ELISA method (Biotect Inc., Austin TX). Myosin degraded in the wheat kernels that were infested with *R. dominica* larva. The mean myosin concentrations after 0, 14, 28 and 56 days post-fumigation were: 1.40, 0.70, 1.02, 0.97 weevil equivalents per 50g wheat. The percentage degradation after 14, 28 and 56 days were 50, 27, and 31%. This study showed that ELISA immunoassay is appropriate for measuring myosin content in flour samples. However, since myosin degrades, the test is most useful for recently milled samples.
Index terms: stored grain, insect fragments, immunodiagnostic assay.

[4068] ENZYME LINKED IMMUNOASSAY TESTS FOR INSECT MYOSIN IN WHEAT: EFFECTS OF MYOSIN DEGRADATION.

M. B. Atui[1], P. W. Flinn[2], F. A. Lázzari[3].
[1]Univ. Federal do Paraná, P.O. Box 19020, 81.531-990 - Curitiba, Paraná, Brazil, E-mail marcatui@hotmail.com; [2]Grain Marketing & Production Research Center, 1515 College Ave., Manhattan, KS 66502, USA, E-mail flinn@usgmrl.ksu.edu; [3]Univ. Federal do Paraná, P.O. Box 19020, 81.531-990 - Curitiba, Paraná, Brazil, E-mail lazzari@netpar.com.br.

Current tests for insect contamination of grain and milled grain products are based on insect fragment count. These tests suffer from subjectivity, are time consuming, and are relatively expensive. Recently, an ELISA immunoassay was developed for dection of insect muscle protein, myosin, in stored grain or flour. We wanted to determine if myosin degrades under typical storage conditions. Hard red winter wheat kernels were infested with *Rhyzopertha dominica* eggs. The infested kernels were placed into individual vials and held at 32°C and 65% RH for 20 days to allow them to develop to 4th instar. After 20 days, when they reached 4th instar, the larvae were killed by exposing them to phosphine gas for 24 h. Kernels containing dead 4th-instar *R. dominica* were held at 65% rh and 32°C for 0, 14, 28, and 56-days post-fumigation. The wheat samples were prepared by adding 2 infested kernels to 12.5g of unifested wheat kernels. The wheat samples were then processed in a blender with a buffer solution. Each treatment was replicated 5 times. Myosin was measured using a commercial ELISA method (Biotect Inc., Austin TX). Myosin degraded in the wheat kernels that were infested with *R. dominica* larva. The mean myosin concentrations after 0, 14, 28 and 56 days post-fumigation were: 1.40, 0.70, 1.02, 0.97 weevil equivalents per 50g wheat. The percentage degradation after 14, 28 and 56 days were 50, 27, and 31%. This study showed that ELISA immunoassay is appropriate for measuring myosin content in flour samples. However, since myosin degrades, the test is most useful for recently milled samples.

[4069] BEHAVIOUR'S ESTIMATION OF *PANSTRONGYLUS MEGISTUS* (HEMIPTERA-REDUVIIDAE) UNDER THE ACTION OF LIME (CAOH)

J.M.S. Barata[1], J.A. da Rosa[2], A.M. Marassá[3], W. Ceretti-Jr[3] &, L.M. Caetano[1], 1 Faculdade de Saúde Pública/USP, São Paulo, Brasil, 2 Depto. de Parasitologia/UNESP, Araraquara, SP, Brasil; 3 Aluno da Pós-Graduação da Faculdade de Saúde Pública/USP, São Paulo,SP, Brasil; 1* Estagiária da Faculdade de Saúde Pública/USP, São Paulo, SP, Brasil.

Among the species of Triatominae that are vectors of Chagas' disease *Panstrongylus megistus* is distinguished by the maintenance of the zooanthropotic cycle and also to favour dwelling in persisting areas of transmission. The aim of this experiment was to verify the lime action (CaOH), which was applied at substrate and the *Panstrongylus megistus* adult's behaviour that were exposed to it as a measure to encourage its control, according to its facilities and lower cost. Three groups of males and females of *P.megistus* were established and were scattered on three wired wooden boxes. The first box was totally painted, the second one had its walls and floor partially painted and the third one was unpainted. 34 specimens (18 males,15 females) were kept in the painted box (group1); 32 specimens (17 males,16 females) were kept in the partially painted box and 32 specimens (16 males,16 females) were kept in the box control. The three groups were fed each 15 days in chicken and maintained under the following conditions: 15° - 32° C and 55-95 % of relative humidity. As a result, the surviving rates were G1 (males)= 17,27 days and G1 (females)= 20,25 days; Group 2 (males)= 28,94 days, Group 2 (females)= 32,06 days and Group 3 (males)= 72,81 days, Group 3 (females)= 73,93 days. Among this groups which were daily observed; Group 3 was the only one which had hatched nymphs. The females from the three groups outlived longer than the males and this varied with the lime's exposition. According to these results, lime produced effectual action to control these insects in laboratory conditions.

[4070] USE OF SYNTHETIC PHEROMONE TRAPS FOR MONITORING OF STORED GRAINS PESTS

T.B. de Campos & S.M. Rodrigues Netto, Centro de Sanidade Vegetal, Instituto Biológico, Av. Cons. Rodrigues Alves 1252, São Paulo, SP, 04014-002, Brasil, E-mail campos@biologico.br

Considering the importance of stored grains preservation, tests were carried out in Tatuí, São Paulo State, Brazil, in October, 1998 and December, 1999. The experiments intended to evaluate the efficiency of sex pheromone traps for monitoring and controlling of moths *Ephestia cautella* and *Plodia interpunctella* in store bulk. The beetles *Rhizopertha dominica* and *Tribolium castaneum* were also studied in conventional store system. Six treatments with four replications were applied in randomized blocks. The counting of trapped insects was made every week during the of period of experiment. *E. cautella* and *P. interpunctella* traps distributed at two meters above the cereal grains surface and collected 173.18 moths of both species. Traps for *R. dominica* and *T. castaneum* were distributed at two meters above the floor and captured 18.59 and 11.93 beetles, respectively. The results confirm the importance of pheromones traps in the monitoring stored grains pests, and an excellent tool in the system of integrated control.

Index terms: *Ephestia cautella*, *Plodia interpunctella*, *Rhizopertha dominica*, *Tribolium castaneum*, integrated control.

[4071] THE EFFICACY OF FOUR INSECT GROWTH REGULATORS AGAINST MITE PESTS IN STORED GRAIN

D. A. Collins, D. A. Cook & J. Bell, Central Science Laboratory, Sand Hutton, York, YO41 1LZ, U.K.

Alternatives to the use of organophosphorus compounds for the protection of stored grain against mite infestations were investigated. Two juvenile hormone analogues (methoprene and fenoxycarb) and two chitin synthesis inhibitors (diflubenzuron and flufenoxuron) were assessed for their efficacy, when admixed with wheat, against mixed stages of organophosphorus-susceptible strains of *Acarus siro*, *Lepidoglyphus destructor* and *Tyrophagus putrescentiae* at 15°C and 75% relative humidity (r.h.). Methoprene and diflubenzuron were applied at 1000, 100, 10 and 1 mg kg^{-1}, whereas fenoxycarb and flufenoxuron were applied at 100, 10, 1 and 0.1 mg kg^{-1}. Population inhibition was assessed after periods long enough to include the passing of at least one generation. Flufenoxuron appeared the most effective compound against all three mite species, with > 95 % mean inhibition at doses of 1, 10 and 100 mg kg^{-1} and against *L. destructor* at 0.1 mg kg^{-1}. Methoprene produced > 95 % mean inhibition of all three mite species at 1000 mg kg^{-1} and also of *A. siro* at 100 mg kg^{-1}. Diflubenzuron was most effective against *A. siro* inhibiting the population by > 95 % at 1000 mg kg^{-1}, whereas fenoxycarb was most effective against *A. siro* and *T. putrescentiae* producing a mean inhibition of approximately 55 % at 100 mg kg^{-1}. Further experiments investigated the efficacy of flufenoxuron against susceptible and organophosphorus-resistant strains of mites and insects on wheat stored at 10°C and 25°C at different times after treatment.

Index terms : *Acarus siro*, *Lepidoglyphus destructor*, *Tyrophagus putrescentiae*

[4072] SURVEY AND IDENTIFICATION OF TERMITES (INSECTA: ISOPTERA) IN AN URBAN AREA OF PIRACICABA, STATE OF SÃO PAULO, BRAZIL

E.S.R. Eleotério[1] & E. Berti-Filho[2], [1]Depto. de Ciências Florestais ESALQ/USP. [2]Depto. de Entomologia, Fitopatologia e Zoologia Agrícola - ESALQ/USP, C.P. 9, 13418-900, Piracicaba, SP. eberti@carpa.ciagri.usp.br. Financial support: CAPES.

This research deals with the occurrence of termites in an urban area of Piracicaba City, State of São Paulo, Brazil. Samples of home and commercial buildings were surveyed and the termites collected were identified. Termite occurrence was related to building age, type of material used in buildings and preventive care upon construction, humidity content of wood and health condition of urban trees. The most frequent species were the drywood termite, *Cryptotermes brevis* (Walker), and the subterranean termite *Coptotermes havilandi* (Holmgren). It was observed that the risk of termite attacks, as well as the number of attacks per building showed a tendency to increase with the age of the buildings. However no relationship was observed between the occurrence of termites in the trees nearby and attack in the buildings.

Index terms: *Cryptotermes*, *Coptotermes*, city area, buildings

[4073] MODIFIED ATMOSPHERE IN BRAZILIAN GRAIN STORAGE

L. R. D'A. Faroni[1], P. A. Berbert[2] & A. P. R. A. Silva[1], [1]Dept. de Engenharia Agrícola, Universidade Federal de Viçosa, Viçosa, MG 36571-000, Brazil, E-mail: lfaroni@mail.ufv.br; [2]Centro de Ciências e Tecnologias Agropecuárias, Univ. Estadual do Norte Fluminense, Av. Alberto Lamego, 2000, Campos dos Goytacazes, RJ 28015-620, Brazil.

The use of modified atmospheres in grain storage represents an alternative to the fumigation practice due to several advantages of this method compared to currently used fumigants. This control method is based on the alteration of the gas proportion of normal atmosphere aiming to obtain a lethal atmosphere to stored-grain insect-pests. In Brazil several studies have been carried out lately, as in other countries, to make feasible the routine utilization of modified atmospheres in grain mills and storage units. Different concentrations of carbon dioxide complemented with artificial air were initially used for controlling *Sitophilus zeamais* and its influence on the physiological quality of maize seeds was also assessed. The results obtained indicate that an atmosphere with > 50% CO_2 would be necessary to eliminate all of the insect developmental phases in about 10 days. In other study CO_2 was associated with phosphine aiming na increase in mortality for controlling insecticide resistant populations of *Rhyzopertha dominica* and *S. zeamais*. In order to speed the insect mortality, the association of high CO_2 and nitrogen levels with different phosphine concentrations was also tried for controlling *R. dominica* and *S. zeamais*. The effective control of these species was achieved at 0.5 $g.m^{-3}$ after 120 hours of exposure. However, such mixture is not economically viable for commercial use, therefore an atmosphere of 100% CO_2 with different phosphine concentrations and exposure periods were tried for controlling *S. zeamais* and *Tribolium castaneum*. With the combination 0.75 $g.m^{-3}$ of phosphine after 120 hours exposure was necessary for effective control. At present we are investigating the association between carbon dioxide, phosphine, and heat aiming to decrease the requested exposure period for effective control since the methods so far proposed do not answer the needs of the mill industry.

Index terms: controlled atmosphere; stored grain; carbon dioxide-phosphine; insect control.

[4074] EVALUATION OF INSECTICIDES TO CONTROL *Sitophilus oryzae* (COLEOPTERA: CURCULIONIDAE) AND *Rhyzopertha dominica* IN STORED BARLEY

R. S. Furiatti[1], P.R.V.S. Pereira[1] & A. R. Pinto Jr.[2], [1] Depto de Fitotecnia e Fitossanidade, Univ. Est. de Ponta Grossa, Caixa Postal 992, 84100-970, Ponta Grossa, PR, e-mail: furiatti@centerline.com.br, prvalle@netpar.com.br; [2] Agrius Capac. e Análises Agronômicas, Curitiba, PR, e-mail: arpinto@netpar.com.br

The efficacy of insecticides was determined against *Sitophilus oryzae* (L.) (Coleoptera: Curculionidae) and *Rhyzopertha dominica* (Fab.) (Coleoptera: Bostrichidae) exposed to treated wheat. The treatments were applied with a propelling air atomizer using 50 ml of mixture/kg of wheat except in the control which used only water. For each treatment 1 .2 kg of wheat were treated in plastic bags and stored in raffia bags in a climatized room (25 f 2°C). Fifteen days after treatment 200 g of the treated wheat from each treatment was infested with 40 adult insects of each species and this procedure was repeated every 30 days until 180 days after treatment. The number of dead insects was counted 1 5 days after each infestation, so the evaluations were made at 30, 60, 90, 120, 150 and 1 RO days after the insecticide application. Fenitrothion (10 ml/t), esfenvalerate + fenitrothion + piperonyl butoxide (15, 20 and 25 ml/t) and deltamethrin + piperonyl butoxide (15 ml/t), were effective against *Sitophilus oryzae* until 180 days after treatment. Esfenvalerate + fenitrothion + piperonyl butoxide (20 and 25 ml/t) and deltamethrin + piperonyl butoxide (15 ml/t) were effective against *Rhyzopertha dominica* until 180 days after treatment. Esfenvalerate + fenitrothion + piperonyl butoxide (15 ml/t) lost their efficacy against this insect, 120 days after treatment.

Index terms: Chemical control, *Rhyzopertha dominica*, *Sitophilus oryzae*

[4075] DISPERSION OF *AEDES AEGYPTI* AND *AEDES ALBOPICTUS* AND THEIR RELATIONSHIP TO DENGUE TRANSMISSION IN THE STATE OF RIO DE JANEIRO, BRAZIL, 1986-1997

A. K. R. Galardo, I. A. Braga[2] & J.R. Pujol-Luz, [3], [1] Aluno do Curso de Mestrado em Biologia Animal da Universidade Federal Rural do Rio de Janeiro, Biólogo do Centro de Controle de Zoonoses, Paracambi, RJ/FUNASA/RJ; [2] MSc, Gerente de Entomologia e Pesquisa Operacional da Fundação Nacional de Saúde/M.S ; [3] Phd, Professor Adjunto do Instituto de Biologia Animal da Universidade Federal Rural do Rio de Janeiro (CNPq/Proc. 300265/96-4)

Until 1986, only *Aedes aegypti* was reported in Brazil. In May of that year, *Aedes albopictus* was first reported from the county of Itaguai in the State of Rio de Janeiro. This was also the year of the first dengue epidemic in Rio de Janeiro where 35,000 cases reported and an estimated 1 million of persons had dengue infections. This study involved a survey of dengue cases and the presence of the two vectors from 1986 to 1997. We related the distribution of *Aedes aegypti* and *Ae. albopictus* to the dengue transmission. In 1986, only 2.3% of the municipalities of the State had *Ae. albopictus*, 2.3% had both species, and 95% had only *Ae. aegypti*. In this 12-year period, the distribution of *Ae. albopictus* increased remarkably. In 1997, this species was present in 100% of the municipalities; 24.2% had only *Ae. albopictus* and 75.8% had both species. During these years, 175 (0.07%) cases of dengue were from municipalities that only had *Ae. albopictus*, 32,875 cases (13.3%) from municipalities with only *Ae. aegypti*, and 214,551 cases (86.7%) from municipalities with both species. These data suggest that *Ae. albopictus* is not very important in the transmission of dengue in the State of Rio de Janeiro. Municipalities with *Ae. aegypti* only had 183 times the number of the cases that municipalities where only *Ae. albopictus* was reported. No dengue virus isolations have been reported from *Ae. albopictus* and the 33 cases of dengue from the following 18 municipalities are probably imported cases.

[4076] EVALUATION OF TEMEPHOS SUSCEPTIBILITY IN *AEDES AEGYPTI* IN RIO DE JANEIRO, BRAZIL

A. K. R. Galardo[1], I.A. Braga [2] & S. S. Soares[3], [1] Aluno do Curso de Mestrado em Biologia Animal da Universidade Federal Rural do Rio de Janeiro, Biólogo do Centro de Controle de Zoonoses, Paracambi, RJ/FUNASA/RJ; [2] MSc, Gerente de Entomologia e Pesquisa Operacional da Fundação Nacional de Saúde/M.S; [3] Fundação Nacional de Saúde/RJ

Temephos susceptibility was evaluated in 7 municipalities in the State of Rio de Janeiro. This insecticide has been used intensively to control dengue epidemics since 1986. *Ae. aegypti* were collected and pooled from several locations in each community using enhanced CDC ovitraps and the F1 generation were compared with a standard Rockefeller strain using the diagnostic dosage of 0.012 mg ai/L. The results indicate the occurrence of resistance in all of the municipalities evaluated. The resulting mortalities were 23,5% for São Gonçalo; 32,5% for Rio de Janeiro; 34,6% for Niterói, 34,8 % for Caxias , 44% for São João de Meriti, 58,2% for New Iguaçu and 74% for Campos. The Rockefeller strain was had a mortality of 100%.

[4077] PARSIMONY ANALYSIS OF ENDEMICITY AND ITS APPLICATION TO DETECT IIIGII ENDEMISM AREAS USING COMBINED DATA FROM INSECTS, VERTEBRATES, AND PLANTS, FROM THE IBERIAN PENINSULA

E. García-Barros[1], M.P. Gurrea[1], J. Martín[1], M.J. Sanz[1], J.C. Moreno[1], J.C. Simón[1], M.J. Luciáñez[1], M.L. Munguira[1] & II. Sainz[1], [1]Dept. Biology, Univ. Autónoma de Madrid, 28049 Madrid, Spain, E-mail garcia.barros@uam.es.

The use of parsimony analysis (frequently employed to construct hypotheses of phylogenetic relatedness among taxa) has been proposed to identify endemism areas, and/or as a way to group area units into larger biogeographic regions that can be characterised by clusters of endemic species with coincident distributions. The authors applied PAE (Parsimony Analysis of Endemicity) to a matrix of presence/absence data of Iberian endemic species, using large area units of 100 x 100 km. The taxa were selected to combine information from insects (several families of Lepidoptera, Coleoptera and Collembola), with that on plants (monocotyledons, ferns), and tetrapods (mammals, reptiles and amphibians). Only species occurring in two or more area units were used. The resulting matrix contained 70 area units (used as "taxa") and more than 300 species (used as "characters"), and was processed using Wagner parsimony. Homoplasy was important, since the consistency index obtained were in the range 0.25-0.30 (retention index values were 0.40-0.50). As a result, multiple trees were obtained that were summarised using strict consensus. The areas highlighted by this procedure coincide to a large extent with those generally designated as relevant from the points of view of the number of endemic species. However, areas that may be considered as transitional, or as contact areas between two or more biogeographic units, are difficult to identify with this method. This is due to the fact that the number of faunal elements (species) shared with other areas, may overrule the number of endemics restricted to such areas. While the procedure may be useful as a complementary procedure, it is shown that a set of successive analyses is required to identify all endemism areas. In the final stage, the procedure becomes equivalent to identifying all the subsets of two or more area units that share one or more species not found elsewhere. Because this kind of analysis is specially sensitive to imperfectly known distributions, data from insects are less informative than a priori expected.

Index terms: Biogeography, Endemic, PAE, Portugal, Spain

[4078] HUMIDITY PREFERENCE AND WATER LOSS IN LARVAE OF THE BROWN HOUSE MOTH (*HOFMANNOPHILA PSEUDOSPRETELLA*)

R. Haeusler & W. Topp, Dep. of Zoology, Univ. of Cologne, D-50923 Koeln. Germany

Hofmannophila pseudospretella originates from the subtropical regions of Asia. During this century the moth expanded its range to include the Atlantic zone of Western Europe where it inhabited tree caves and birds' nests. From these biotopes *H. pseudospretella* invaded houses and storerooms. Because of its abundance and polyphagy it became one of the most significant pest species in Western Europe. The water balance *of H. pseudospretella* larvae was studied at 20 °C and different relative humidities in darkness. The following results were obtained: 1. Optimal development took place at vapor pressure deficiencies (vpd) ≤ 351 Pa (i.e. 20 °C, rh = 86 %). At higher vpd, growth of larvae was reduced and resulted in pupae of lower weight ($p < 0.001$). Smaller females produced a lower number of eggs ($p < 0.001$). 2. Larvae produce cocoons. The cocoon protected the larvae at favorable conditions (≤ 363 Pa) minimizing water loss in the course of their development and affected the fertility in females. It had no effect on water loss of larvae at vpd ≥ 363 Pa. 3. Evaporation at unfavorably dry conditions (i.e. 20 °C, rh < 5%) was at 55 $\mu g\ cm^{-2}\ h^{-1}$ on the average. This corresponds with the evaporation rates of many arthropods, which live in mesic habitats. 4. Larvae tolerated high losses of total body water. Total water content (= percentage of the species' fresh weight) of larvae was found to be 70%. Under experimental conditions, a body water loss of 40% (i.e. fresh weight loss of 47%) was not lethal. Data accounted for 65% of the variance (ANOVA) with high values for vpd (238 - 2455 Pa, 27%) and low values for nutrition (starving vs. fed individuals, 11%) or the duration of a particular vpd (0-622 h, 12%). Water loss under extremely dry conditions (2455 Pa) cannot be compensated by nutrition. 5. Starving individuals reduced their total water content from 70 to 54% after 10 days when exposed to 2455 Pa. This value remained constant for at least one month. In analogy to the results obtained from other insects, we conclude that the larvae of *H. pseudospretella* entered a dormant stage characterized by a low metabolism when exposed to water stress. This lower metabolism occurred even if nutrition was offered ad-lib. 6. Fresh weight loss of individuals in a dormant stage was lower than of individuals in a non-dormant stage ($p < 0.001$).

[4079] EFFECT OF THE SPRAYING TEMPERATURE ON THE DEGRADATION AND BIOLOGICAL EFFECTIVENESS OF PIRIMIPHOS-METHYL ON STORED GRAINS

L. S. Hamacher[1], L. R. D'A. Faroni[1], R. N. C. Guedes[2] & M. E. L. R. Queiroz[3], [1]Dept. de Engenharia Agrícola, Universidade Federal de Viçosa, Viçosa, MG 36571-000, Brazil, E-mail: lfaroni@mail.ufv.br; [2]Dept. de Biologia Animal, Universidade Federal de Viçosa, Viçosa, MG 36571-000, Brazil. [3]Dept. de Química, Universidade Federal de Viçosa, Viçosa, MG 36571-000, Brazil.

According to reports from storage unit managers and thermometric recordings, the air temperature near the conveyor belt in a storage facility can reach up to 50°C at the warmest period of the day. Since it is possible that these high temperatures can interfere in the insecticide action, this study was carried out aiming to assess the immediate and latent effects of high air temperatures during the spraying of pirimiphos-methyl on maize grains. To achieve that, grains were sprayed with insecticide within a climatic chamber at 25, 30, 35, 40, 45, and 50°C, and 50% relative humidity. An optimized technique developed from the multiresidue extraction technique from Luke was used to assess the residue level at the sprayed samples. Such a technique provided an extraction efficiency of 86% for the active ingredient. The extractions were carried out soon after and every 30 days and up to 90 days after spraying. Twenty insects of the species *Sitophilus zeamais* were placed in a Petri dish containing sprayed grains, and kept in chambers of biological development on ideal conditions (27°C). The insecticide biological effect was evaluated after 24 and 48 hours after exposure to the sprayed grain. Abbott's formula was used for the correction for natural mortality. The biological effectiveness tests were carried out every 15 days after spraying, up to 90 days. The maize pirimiphos-methyl residue decreased with storage time and the increase in air temperature led to a higher insecticide degradation. The biological effectiveness of pirimiphos-methyl sprayed maize grain decreased with the increase on storage time, and the increase in air temperature during the insecticide spraying also decreased the insecticide biological effectiveness.
Index terms: *Sitophilus zeamais*, temperature, residue insecticide, storage period.

[4080] LABORATORY AND GRANARY TRIALS USING PEA PROTEIN TO CONTROL STORED-PRODUCT INSECTS

Xingwei Hou[1] & Paul Fields[2]. [1]Dept. of Entomology, University of Manitoba, Winnipeg, MB, Canada, R3T, 2N2. E-mail: xhou@em.agr.ca; [2]Cereal Research Centre, Agriculture & Agri-Food Canada, 195 Dafoe Road, Winnipeg, MB, Canada, R3T 2M9. E-mail: pfields@em.agr.ca.

A protein-rich pea flour obtained from Parrheim Foods Ltd. (Saskatoon, Canada) was toxic to stored-grain insects, reduced the second generation and was repellent. Rice weevil (*Sitophilus oryzae*) was the most sensitive insect, followed by rusty grain beetle (*Cryptolestes ferrugineus*) which was more susceptible than red flour beetle (*Tribolium castaneum*). Insects held on wheat and barley showed similar sensitivities to pea protein, whereas insects held on maize were less sensitive. Granary tests were conducted from late August until late October. Granaries were filled with approximately 10 t of barley and treated with 0.1% pea protein (entire grain bulk), 0.5% pea protein (top half only) or untreated (2 granaries/treatment). *Sitophilus oryzae, C. ferrugineus* and *T. castaneum* were placed on the top surface of the grain (ca. 2 adults of each species/kg barley). The barley was sampled for insects at 4 times during the 2-month test (10 one-kg samples/granary). Grain samples from the bin were also incubated in the laboratory to estimate the number of offspring in the grain. *Sitophilus oryzae* was controlled at 0.1%, *C. ferrugineus* and *T. castaneum* were reduced at 0.1% pea protein. The treatment of 0.5% was similar to the 0.1% treatment in the treated half of the bin, but insects were able to reached the untreated grain. Pea protein also increased the movement of the three species tested, in both granary and laboratory trials.
Index terms: *Sitophilus, Cryptolestes, Tribolium*, plant fractions

[4081] HONEY-CROP MODIFIES THE CLASSICAL CONDIGIONING OF PROBOSCIS EXTENTION REFLEX (PER) IN HONEYBEES

N. Ichikawa[1], and M. Sasaki[2], [1, 2]Laboratory of Entomology, Faculty of Agriculture, Tamagawa University, Machida, Tokyo, 194-8610 Japan. [2]E-mail sasaki@agr.tamagawa.ac.jp

Proboscis extension is conditioned in honeybees with an odor as the conditioned stimulus (CS) and sucrose solution as the unconditioned stimulus (US). We report the effect of the degree of expansion of honey crop on the conditioning of PER response, by adjusting the crop volume of worker *Apis mellifera* artificially at 0, 10 or 30 □l. Bees of 30 □l group showed the lowest responsiveness in both acquisition and retention of PER conditioning, whereas bees of 0 and 10 □l group resulted high percentage of conditioned response (CR), suggesting that the crop expansion affected on the association between CS and US in some way. The effects of crop volume on CR and UR (unconditioned response) were then evaluated by using the bees confirmed to be once conditioned. Bees of 30 □l group were inhibited in CR rather than in UR. Proboscis extension was facilitated by the bees of □**larger amount, but the effect was** rarely due to the experience of US which was delivered to the antennae then to the proboscis. The results showed the considerable importance of crop volume in modifying the classical PER conditioning.
Index terms: *Apis mellifera*, associative learning

[4082] CONTROL OF HOUSE FLIES WITH LARVICIDE AND POISON BAITS

S. Ignatowicz[1], J. Swietoslawski[2], [1]Warsaw Agricultural University, Department of Applied Entomology, Nowoursynowska 166, 02-787 Warszawa; [2]„BEST-PEST", Mozdzierzowcow 6a, 43-200 Jaworzno, Poland.

Baits (Tables „Muchomox"; „Muchomox - Granulat") containing 1% methomyl and pheromone (Z)-9-tricosene used together with a larvicide („Muchomox - Larwicyd") seem to be an improved method of fly control. We evaluated the efficacy of the toxic (1% methomyl + synergist) baits with a sex pheromone, (Z)-9-tricosene, in controlling adults of the house fly, *Musca domestica* (L.). The poison bait was distributed on the carton Tables „Muchomox" in a form of color pattern and prints. Each table contained a shelf to collect the dead flies. The tables were placed in enclosures infested with house flies, and number of dead insects was recorded daily for a week period. A fly control method with the „Muchomox - Granulat" and „Muchomox - Larwicyd" was incorporated in the 150 m^2 enclosure with cattle. „Muchomox - Granulat" was used at a concentration of 40 g per 10 L, and „Muchomox - Larwicyd" was placed on 6 trays (40 x 25 cm). The efficacy of the method was assessed using Tables „Muchomox". Tables „Muchomox" were found to be effective in controlling house flies for at least 2 month period. Poison baits provided rapid knockdown of adult flies, causing large numbers of flies to die near the baited areas. Number of dead flies found in the shelter of the Tables „Muchomox" or under them varied with the location, time of the treatment, and with the level of infestation of the enclosed space. Tables „Muchomox" may be used to determine the changes in population density after the treatments aimed to control the immature stages, and simultaneously, to enhance the effectivity of these treatments. A fly control method with the „Muchomox - Granulat" and „Muchomox - Larwicyd" was incorporated in the 150 m^2 enclosure with cattle. „Muchomox - Larwicyd" was used at a concentration of 40 g per 10 L, and „Muchomox - Granulat" was placed on 6 trays (40 x 25 cm). At the beginning of the program about 190 flies were catched on the sticky trap. After 2 weeks, the Tables „MUCHOMOX" killed about 20 insects daily, indicating a high efficacy of this program. The main advantage of the poison baits is that they may be placed in scattered places within the enclosure, whereas the non-residual insecticides (pyrethroids) must be sprayed on all inner and outer surfaces of the buildings.

Index terms: *Musca domestica*, tricosene, methomyl.

[4083] CONTROL OF PSOCIDS IN STORED WHEAT AND ITS PRODUCTS

I. Kalinovi[1] & V. Rozman[1], [1]Facul. of Agriculture, Univ.J.J. Strossmayer in Osijek, P. O. Box 719, 31000 Osijek,Croatia, E-mail kirma@suncokret.pfos.hr .

Psocids (*Psocoptera*) are insects widespread in stored wheat and its products (flour, dough, gric, etc.) in most storage in the Republic of Croatia. During the years 1975-1999, 17 species of *Psocoptera*, suborder *Trogiomorpha, Troctomorpha* and *Psocomorpha* were investigated as following: *Trogium pulsatorium, Lepinotus reticulatus, L. inquillinus, Dorypteryx domestica, Psyllipsocus ramburi* f. *destructor, P. ramburi* f. *troglodytes, Liposcelis bostrichophila, L. corrodens, L. brunnea, L. decolor, L. entomophila, L. mendax, L. paeta, L. pearmani, L. pubescens, L. tricolor, Lachesilla pedicularia.* On stored wheat in silos most widespread was genus *Liposcelis,* species *L. decolor.* The detection of *L. tricolor,* which was, in our opinion carried into the silos at the harvest time, is especially important. Psocids are harmful insects. They transmit harmful microorganisms – fungi and bacteria on their bodies, hair, and in faeces, spreading them all over the storehouse and infesting the products. Psocids are found to be harmful pests on seed goods as well for causing damage on seed kernels. Control of *Psocoptera* in stored wheat and its products is partly based on the integrated pest menagament (IPM): sanitation of store houses (by cleaning and removing old wheat supply, desinfection of empty spaces with insecticides of a.i. pirimiphos-methyl, dichlorovos, pyrethrin); by physical methods (aeration on low temperature 5-10° C, high temp. 32-34° C). Chemical control of psocids was considerably rare, applied only on the packed final products by using fumigant based on phosphine. As non-chemical grain protectant inert dusts – diatomaceous earth has been used. As the alternative measures for the control of psocids on the small quantity of stored wheat and packed flour, etheric oils and dust of domestic aromatic plants (*Lavandula officinalis, Thymus vulgaris, Rosmarinus officinalis, Laurus nobilis)* have been used.

Index terms: *Psocoptera*, store houses, IPM.

[4084] SIMULATION STUDIES ON THE EFFECTS OF SOLAR HEAT ON EGG-LAYING, DEVELOPMENT AND SURVIVAL OF *CALLOSOBRUCHUS MACULATUS* AND *CALLOSOBRUCHUS SUBINNOTATUS* IN STORED BAMBARA GROUNDNUT, *VIGNA SUBTERRANEA*

N. E. S. Lale & S. Vidal, Institute for Plant Pathology and Protection, Entomological Section, Georg-August-University, Grisebachstr. 6, D-37077 Goettingen, Germany.

The effects of simulated solar heat on oviposition, development and survival of *Callosobruchus maculatus* and *Callosobruchus subinnotatus* in stored bambara groundnut, *Vigna subterranea*, were evaluated over a range of three high temperatures (40°C, 45°C and 50°C) at a constant, low humidity (30% RH). Exposure to these temperatures for 6 h significantly reduced oviposition in *C. maculatus* and *C. subinnotatus* females. Females of both species that were exposed to the temperature of 50°C laid significantly fewer eggs than those exposed to 40°C, and in the case of *C. maculatus*, females exposed to 45°C also laid significantly fewer eggs than those exposed to 40°C. The percentage of adult progenies that developed from eggs laid by females of both species that were exposed to 50°C was significantly lower than the percentage that developed from eggs laid by females that were exposed to 40°C, and in the case of *C. maculatus*, the percentage of adult progenies that developed from eggs laid by females that were exposed to 45°C was significantly lower than the percentage that developed from eggs laid by females that were exposed to 40°C. At 50°C, the percentage of adult progenies that emerged from seeds bearing 1-day old eggs or harbouring first or late instar larvae of either species was significantly lower in seeds exposed for 4 or 6 h than the percentage of adults that emerged from seeds exposed for 1 h. Also, the percentage of adults of both species that emerged from seeds infested with eggs, first or late instar larvae exposed to 50°C for 1, 2, 4 or 6 h was significantly lower than the percentage of adults that emerged from seeds infested with similar developmental stages of the bruchids but were not exposed to this temperature. No adult progeny emerged from seeds bearing eggs or harbouring first instar larvae of both species that were exposed for 6 h to this temperature. Also, no adults of *C. maculatus* emerged from seeds harbouring first instar larvae exposed for 2 or 4 h to the temperature of 50°C, and no adults of *C. subinnotatus* emerged from seeds bearing eggs or harbouring first or late instar larvae exposed for 4 h or from seeds bearing eggs or harbouring first instar larvae exposed for 2 h to the temperature of 50°C

[4085] IDENTIFICATION OF COWPEA *VIGNA UNGUICULATA* GENOTYPES RESISTANT TO *CALLOSOBRUCHUS MACULATUS*

M.P.L. de Lima[1], J.V. Oliveira[1], R. Barros[1] & J.B. Torres[1], [1]Fitossanidade, Univ. Fed. Rural de Pernambuco, Av. D. Manoel de Medeiros s/n. Dois Irmãos, 52171-900, Recife, PE. E-mail: marcile@elogica.com.br

The present work aimed to identify sources of resistance in thirty cowpea genotypes, from EMBRAPA/Centro Nacional de Pesquisa do Meio Norte, to the cowpea weevil *Callosobruchus maculatus.* The test without choice chance, was used in a completely randomized design with five replications, being confined two pairs of insects in 30 grains. To evaluate the resistance of the genotypes, the parameters number of eggs/female, viability of eggs, duration of the immature phase, viability of the immature phase, natural rate of population increase, and index of resistance were used. The natural rate of population increase was not a good parameter for evaluating the genotypes. On the other hand, the index of resistance, classified them as moderately resistants IT89KD-245, TE90-180-10F, CNCx 409-12F, IT86D-716, IT89KD-260 and BR17-Gurgueia; susceptible CNC 0434, CNCx 405-17F, TE90-170-76F, TVu-249, IT89KD-381, BR14-Mulato, TE87-98-8G, TE87-1115-10G, CNCx 955-1F, CNCx 676-51F, TE87-98-13G, TE90-172-42E and TE87-98-9G-2, and highly susceptible Bico de pato, TE90-180-3E, TE90-179-14E, TE90-170-29F, Monteiro, TE84-27-7G, TE90-172-33F, CNCx 409-11F, TE90-180-88E, TE90-172-42E, TE90-180-13E. The genotype IT89KD-245 was the only one classified as resistant, according to the natural rate of population increase, and for presenting the smallest viability and the largest duration of the immature phase, being considered carrier of the resistance by antibiosis.

Index terms: Insecta, plant resistance, antibiosis, cowpea stored pest.

[4086] ANALYSIS OF VARIATION OF SPECIFIC CHARACTERS OF *CULEX (CULEX)* IN TWO ENVIROMENTS AND DETECTION OF NEW SPECIES IN THE CITY OF BUENOS AIRES

V. Loetti, L. Peresan, P. Korob, S. Zelenay, P. Orellano & N. Schweigmann, Dto. de Cs. Biológicas, Facultad de Cs. Exactas y Naturales, U.B.A., Pab. II Cdad. Univ. (1429), Cdad. de Bs. As, Argentina. E-mail: mosquito@bg.fcen.uba.ar.

In the last 30 years the taxonomic studies of the *Culex* species are very rare, quoting thirteen kinds of *Culex (Culex)* for Buenos Aires. For the first time are quoted here, for the city of Buenos Aires *Culex acharistus* and *Culex saltanensis*, both from the ecologic reserve "Costanera Sur". It wides the rank of variation of the following morphological characters in larval state: number of ramifications of the hair 5-C of *Culex eduardoi* and number of ramifications of hair 1-S of *Culex pipiens.* Larvae in the fourth stadium were studied collected in different points of the city, and when possible it was completed the development of the samples, determining also the adult. Both stadiums were determined according to the key of Darsie & Mitchell (1985, Mosq. Syst. 17 (3,4)). Some species were revised according to characters of taxonomic relevance. 100% of the rafts from the ecologic reserve are *Culex eduardoi* (4/4); from the city 78% are *Culex pipiens* and the rest (7/33), determined in their larval stadium as *Culex eduardoi*, produced morphological adults undistinguishable of *Culex chidesteri* or *Culex dolosus* (variation from 30 to 70%). The utilization of genetic molecular techniques may help to clarify such problems.
Key words: *Culex* spp., larvae, adults, taxonomy.

[4087] INCUBATION PERIOD AND EGGS VIABILITY OF *LONOMIA OBLIQUA* (LEPIDOPTERA; SATURNIIDAE) IN LABORATORY

L.M.Lorini,[1] & G.S. Rebelato[1], [1] Laboratory of Entomology, Instituto de Ciências Exatas e Geociências of University of Passo Fundo. P.O. Box 611, 99001-970. Passo Fundo, RS. Brazil. E-mail: lisete@upf.tche.br.

Lonomia obliqua is an insect that has urticant spines in the larval stages. This species may cause death as a result of haemorrhages caused by a toxin released from the caterpillar's spines onto the skin of the victim when touched. From 1989 when this species was identified in Rio Grande do Sul, south of Brazil, many accidents happened causing some deaths of people. From 1997 to 1998 this species caused 169 victims due the increasing in the population in that region. The aim of this study was to verify the incubation period and the viability of the species to improve the knowledge about the insect and prevent the people to be victims. The work was done in the Laboratory of Entomology, Science and Biological Institute of University of Passo Fundo from caterpillars collected in the field on the localities of Chapada, Erechim, Guaporé, Não-Me-Toque, Passo Fundo, Selbach, Santa Cruz do Sul e Vila Maria, all in Rio Grande do Sul state, and Concórdia in Santa Catarina state. The caterpillars were reared in laboratory room registering the temperature and humidity daily up to pupae and adult emergence. After that the adults were sorted by sex and left each couple in a moth's cage to mating and laying eggs. Nine couples were observed daily counting the numbers of eggs and the caterpillar emerged from the eggs. The results showed the mean incubation period of 32.6 (±7.9) days, ranging from 17 to 42 days. The mean eggs viability was 65.1 (±32.4) %, ranging from 13.6 % to 96.6 %. That variation was due, probably, by the alterations on the temperature and humidity during the incubation period which were not at the same time for each couple observed. The temperature in the laboratory room ranged from 13°C to 24°C (average of 18.6°C) and the humidity ranged from 64 % to 92 % (average of 80.6 %) which may affected the eggs viability.
Index terms: *Lonomia obliqua,* urticant caterpillar, biology aspects, public health.

[4088] INVASION OF *AEDES AEGYPTI* (DIPTERA: CULICIDAE) IN URUGUAY

M. Martinez[1], G. Willat[2], A. Boga[2], A. Capdevila[2] & N. Piñon[1], [1]Sec. Entomología, Facultad de Ciencias, Iguá 4225, 11400 Montevideo, Uruguay, E-mail mm@fcien.edu.uy. [2]Dpto. Zoonosis y Vectores, Ministerio de Salud Pública, Leguizamón 3552, 11600 Montevideo, Uruguay, E-mail zoonosis@adinet.com.uy

Until recently, the culicidae mosquito *Aedes aegypti*, the well-known vector of dengue viruses that had been eradicated in Uruguay for the last 39 years. In 1997, on routine control operations, *A. aegypti* was recorded in Colonia, a coastal city on the Río de la Plata, close to Buenos Aires city. From this finding a large scale program against *A. aegypti* larvae was undertaken by the Ministry of Public Health which represents up to now the biggest collective operation against the dengue disease vector in Uruguay. This communication describes the presence and the distribution of *A. aegypti* in Uruguay from 1997 up to present. The presence (positive) ot absence of the domestic larvae of *A. aegypti* in a locality (city, town, or village) were determined on the examination of 100% houses/locality. In 1997, other localities were shown to be positive: the littoral cities of Fray Bentos, Mercedes and, a sample from the International bridge "Paysandú-Colón" with Argentina. Also, several close resort cities, with a great fluency of argentinan tourists, Maldonado, Punta de Este and San Carlos, were registered as positive. Furthermore, two close resort cities: Piriápolis and Pan de Azúcar, were positive in 1998. Besides to the insecticide control undertaken since 1997, two other additional cities were found to be positive: Salto, a littoral city close to the Argentinan border, and Treinta y Tres, a city located at Southeast Uruguay, close to the Brazilian border. At present, the area of Paysandú has been controlled while the other localities showed a significative decrease in the house index of *A. aegypti* to less than 2%. We postulate that the recent invasion of *A. aegypti* in the localities situated in the Departamentos of Salto, Paysandú, Río Negro, Soriano, Colonia and Maldonado could be related to both, the passive terrestrial transport via the several International bidges with Argentina and, the marine transport with Argentina. In the case of Treinta y Tres city' infection, a passive terrestrial transport from Brazil could be postulated. Actually, we continue applying the program against *A. aegypti* with inter-institutional, and community participation.
Index term: *A. aegypti*, vector, dengue, Uruguay.

[4089] OCCURRENCE OF *RHINOTERMES MARGINALIS* (ISOPTERA: RHINOTERMITIDAE) IN URBAN AREAS OF RIO DE JANEIRO CITY

E. B. Menezes[1], L. R. Fontes[2], E. L. Aguiar-Menezes[3], A. C. Bicalho[1] & A. S. Diogo[1], [1]CIMP "CRG"/ UFRRJ, BR 465 – km 7, Seropédica, RJ 23890-000, Brazil, E-mail ebmen@zaz.com.br; [2]SUCEN, R. Cardeal Arcoverde, 2878, 05408-003 São Paulo, SP, Brazil, E-mail lrfontes@uol.com.br; [3]Embrapa Agrobiologia, Caixa Postal 74538, Seropédica, RJ 23980-000, Brazil, E- mail menezez@cnpab.embrapa.br.

The subterranean termite, *Coptotermes havilandi* and the dry wood termite *Cryptotermes brevis* are the most destructive and frequently encountered kind of termites found in the urban, suburban and countryside in coastal regions of Brazil, mainly in the state of Rio de Janeiro. An inspection with the aim of survey the species that were causing damages to a residential mansion constructed in the decade of 30, actually has been used as private high school, localized in the Botafogo neighborhood in Rio de Janeiro, RJ was done by us from August to September/1999. We recovered 3 species of termites: *C. havilandi, C. brevis* and an specie identified as *Rhinotermes marginalis. C. havilandi* was the predominant and aggressive species, that was causing damage in the house, in the living trees used for ornamental and shade purpose. *C. brevis* is the most common species infesting woodwork in the house and furnitures. *Rhinotermes marginalis* is a subterranean termite that is commonly found in the north of South America, mainly in the Amazonian region. This termite is known to damage semi decomposed dry wood and their nests are diffused and not well defined. Workers, 2 types of soldiers, alate reproductives, nymphs and eggs of *R. marginalis* were collected from skirting boards of 40cm of width by 2cm thick. It seems that the infiltration of water and prior attack of *C. havilandi* favor the infestation of *R. marginalis.* The mansion house and the garden area were treated with a solution of the chlorpiriphos plus mineral oil diluted into water, according to the dosage recommended by manufacturer, and applied by spraying and forced injection. as soon it was done, the garden area was covered by pine stakes with the objective to know if still occurring infestation or the total elimination of subterranean termites . Stakes were checked monthly and six months later *C. havilandi* was present, however, *R. marginalis* was eliminated, totally.
Index terms: *C. havilandi, C. brevis, R. marginalis*, survey, chemical control, residential mansion

[4090] CYTOTOXICITY OF LUFENURON IN UNHATCHED LARVAE OF THE CAT FLEA *CTENOCEPHALIDES FELIS*

R. W. Meola[1], S. R. Dean[1], S. M. Meola[2], H. Sitterz-Bhatkar[3] & R. Schenker[4], [1]Dept. of Entomology, Texas A&M Univ., College Station, TX 77843, USA, E-mail rwmeola@tamu.edu; [2]USDA-ARS, Food Animal Protection Research Lab., 2881 F & B Road, College Station, TX 77845, USA; [3]Electron Microscopy Center, Texas A&M Univ., College Station, TX 77845; [4]Novartis Animal Health, CH-4002 Basel, Switzerland.

Lufenuron known commercially as Program is a chitin synthesis inhibitor that acts as a larvicide in fleas. When the chemical is fed to pet animals, it is absorbed in the fat cells and then diffuses into the blood where it is ingested by adult fleas. Examination of eggs laid by lufenuron-fed fleas showed that larvae developed and then died within the chorion of the egg. Transmission electron micrographs of unhatched larvae revealed that mortality occurred because lufenuron prevented normal cuticle formation by injuring the epidermal cells. Instead of depositing lamellate cuticle composed of alternating layers of chitin and protein, treated larvae often produced two separate layers of cuticle in response to treatment. The first cuticle consisted of an indistinct layer of epicuticle and a procuticle composed of masses of disorganized chitin microfibrils. After the first layer of procuticle separated from the epidermal cells, a second layer of proteinaceous procuticle was deposited. These structural defects in the cuticle appeared to be due to the cytotoxic effects of lufenuron. The epidermal cells of treated larvae showed evidence of disintegration (i.e., the nuclei and mitochondria appeared to be degenerating with a corresponding decrease in the amount of endoplasmic reticulum and other cytoplasmic organelles). The chorion of lufenuron-treated larvae consisted of an outer layer, middle and inner layers that were thinner and less electron dense than those of controls, and lacked the innermost chorionic layer found in the control larvae. The vitelline membrane also was thinner than that of the controls. Abnormalities in the chorion did not appear to influence hatching. Larval hatching was prevented by ruptures in the cuticle, which opened during eclosion resulting in the loss of hemolymph and desiccation of the larva. Evidently, tearing of the cuticle was caused by abnormal formation of the procuticle that was not strong enough to withstand the cuticular expansion and muscular movement of the larva within the egg shell. For more information on this research see the paper "Effect of lufenuron on chorionic and cuticular structure of unhatched larval *Ctenocephalides felis* (Siphonaptera:Pulicidae)" by R. W. Meola, S. R. Dean, S. M. Meola, H. Sitterz-Bhatkar and R. Schenker. 1999. Jour. Med. Entomol. 36:92-100

Index terms: insect growth regulator, chitin synthesis inhibitor, larvicide.

[4091] DATA ON INSECTS IMPLICATED IN THE DESTRUCTION OF WORKS OF ART IN SPAIN

F. Molino-Olmedo[1], J.L. Viejo[1], N. Valentín[2] & R. García[2], [1]Dep. de Biología, Univ. Autónoma de Madrid, Cantoblanco, 28049 Madrid, Spain, E-mail joseluis.viejo@uam.es, [2]Centro de Investigaciones Biológicas, CSIC, Madrid, Spain.

Spain boasts an important artistic heritage, a great part of which is composed of works of art and of history principally made of organic materials such as paper, tissue, wood and mummified flesh. Although these materials are difficult to digest, many insects, in particular Coleoptera, Isoptera and Lepideptera, have adapted themselves to them as a food source. Some of these insects, which were initially (and in many cases continue to be) forest-dwelling, have become associated with human habitation, and subsequently museums churches, libraries, etc., where they find suitable conditions of temperature, humidity, light, absence of predators, and a large quantity of food in the form of books, mummies, altar-pieces, wooden sculptures, etc., which they destoy. In this study we present a list of insect species that, in Spain, destroy different works of art, indicating their basic ecological requirements, given that knowledge of them may be used to prevent damage and to control populations of such insects effectively. The ptinids and dermestids, among the beetles, and the tineids, among the Lepidoptera, attack tissues of animal or vegetable origin, silks and zoological and botanical collections; of the 12 species, *Mezium affine, Trogoderma variabile, Attagenus trifasciatus, Attagenus piceus, Attagenus brunneus, Anthrenus flavipes, Anthrenus pimpinellae, Anthrenus coloratus*, and *Dermestes* sp. are common. Wood is attacked by Isoptera, anobiids, lyctids and cerambycids, the most frequent attacks being by *Reticulitermes lucifugus, Oligomerus ptilinoides, Anobium punciatun, Lyctus linearis* and *Hylotrupes bajulus* of the 21 species that we encountered. Finally, books and paper are attacked fundamentally by 6 species belonging to the Thysanura, Psocoptera and anobiid Coleoptera; of these species, the most common are *Liposcelis divinatorius* and *Nicobium castaneum.*

Index terms: Ptinidae, Dermestidae, Lyctidae, Anobiidae, Cerambycidae

[4092] OVICIDAL EFFECT AND EMBRYO RESISTANCE TO INSECTICIDES IN *PEDICULUS CAPITIS* (PHTHIRAPTERA, PEDICULIDAE)

G.A. Mougabure Cueto; M.J. Picollo & E. Zerba, Centro de Investigaciones de Plagas e Insecticidas (CIPEIN / CITEFA - CONICET), Zufriategui 4380 (1603) Villa Martelli, Buenos Aires, Argentina. e-mail: cipein@citefa.gov.ar. This investigation received financial support from Agencia Nacional de Promoción Científica y Tecnológica (Argentina) and Interbelle Cosmetics (Argentina).

The lack of ovicidal activity is considered as a contributive cause for pediculicide failure for head lice control. The objective of the present study was to assess, at laboratory level, the ovicidal efficacy of pyrethroid insecticides against the eggs of susceptible and permethrin resistant head lice *Pediculus capitis.* Survival of a field colony head lice at different environmental conditions, was evaluated to optimise bioassay variables. The longest survival of control insects in the laboratory was obtained by keeping them at 27 ± 1°C and 75 % RH and photoperiod 12:12 h. The incubation of untreated eggs in such environmental conditions, produced 90 ± 10 % of hatched eggs after 10 days. Developing eggs were characterised every day by their external morphological appearance. It was established that ocular pigments and appendages were visible through transparent chorion during later development. These eggs were selected to evaluate ovicidal activity of the pyrethroid d-phenothrin against two colonies with d-phenothrin resistance detected: GH colony (resistant ratio (RR): 40.9), and VM colony (RR > 90). Eggs were treated by topical application with 0.1 µl of 10 % w/v acetone solution of the insecticide and incubated at optimal condition during 10 days. Topical application of d-phenothrin to the lower resistant colony GH produced 43.1 ± 11..3 % mortality, while the same to the higher resistant colony VM was not able to produce any mortality. More studies are in advance in order to assess correlation between the resistance level of embryos and adults from the same colony.

Index terms: *Pediculus capitis*, ovicidal activity, insecticide resistance

[4093] LOUSE COMB VERSUS HAND EXAMINATION FOR THE DIAGNOSIS OF HEAD LOUSE INFESTATIONS

K. Y. Mumcuoglu,[1] M. Friger,[2] I. Ioffe-Uspensky,[1] F. Ben-Ishai,[3] & J. Miller,[1], [1]From the Dept. of Parasitology, Hebrew University-Hadassah Medical School, Jerusalem, [2]The Dept. of Epidemiology, Faculty of Medicine, University of Negev, Beer-Sheva and [3]The Ministry of Health, Jerusalem, Israel.

The techniques used for diagnosis of head louse (*Pediculosis capitis*) infestation are a source of controversy. Most epidemiological and diagnostic studies have been done using hand examination. The main objective of this study is to compare the efficacy of hand examination versus the louse comb method. The hair of each child was examined twice; one team used a screening stick and a different team used a louse comb. Seventy-nine boys and 201 girls, 7-10 years-old were examined. Examination with a louse comb revealed that 25.4% of the children were infested with both lice and nits, while another 31.3% had nits only. Boys were significantly less infested with lice and nits than girls (lice: 15.2 and 29.6%; nits: 21.5 and 35.4%). The infestation rate with lice and nits was significantly higher in children with long (68.9%) and medium (63.9%) hair than in children with short hair (44.0%) ($p<0.01$). Examination by hand revealed that 5.7% of the children were infested with both lice and nits, and another 49.0% with nits only. The average time until detection of the first louse was 57.0 sec with the comb as compared with 116.4 sec by hand examination. Diagnosis of louse infestation using a louse comb is 4 times more efficient than examination by hand and twice as fast. The hand examination technique underestimates active infestation and detects past, non-active infestations.

[4094] ARTIFICIAL FEEDING OF MOSQUITOES VIA A MEMBRANELESS SYSTEM

G. Nentwig[1], R. Flügel[1], J. Egger[1] & M. Arnold[1], [1]BAYER AG, Animal Health Business Group, Biological Technology Center, Alfred Nobel – Str. 50, 40789 Monheim, Germany, E-mail guenther.nentwig.gn@bayer-ag.de.

Mass rearing of mosquitoes requires animal hosts which implies additional work for animal maintenance. Also regarding the ethical aspect to reduce the numbers of testing animals it is obvious to replace natural hosts by artificial feeding systems. In fact much work has been done to establish such devices. Most of them consist of a container filled with warmed blood. The opening of the container is closed with a membrane through which the insects suck the blood. The handling of such systems sometimes is not simple. Therefore our aim was to develop a system without membrane. Our work resulted in a plastic disk with a circular opening of 13 cm diameter. Around this opening there are walls of 2 cm height which have an outer diameter of 14 cm. These walls are on the top and on the down side. In a plastic ring of the same size a lens paper is placed above the opening and covered by a wire gauze. The whole feeding system fits into an opening of a mosquito (*Culex quinquefasciatus*) containing cage's floor The wall of the lower system's part towers down the lower side of the cage's floor. A heating unit with a glass dish is placed on a lever device and filled with cattle blood. It is levered up until the lower wall of the feeding system is immersed. The blood-level reaches the paper but not the gauze. The blood is warmed to body temperature and the mosquitoes are able to take the blood without touching it with their feet. After a few hours most mosquitoes are engorged, the system is switched off and removed next day. The new system was pursued parallel with the conventional feeding on guinea pigs. After the 10th generation tests with different insecticides and repellents were carried out with mosquitoes reared by the two techniques. The biological data revealed no differences between the two methods. A comparison of the attraction of both systems after 15 generations showed that the artificial one attracted one third of the mosquitoes compared with the guinea pig. Offspring rates were also a little lower. These facts were compensated by using a higher number of mosquitoes and by a longer feeding time. The artificial feeding requires only 30 percent of the work for the natural host feeding. Since the beginning of this year no guinea pigs are used any longer and now the 23rd generation of artificially fed mosquitoes is reached. One year before starting with *Culex quinquefasciatus* the same has been done with *Aedes aegypti*. Without any severe problems we have now the 25th artificially fed generation. No guinea pigs are used any longer since the 13th generation at the beginning of 1999. So we have reduced testing animals and costs.

Index terms: *Aedes aegypti*, *Culex quinquefasciatus*, feeding procedure

[4095] EVALUATION OF INSECTICIDES IN THE CONTROL OF RICE WEEVIL AND LESSER GRAIN BORER ON STORED BARLEY

J. P. S. Novo[1], G. E. Valle[1], A. C. Durigan[1] & J. A. Souza Jr.[2], [1]Instituto Agronômico, Caixa Postal 28, 13001-970, Campinas, SP, Brazil, E-mail: jpsnovo@cec.iac.br; [2]Iharabras S.A., Caixa postal 303, 18001-970, Sorocaba, SP, Brazil.

The effectiveness and residual effect of insecticides in the control of *Sitophilus oryzae* and *Rhyzopertha dominica* in stored barley was evaluated in a laboratory essay. For each species, the experiment consisted of 6 treatments and 4 replications, in randomized blocks. In each treatment, 8.0 kg of grains, previously fumigated, were manually sprayed with the studied mixtures at the rate of 5 L/t and homogenized for 2 minutes. The treatments consisted of: esfenvalerate + fenitrothion (EC, 25 + 500 g/L), 15 ml/t, 20 ml/t and 25 ml/t; deltamethrin (EC, 25 g/L), 15 ml/t; fenitrothion (EC, 500 g/L), 20 ml/t and a control without insecticide. The evaluations were made at 30 days intervals, until 210 days after the treatment. Each replication of 120 g of grains was infested with 30 adult insects, and the mortality assessed after 7 days for *S. oryzae*, and 14 days for *R. dominica*. The results were submitted to the analysis of variance and the efficacy calculated by Abbott's formula. The progeny of *S. oryzae* was evaluated 45 days after the infestation. Esfenvalerate + fenitrothion in the dosages of 15, 20 and 25 ml/t, and fenitrothion, controlled *Sitophilus oryzae* in stored barley until 210 days after the application, with efficacy above 80%, causing at this date progeny reductions over 80% in relation to the control. Deltamethrin did not control *S. oryzae* and caused progeny reduction of less than 70% in relation to the control, in all the evaluations. Esfenvalerate + fenitrothion in the three dosages, and deltamethrin, controlled *Rhyzopertha dominica* in stored barley until 210 days after the application. At this date, only the esfenvalerate + fenitrothion, 25 ml/t, showed efficacy above 80%. Fenitrothion did not control *Rhyzopertha dominica*.

Index terms: *Sitophilus oryzae*, *Rhyzopertha dominica*, *Hordeum distichum*, stored grain insects, chemical control

[4096] EFFECT OF VEGETABLE OILS ON THE PREFERENCE FOR OVIPOSITION AND VIABILITY OF IMATURE PHASE OF *CALLOSOBRUCHUS MACULATUS* (COLEOPTERA: BRUCHIDAE) IN COWPEA GRAINS

J.V. Oliveira[1], R.L.B.C. Coitinho[1], G.J.R. Silva[1] & P.R. Machado[1], [1]Fitossanidade, Univ. Fed. Rural de Pernambuco, Av. Dom Manoel de Medeiros s/n, Dois Irmãos, 52171-900, Recife, PE. E-mail: jvolivei@elogica.com.br

The effect of vegetable oils on the oviposition and emergency of *Callosobruchus maculatus*, was studied in cowpea grains. Arenas formed by three plastic circular recipients were used in the tests. The central recipient was symmetrically connected to the two lateral recipients by plastic tubes. Four couples of *C. maculatus* with 0-24 hours of age were placed into the central recipient, and 20 g of cowpea grains, treated and non-treated with oil, was placed into each one of the lateral recipients. Each dose of the oil was tested separately, in ten arenas. After three days, the insects were discarded and the grains placed in other plastic recipients at the emergency. Viable eggs were counted at 16 days after confinement of the insects in the arenas, examining all the grains with a stereoscopic microscope. Emergency was evaluated at 32 days after confinement. Neem, eugenol and eucalyptus reduced the posture of 100 and 49.4%, 99.8 and 79.5%, and 99.1 and 32.7% and emergency of 100 and 81.8%, 99.8 and 77.6%, and 99.8 and 23.1%, at the doses of 2.5 and 0.5 ml/kg of grains, respectively.

Index terms: Insect, cowpea weevil, natural insecticide, biology.

[4097] MITES OF STORED HAZELNUTS IN TURKEY

S. K. Ozman[1] & E. Zdarkova[2], [1]Trakya Univ., Corlu Technical College, Corlu, 59850, Turkey; Present address: Univ. of Queensland, Dept. of Zoology and Entomology, Brisbane, 4072, QLD, Australia, E-mail sozman@zoology.uq.edu.au; [2]Research Inst. of Crop Production, Drnovska 507, 161 06 Prague 6, Czech Republic

Turkey is a major producer of hazelnuts, which are processed at processing plants and stored in warehouses prior to distribution and export. It is during the processing and storing that hazelnuts could possibly be more vulnerable to infestation by mites which are the main pest group affecting both the quality and quantity of stored products. This study was conducted on species of mites associated with stored hazelnuts between 1995 to 1997 in the Black Sea Region of Turkey. Samples taken from the processing plants and warehouses were placed in Berlese funnels. The mites were extracted in ethyl alcohol (70 %) and slides prepared in HoyerÕs medium for identification. All the processing plants and warehouses were infested with mites, including 28 mite species belonging 15 families. These were *Acarus siro*, *Acarus farris*, *Tyrophagus putrescentiae*, *Tyrophagus neiswanderi*, *Tyrolichus casei*, *Rhizoglyphus callae*, *Suidasia nesbitti* (Acaridae); *Glycyphagus ornatus*, *Lepidoglyphus destructor* (Glycyphagidae); *Chortoglyphus arcuatus* (Chortoglyphidae); *Euroglyphus maynei* (Pyroglyphidae); *Cheyletus eruditus*, *Cheyletus trouessarti*, *Cheyletus aversor*, *Cheyletus malaccensis* (Cheyletidae); *Tarsonemus granarius* (Tarsonemidae); *Androlaelaps casalis casalis* (Dermanyssidae); *Melichares agilis*, *Blattisocius tarsalis*, *Blattisocius keegani*, *Blattisocius dentriticus* (Ascidae); *Amblyseius* sp. (Phytoseiidae) and 6 unidentified species belonging to Tydeidae, Stigmaeidae, Tetranychidae, Tenuipalpidae, Trombidiidae and Oribatidae. The most common mite was *T. putrescentiae*. Six species of mites, namely *T. neiswanderei*, *T. casei*, *G. ornatus*, *E. maynei*, *M. agilis* and *B. denriticus* were first recorded for the Turkish fauna. It was found that the mites are still a great problem in stored hazelnuts. These pests should be controlled in stored hazelnuts through frequent sampling in all processing plants and warehouses. The efficiency of biological control of the harmful mite species by the predatory mites should also be investigated.

Index terms: Acari, stored products, faunistics.

[4098] MONITORING INSECTS (COLEOPTERA) OUTSIDE GRAIN STORAGE FACILITIES

P.R.V.S. Pereira[1] & F.A. Lazzari[2], [1] Depto de Fitotecnia e Fitossanidade, Univ. Est. de Ponta Grossa, Caixa Postal 992, 84100-970, Ponta Grossa, PR, e-mail: prvalle@netpar.com.br; [2] Depto de Zoologia, Univ. Fed. do Paraná, Caixa Postal 19020, 81531-970, Curitiba, PR.

Monitoring of stored product insects is essential for adoption of preventative control measures, especially what is fundamental for integrated pest management programs. The objective of this research was to evaluate the use of food-baited cage traps around grain storage facilities to detect stored product insects. The experiment was conducted in two grain storage facilities located in southeast Parana, Brazil. For this work a food-baited cage trap containing a mixture of corn, wheat, wheat germ and ground corn was adapted, and evaluated for 12 and 21 months. The traps distributed in different places around the storage facility collected a total of eight species of stored product insects, and the most common were: *Sitophilus oryzae* and *S. zeamais* (Coleoptera: Curculionidae), *Oryzaephilus surinamensis* (Coleoptera: Silvanidae), *Cryptolestes* spp. (Coleoptera: Cucujidae) and *Carpophilus* spp. (Coleoptera: Nitidulidae). The results showed that the cage traps were sensitive to detect insect populations around storage facilities, even at small number. The main factors associated with the presence of insects around grain storage facilities are the deposit of grain debris, poor cleaning and precarious structure conditions of bins and silos. All these factors, associated with favorable climatic conditions, offer suitable conditions for the development of insects throughout the year. Food-baited cage traps showed their efficiency as an important tool for early detection of insect populations, allowing the adoption of timely good management practices in order to avoid serious infestations of the grain mass.

Index terms: Traps, sampling, stored products insects

[4099] SYNERGIZED PYRETHROIDS FOR THE CONTROL OF PERMETHRIN RESISTANT HEAD LICE *PEDICULUS CAPITIS* (PHTHIRAPETRA, PEDICULIDAE)

M. I. Picollo; C. Vassena; G. Mougabure Cueto & E. Zerba, Centro de Investigaciones de Plagas e Insecticidas (CIPEIN/CITEFA-CONICET), Zufriategui 4380, (1603) Villa Martelli, Buenos Aires, Argentina. E-mail: cipein@citefa.gov.ar. This investigation received financial support from Agencia Nacional de Promoción Científica y Tecnológica (Argentina) and Interbelle Cosmetics (Argentina).

Insecticide failure for head lice control in Argentina, had been previously studied in our laboratory. Pyrethroid resistance found in field colonies from Buenos Aires and inadequate formulation of insecticides, are two important reasons for explaining chemical control failure. This work was conducted to study the enhancement of the insecticide activity of pediculicide capillary lotions by adding aliphatic alcohols. A dipping method was develop to evaluate in laboratory, the toxicity of commercial and experimental capillary lotions, on permethrin resistant head lice (resistant ratio > 88.7x) collected from infested heads of children 6-12 years old. Experimental capillary lotions based in d-phenothrin as active ingredient, did not produce higher lice mortality as the concentration of d-phenothrin was increased from 0,2 to 0,5%. Otherwise, the mortality of permethrin resistant head lice was greatly enhanced when 1-decanol and 1-dodecanol were added to experimental lotions containing d-phenothrin 0,3%. Measured mortalities increased from 5±5% for experimental insecticide lotion, to 70±10% and 100±0% for the ones containing 5 and 20% dodecanol respectively. Lotions based on dodecanol 5% (without insecticide) showed 42±6% knock down that was reverted at 24h pos-treatment, in contrast with insecticide + alcohol treatments. The synergist effect on d-phenothrin activity produced by 1-decanol and 1-dodecanol, demonstrated the importance of the coadjutants on the final toxic effect. Moreover it proved to have a practical value for use in permethrin resistant head lice control.

Index terms: *Pediculus capitis*, experimental formulation, d-phenothrin synergism

[4100] REVERSION OF PERMETHRIN RESISTANCE BY INSECTICIDE SYNERGISTS IN THE HEADLICE *PEDICULUS CAPITIS* (PHTHIRAPTERA, PEDICULIDAE)

M. I. Picollo; C. Vassena; G. Mougabure Cueto; S. Barrios & E. Zerba, Centro de Investigaciones de Plagas e Insecticidas (CIPEIN/CITEFA-CONICET), Zufriategui 4380, (1603) Villa Martelli, Buenos Aires, Argentina. E-mail: cipein@citefa.gov.ar. This investigation received financial support from Agencia Nacional de Promoción Científica y Tecnológica (Argentina) and Interbelle Cosmetics (Argentina).

Permethrin resistance has been detected in many field populations of *P. capitis* from Buenos Aires. Four highly resistant colonies (resistance ratio, RR > 88,7) previously examined in our laboratory, showed that enhanced metabolism was involved in pyrethroid resistance. In this work a highly permethrin resistant field population (LAN, RR:59,7) and a low resistant one (DB, RR:50) were chosen to establish the resistant profile and examine resistance mechanism. Both permethrin resistant populations showed also resistance to deltamethrin, another pyrethroid used as pediculicide in Argentina (RR LAN: 66,8. RR DB: 6,4), but resistance was not observed to the carbamate carbaryl. Treatment with the esterase inhibitor triphenylphosphate (TPP) or the multifunction oxidase inhibitor piperonyl butoxide (PBO), produced partial reversion of permethrin resistance in both field populations. Resistance ratio for permethrin in LAN colony decreased to 30,46 after PBO treatment, and 39,63 after TPP treatment. Resistance ratio for permethrin in DB colony decreased to 3,8 after PBO treatment and 1,8 after TPP treatment. Biochemical assays using phenyltioacetate as substrate (PTA) did not show significant differences in the enzymatic activity between susceptible and resistant populations, probably because PTA is a wide spectrum substrate for esterase and not an specific pyrethroid esterase. Results presented here concerning to resistance to different pyrethroids and the significant synergism determined by enzyme inhibitors, suggest that a common degradative pathway is involved in pyrethroid resistance.

Index terms: *Pediculus capitis*, insecticide resistance, cross resistance, synergism

[4101] INSECTICIDE ACTION OF ETHANOLIC EXTRACT FROM *ANNONA CRASSIFLORA* SEEDS AGAINST *SPODOPTERA FRUGIPERDA*

H.T. Prates[1], P.A. Viana[1], L.P.S. Pimenta[1], M.A.D. Boaventura[2], [1] Embrapa Milho e Sorgo. Caixa Postal 151, 35701-970, Sete Lagoas, MG, Brazil.; [2] Depto. de Química – ICEx-UFMG. Av. Antonio Carlos, 6627, Caixa Postal 702, 31270-901, Belo Horizonte, MG, Brazil. E-mail: htprates@cnpms.embrapa.br.

The Annonaceae plant species represent a source for biologically active acetogenins which is described with a broad range of activities in different potential biological roles in the pharmaceutical industry, as cytotoxic, antitumor, antiparasitic, antimicrobial and immunosuppressive, and lately with pesticide activity. *Annona crassiflora* Mart. is a native Brazilian tree growing in the savanna area ("cerrado") with seeds being traditionally used in folk medicine as antidiarrheal and insecticide. Hence, it was included in Embrapa Milho e Sorgo screening program against fall armyworm, *Spodoptera frugiperda* which attacks maize plant in the field causing losses of approximately 34 % in crop production. Synthetic insecticides are the conventional way to control this insect. However, natural products from plants have been studied as an ecologically alternative in protecting crops. Bioassays to determine the insecticide activity were carried out in laboratory with ethanolic extract from seeds of *A. crassiflora* (F01) at concentration 10000 µg mL^{-1} incorporated to an artificial diet. A group of 12 insects were used. Each insect was fed in a 50 mL plastic cup containing 4.8 g of diet with incorporated extract. Two check treatments were used with diet without extract (water and acetone). Observations on control efficacy were made 1) on mortality (%) according to Abbott procedure 12 days after larvae eclosion and 2) the development of the live larvae (larva length, weight and width of the head capsule). Results showed control efficiency of 56,7 %. The surviving larvae were 0,19 mm long, weighed 1 mg and had a head capsule width of 0.35 mm, and a strong negative effect was observed on its development as compared to the larvae in the check treatment showing 1.76 mm long, 329 mg of weight and a head capsule width of 2,27 mm. Therefore, seeds ethanolic extract presents potential insecticide action against this insect.

Index terms: Annonaceae, fall armyworm, natural insecticide, *Zea mays*

[4102] THE SEASONAL ABUNDANCE AND CONTROL OF *CHRYSOMYA MEGACEPHALA* INFESTING DRYING FISH IN SOUTH-WEST INDIA

R.Wall[1], J. Bindu[2], J.J. Howard[1], Sanders1 &M.L. Warnes[1], [1]School of Biological Sciences, The Univ. of Bristol, Bristol, BS8 1UG, U.K. E-mail: richard.wall@bristol.ac.uk; [2]C.I.F.T., Calicut-637 005, India.

The infestation of sun-drying fish by blowflies is a major economic problem in many developing countries of Asia, Africa and the Pacific. Blowfly populations were monitored at a fish landing and drying site on the coast of south west India. During the 548 day sampling period, a total of 96,953 adult Diptera were collected from sixteen sticky targets, placed inside and outside eight fish-storage sheds. Of these, 95% were *Chrysomya megacephala*. The population of *C. megacephala* showed pronounced seasonal fluctuations in response to climate, particularly relative humidity. Significantly shorter-frequency fluctuations within fish processing sheds were also evident, the periodicity of which corresponded approximately to *C. megacephala* generation cycles. Spatial variation in *C. megacephala* abundance was evident within the site; higher populations occurring closest to the beach and numbers declining with distance inland. The pattern of drying-fish infestation by *C. megacephala* broadly followed changes in the density of adult flies and the seasonal change in weather, with peaks during the monsoon and troughs in the dry hot periods. High relative humidity played a significant, but secondary role in increasing infestation. Insecticide-impregnated cloth targets were developed and used to suppress the populations of *C. megacephala*. The use of target-technology for control of these pests is didscussed.

Key words: *Chrysomya megacephala*, fish, blowfly, infestation, control, India

[4103] IMPACT OF URBANIZATION ON AN INSECT/PLANT INTERACTION: BRUCHID BEETLES ON BLUE PALO VERDE

L.A. Ramirez, T.P. Craig, & J. R. Wallace, Department of Life Sciences, Arizona State Univ. West, P. O. Box 37100, Phoenix, AZ 85069, USA.

We investigated the causes of variation in the population density between urban and natural desert sites in three bruchid beetles, *Mimosestes amicus, M. ulkei* and *Stator limbatus* (Coleoptera: Bruchidae) on the Blue Palo Verde, *Cercidium floridum* (Leguminoseae). Population densities of the three beetles varied between urban and desert sites. *Stator limbatus*, which is highly polyphagous, had much higher densities in urban sites. *Mimosestes ulkei*, which feeds on seeds of only one native and one introduced species, had much higher densities in natural desert sites. *Mimosestes amicus*, which feeds on seeds of five native species, had higher egg densities in the urban sites. However, rearing studies indicated that adult emergence rates of *M. amicus* did not differ between urban and desert sites. We hypothesized that differences in population densities could be explained by differences in preference for, and performance on, urban and desert pods. In laboratory choice experiments, *Mimosestes amicus* had a preference for urban pods of *Cercidium floridum*. In the field choice experiments there was a complex pattern of oviposition preference in *M. amicus*. There was a preference for urban pods, but preference was also influenced by the site where the experiment was carried out, the number of seeds per pod and the length of the pods. Survival was strongly influenced by an interaction between source (urban or desert) and the location where the experiments were carried out. These data imply that the differences in the population densities of the bruchid beetles between desert and urban sites is due to both to behavioral choices by the beetles and variation in host plant quality.

Index terms: *Mimosestes amicus*, *Mimosestes ulkei*, *Stator limbatus*, Bruchid beetles, preference.

[4104] PATCH ISOLATION AND PRIORITY EFFECTS AND THE STRUCTURE OF ARTHROPOD COMMUNITIES INHABITING CREOSOTE BUSH IN CENTRAL ARIZONA

J. J. Rango, Dept. of Biology, Arizona State Univ., P.O. Box 871501, Tempe, AZ, 85287-1501, USA, E-mail jrango@asu.edu.

Habitat fragmentation is accelerating, especially in urban settings like Phoenix, Arizona, and is thought to greatly affect community diversity. Creosote bush (*Larrea tridentata*) is populated by a diverse and abundant arthropod community making it a model system in which to study concepts central to community ecology such as the impacts of habitat patch isolation and priority effects on arthropod community structure. To quantify the impact of patch isolation on creosote bush arthropods I compared the composition of communities in two natural desert areas (located on the outskirts of Phoenix) to those in two isolated desert remnants (located within the Phoenix metropolitan area). Composition of communities was determined by sampling arthropods on creosote bush every two weeks from March – November 1999. Arthropod communities were richer on creosote bushes located in natural desert areas than in isolated desert remnants. Additionally, during some time periods greater numbers of individuals occurred on creosote bushes located in natural desert areas than in isolated desert remnants. I conducted a priority effects pilot to investigate the influence of pioneer colonists on the recovery of arthropod communities to previously defaunated creosote bushes. This experiment consisted of removing all arthropods from bushes and then seeding the bushes with the following pioneer colonists in natural densities: 1) leaf hoppers, 2) jumping spiders, and 3) no pioneers. No differences in the relative recovery of arthropod communities were observed among treatments suggesting that priority effects may not be important in structuring creosote bush arthropod communities following disturbance. Future studies will investigate the impact of different predatory pioneer colonist species and different beginning densities of pioneer colonists on creosote bush arthropod community structure.

Index terms: *Larrea tridentata*, fragmentation, priority effects.

[4105] THE NEAR FUTURE OF URBAN ENTOMOLOGY

F. Rettich, Nat. Inst. of Public Health, Srobarova 48, Prague 10, 100 42, Czech Republic, E-mail rettich@szu.cz

Urban entomology has firmly established itself in the last 25-30 years as a distinct discipline and we can expect a further strengthening of its role at the beginning of the coming century and millennium. There are two distinct trends important for changes in insect pest dispersal in urban areas: further urbanization of the world and globalization of world activities. It is expected that the world population living in urban areas will soon exceed 55%. But even modern technology of building construction can hardly prevent the emergence of new habitats for domestic and peridomestic pests. Globalization will make possible not only a broad distribution of new safe pesticides but the spread of some synanthropic and exotic insect species as well. The spread of *Aedes albopictus* (Skuse), a possible vector of virus diseases, through North America and southern Europe by the used tyres trade is now a classic example of such a trend. The predicted global warming would make possible the movement of some insect pest species to more northern areas of temperate climate zones. Movements of large groups of people may contribute to the further spread of some pest species, too. Methods of urban pest management are changing. But a nice story of the successful and revolutionary use of the biolarvicides *Bacillus thuringiensis israelensis* or *B.sphaericus* against mosquitoes will hardly be repeated. On the other hand, in the past decade a shift from insecticidal sprays to the use of baits against termites or cockroaches was generated by the development of new and extremely efficient active ingredients. This trend will probably continue. A new approach to the IPM and IRM strategies is expected in insect control in urban and periurban environments. Also strict implementationon of rules of HACCP in the food processing industry and frequent use of methods of GPS, GIS and software programmes addapted for urban pests control is expected. Political changes have recently positively influenced the quality of urban pest control in Eastern Europe. The future implementation of the Biocide Directive and strenthened position of the CEPA (Confederation of European Pest Control Associations) will have a great impact on the use of pesticides in EU countries. We believe that urban entomologists, engaged both in basic and applied research and in pest control practice will play a key role in maintaining the quality of life in modern urban society.

Index terms: pest control, globalization, urbanization, Biocide Directive, CEPA, *Aedes albopictus*

[4106] BIORATIONAL APPROACH TO SUPRESSING AMERICAN COCKROACHES, *PERIPLANETA AMERICANA*, IN SEWAGE SYSTEMS

M.K. Rust[1] & E.O. Paine[2], [1,2] Dept. of Entomology, Univ of California, Riverside, CA 92521, USA, E-mail eileen.paine@ucr.edu

American cockroaches, *Periplaneta americana*, are a major pest of sewer and waste water facilities in the western United States. Chemical treatments of sewers are problematic because of the potential contamination of water and pesticide exposure to sewer personnel. In cooperation with the City of Santa Monica, we treated sewers with 0.01% fipronil and 2.15% imidacloprid gel baits, combinations of gel baits and oothecal parasitoid, *Aprostocetus hagenowii*, and the oothecal parasitoid alone. The design of the bait station was important in preventing baits from becoming moldy and allowing cockroaches access to the bait. Strips of evaporative cooling pad glued to the surface of plastic cards provided an excellent matrix to apply the bait. The fipronil and imidacloprid baits provided 87 and 89 % reduction in the number of cockroaches observed at 21 weeks, respectively. Combinations of fipronil and imidacloprid baits with the oothecal parasitoid provided 76 and 92 % reductions at week 18. The amount of alternate food may be in part responsible for the slow but steady decline in cockroaches in the sewers with bait. Monitoring with sentinel oothecae to detect established populations of *A. hagenowii* failed to show parasitoid establishment, after 2 separate parasitoid releases. The parasitoid releases will be re-evaluated after 1 year. *Aprostocetus hagenowii*, fipronil, imidacloprid.

[4107] EFFICACY OF PHOSPHINE AND CARBON DIOXIDE TO CONTROL ALL LIFE STAGES OF *SITOPHILUS ORYZAE*

J. P. Santos[1], D. S. Santos[1] & J. T. Jorge[2], [1]Embrapa Milho e Sorgo, C. Postal 151, 35701-970, Sete Lagoas, MG, Brazil, E-mail: jamilton@cnpms.embrapa.br; [2]FEAGRI, Cidade Universitária Zeferino Vaz. UNICAMP, C. Postal 6011. 13081-970. Campinas, SP. Brazil.

The stored grain pests is an important problem to solve especially in the tropics where the infestation starts in the field and multiply very fast during storage because the favorable climate over year. Fumigation with phosphine (PH^3) is the most employed insect control method. Inadequate structure, poor sealing and insect resistance development are the main operational concern. To increase the chance to overcome these constraints some tests using a mixture of PH^3 and carbon dioxide (CO_2) were performed aiming to control all life stages of *S. oryzae*. Fumigation chambers measuring 25 cm high x 30 cm diameter were built with PVC tubes. Valves for injection and exhaustion of gases were mounted low on the side and on top, respectively. The experimental chambers were filled with wheat grain at 13.5% moisture and infested samples with all developmental life stages (eggs, 1st, 2nd, 3rd, 4th, pupa and adults insects) were individually involved in soft cloth and placed inside the chambers. Fumigation tests were conducted for 48, 72 and 96 hours under a combination of 100, 200, 400 and 600 ppm PH^3 in an atmosphere saturated with 10, 20, 30 and 40% CO_2. First the natural atmosphere, in each test chamber, was substituted for the respective CO_2 concentration from cylinders . Following, PH^3 was transferred from a PH^3 release apparatus using an industrial gas syringe at the correct doses. Adequate control of eggs was obtained only at the fumigation time of 96 hours, and under 400 or 600 ppm PH^3 in combination with CO_2. The 1st instar larva was, in general, less tolerant to the combination of PH^3 and CO_2. Adequate control was obtained in all treatments, except when the low doses of CO_2 and PH^3 were combined. The efficacy of the mixture of PH^3 and CO_2 to control the 2nd, 3rd and 4th instar larva followed the pattern observed for the 1st instar larva. Sufficient control of the pupa stage was accomplished only under 96 hours fumigation time and when PH^3 was mixed with CO_2. Adults were easy to control in all fumigation time tested, specially when PH^3 and CO_2 were associated, but CO_2 alone provided efficient control at 30 and 40% concentration and under 72 and 96 hours fumigation time. A conclusion drawn is that the mixture of PH^3 and CO_2 can be used to control all life stage of *S. oryzae* and that was observed a synergistic effect of CO_2 when added to PH^3.

Index terms: Rice weevil, fumigation, controlled atmosphere, stored grain

[4108] MODELLING POPULATION GROWTH OF *RHYZOPERTHA DOMINICA* (COLEOPTERA: BOSTRICHIDAE) ON STORED WHEAT

A. A. L. da Silva[1], L. R. D'A. Faroni[1] & R. N. C. Guedes[2], [1]Dept. de Engenharia Agrícola, Universidade Federal de Viçosa, Viçosa, MG 36571-000, Brazil, E-mail: lfaroni@mail.ufv.br; [2]Dept. de Biologia Animal, Universidade Federal de Viçosa, Viçosa, MG 36571-000, Brazil.

Models are important tools for evaluating, predicting, and understanding the population dynamics in natural ecossystems or on artificial ones criated under a variety of environmental conditions and management strategies. Models allow the comparison among different control strategies. These models are particularly useful for predicting the efficiency of non-chemical control methods such as biological control and aeration. New insect monitoring techniques have been recently developed for stored grains and the aim of the present work was the development of suitable population growth models of *R. dominica* for these new monitoring techniques. We seeked models based on number of adult insects which could predict the population growth from environmental conditions and the numbers of adult insects per kg grain determined by monitoring systems. *R. dominica* population growth was assessed in wheat at 10.6% of water content, at 32°C temperature and 70% relative humidity. Initial adult insect densities were 0, 2, 4, 6, 8, 10, 12, and 14 insects/1.5 kg wheat and the storage periods were 15, 30, 45, 60, 75, and 90 days. The results obtained provide support for the significant effect of initial population density and storage period. The model $P = (0.48t^2 - 23.71t)*(-0.12P_o^2 + 1.61P_o) + 600.12$ ($r^2 = 0.89$) provides a population P of adults/kg wheat originated from an initial population P_o after t days of storage. This model was obtained from malthusian conditions and can be applied in storage studies since storage units provide virtually unlimited food source for stored insect-pests.

Index terms: Lesser grain borer, temperature, initial infestation, storage period.

[4109] THE EXTRACTION OF PYRALID EGGS FROM FLOUR: THE EFFECTIVENESS AND IMPACT ON EGG EXTERNAL MORPHOLOGY

V. Stejskal, Z. Kučerová, Dept. of Stored Product Pest Control, Res. Inst. of Crop Production, Drnovská 507, CZ-161 06 Prague 6, Czech Republic, E-mail stejskal@hb.vurv.cz

Food and agricultural commodities are often infested by stored product pests of various instars, but commodity samples frequently contain only eggs of the pest. Usually the eggs are very difficult to find in, or extract from the commodity sample. The egg separation is necessary for determination of the pest species and detection of the infestation level. The goal of the project was (1) to test efficiency of a new extraction method to disclose pest eggs in flour samples, and (2) to evaluate an impact of the extraction process on external morphology of eggs (sizes and surface structure). A modified flotation method based on sodium chloride solution was tested for egg separation. Three types of flour and eggs of two pyralid moths (*Ephestia kuehniella, Plodia interpunctella*) were used in our experiment. Flotation tests were done both with fresh and highly matured eggs. Size measurements and SEM micrographs of eggs were done before and after flotation to compare potential morphological differences. The results showed that the flotation method was highly effective for both egg species (*E. kuehniella* – 82-97%, *P. interpunctella* – 78-93% of extraction). The efficiency of extraction depended on the type of flour and the age of eggs; it increased with the decrease of age and the degree of flour milling. Size differences in eggs before and after flotation were insignificant and there were no visible changes on the surface morphology of the eggs after flotation. This method proved to be useful for the detection and evaluation of pest egg infestation in flour samples and pest determination according to egg morphology.

Index terms: Ephestia kuehniella, Plodia interpunctella, flotation.

[4110] MODELING TEMPERATURE CHANGES DURING HEAT TREATMENT OF FLOUR MILLS FOR INSECT CONTROL

Bh. Subramanyam[1], P. W. Flinn[2], & R. Roesli[3], [1]Department of Grain Science and Industry, Kansas State University, Manhattan, KS 66506, USA, E-mail: bhs@wheat.ksu.edu; [2]USDA, ARS, Grain Marketing & Production Research Center, 1515 College Avenue Manhattan, KS 66502, USA, E-mail: flinn@usgmrl.ksu.edu; [3]Department of Grain Science and Industry, Kansas State University Manhattan, KS 66506, USA, E-mail: rroesli@wheat.ksu.edu.

Heating flour mills to ≥ 50°C for 24-36 h is a viable technique, and an alternative to methyl bromide, for stored product insect management. Although heat treatments have been in use since the early 1900's, very little information is available on predicing temperature changes during a heat treatment. The Kansas State University pilot flour mill was treated three different times during 1999 with gas, electric, and steam heaters. During each of the heat treatments, we recorded tempertures with Hobo sensors, or with an infrared gun, at critical locations within the flour mill. We fit temperature and humidity data to either a two or three parameter nonlinear model. For the three types of heaters, the models predicted the number of hours to reach 50°C and the number of hours above 50°C for a given location in the flour mill. The models also predicted the number of hours to cool down to ambient temperature after the heaters were turned off. The models predicted changes in temperature will (R^2 > 98%). We are currently working on an accumulated heat-unit model to predict mortality of insects as a function of stage, time, and temperature. Incorporating the heat-unit model into the temperature prediction model will be useful for predicting insect mortality during heat treatments.
Index terms: IPM, Heat, *Tribolium castaneum*, prediction, methyl bromide alternative.

[4111] MORPHOLOGICAL DESCRIPTION OF HYBRIDS FROM INTER-SPECIFIC CROSSES BETWEEN *A. FARRIS* AND *A. SIRO*

E. Szlendak [1] & J. Muggleton[2], [1]Dept. of Applied Entomology, Warsaw Agricultural Univ., ul. Nowoursynowska 166, 02-787 Warsaw, Poland, E-mail szlendak@alpha.sggw.waw.pl; [2]30 Penton Road, Staines, Middx, TW18 2LD, UK.

Although hybridisation between species in the '*A. siro* complex' is well known there does not appear to be any published morphological description of the hybrids. This paper fills that gap and presents additional results from hybridisation experiments between *A. siro* and *A. farris*. Unlike other species where the setae are used to differentiate species and intermediates this is not possible for the '*A. siro* complex'. For this work separation of adult stages from '*A. siro* complex' and their intermediates was based on differences of shape of two micro-characters namely, the solenidion omega 1, and spine s of tarsus II. F1 hybrids were produced between *A. farris* and *A. siro* and examination of the hybrids between female *A. farris* and male *A. siro* showed that they possessed intermediate features inherited from the parental stock. Successful inter-specific crosses were recorded only when male hybrid F1 were back-crossed to *A. farris* females. Examination of specimens of the F2 hybrid back-cross obtained from crossing F1 males (progeny of *A. farris* female x *A. siro* male) with parental *A. farris* females showed that they possessed most of the tarsal micro-taxonomic characters typical of *A. farris*. Descriptions are given of the hybrid specimens.
Index terms: *Acarus siro*, *Acarus farris*, hybrids

[4112] MONITORING OF ARTHROPODS IN A CENTRAL ITALY FEED-MILL

P. Trematerra[1], [1]Department of Animal, Plant and Environmental Science, University of Molise, Via De Sanctis, I-86100 Campobasso, Italy, E-mail: trema@hpsrv.unimol.it.

Arthropods fauna collected by bait and pheromone traps during one-year study, 1998, in a Central Italy feed-mill are reported. The feed-mill was a big building of about 2000 m^2 with 5 floors. A total of 17,919 Arthropods were collected: Arachnida, Isopoda and Insecta. In the Arachnida we found Mites, Pseudoscorpions and mostly Spides; while in the Isopoda the only species noted was *Porcelio scaber*; in the Insecta 9 orders and 33 determined species were associated with the feed-mill: Collembola, Thysanura, Dermaptera, Pscocoptera, Rhynchota, Lepidoptera, Coleoptera, Diptera and Hymenoptera. In the order Lepidoptera were about 55% of the insects collected. Eight species of stored product Lepidoptera were catched: *Ephestia kuehniella*, was the most abundant and wide-spread in the feed-mill (with 8,230 males, 83.53% of Lepidoptera trapped), followed by *Plodia interpunctella*, (1,415 males) and *Ephestia elutella*, (161 males). Coleopterans made up 40.43% of the insects collected. *Tribolium confusum*, was the most abundant and wide-spread in the feed-mill (with 5,451 specimens, 75.23% of Coleoptera trapped); less abundant were *Oryzaephilus surinamensis* (752 specimens), *Tribolium castaneum* (359 specimens), *Attagenus brunneus* (223 specimens), *Stegobium paniceum* (156 specimens) and *Sitophilus oryzae* (118 specimens). Arthropods infestation level found during this survey were probably directly proportional to the amount of debris present in the departments. Because of these and other peculiarities, the feed-mill staff have to be continually alert to prevent, detect, and control pest problems within their work environment.
Index terms: Fauna, survey, pheromone traps, bait traps.

[4113] CONTROL OF *Nasutitermes* sp. IN A HISTORICAL PATRIMONY IN THE CONTRYSIDE OF RIO DE JANEIRO

A. A. Trindade[1]; L. O. Andrade[1]; A. S. Diogo[1]; E. B. Menezes[1] & E. L. Aguiar-Menezes[2], [1]CIMP "CRG"/ UFRRJ, BR465, km 7, Seropédica, RJ 23890-000, Brazil, E-mail ebmen@zaz.com.br; [2]Embrapa Agrobiologia, Caixa Postal 74505, Seropédica, RJ 23890-000, Brazil, E-mail menezes@cnpab.com.br.

The termites of the genus *Nasutitermes* have became an urban pest, causing serious economic damages because of their great capacity of destruction to constructions such as buildings, homes, fabrics, etc. They eat any material containing cellulose. They may be found throughout the Rio de Janeiro state because of its adequate temperature and humidity for their development. In the district of São Sebastião, belonged to the city of Campos dos Goytacazes (RJ), there is a church, which was considered, by the Brazilian government, a very old historic patrimony (approximately 250 years old). It was built basically with wood materials (stairs, floors and a part of the roof). We did a detailed inspection there and confirmed the presence of *Nasutitermes* sp., which caused damages in the wooden parts of the old construction. We found 8 nests in the wooden roof. In the other infested parts of the church, we found only tunnels. The results that came from the inspection gave us the base to choose as the most appropriated control method a preventive and curative chemical treatment using a chlorpyriphos solution (480 g a.i./l) at the dosage 400ml/20l of water. The walls and wall wooden parts were perforated and the insecticide solution was applied by spraying. A chemical barrier was made externally to the church applying 5l insecticide solution/ m^2 in the ground, next to the walls. A new inspection was done a month later, and we observed that the colonies were completely destroyed, showing that the method used was efficient to control the colonies of *Nasutitermes* sp.
Index terms: Termite, urban pest, chemical control

[4114] CONTROL OF *NASUTITERMES* SP. ATTACKING A STORE OF FABRICS IN THE COUNTRYSIDE OF RIO DE JANEIRO STATE

A.A. Trindade[1]; L.O. Andrade[1]; A.S. Diogo[1]; E.B. Menezes[1] & E.L. Aguiar-Menezes[2], [1]CIMP "CRG"/ UFRRJ, BR 465, km 7, Seropédica, RJ 23890-000, Brazil, E-mail: ebmen@zaz.com.br; [2]Embrapa Agrobiologia, Caixa Postal 74505, Seropédica, RJ 23840-000, Brazil, E-mail menezes@cnpab.embrapa.br.

The termites of the genus Nasutitermes have became a urban pest, causing serious economic damages because of their great capacity of destruction to constructions such as buildings, homes, fabrics, etc. They eat any material containing cellulose. They may be found throughout the Rio de Janeiro state because of its adequate temperature and humidity for their development. In the center of Campos dos Goytacazes city, state of Rio de Janeiro, there is a store which serve as a deposit of fabrics that were being attacked by termites. We did a detailed inspection and found the presence of *Nasutitermes* sp., which were caused damages to the stored fabrics as well as the wooden cabinets were they were stored. We observed several actives tunnels on the walls and shelves of the cabinets. However, the fabrics were stored in the center of the store, the termites were able to reach them from 20 points on the ground where we found one nest per point. To control the population of *Nasutitermes* sp., we used a preventive/curative treatment with a chlorpyriphos solution (480 g a.i./l) at 400ml/20l of water. The tunnels were removed with a steel brush, all wood structures were perforated and the insecticide solution was sprayed. A external chemical barrier to the store was made using the same solution (5 l/m^2) applied in the ground aiming to destroying the primary nest. The fabrics could not be repaired. After the treatment, a new inspection was done, and new colonies were not detected, proving the efficacy of the method used.
Index terms: *Nasutitermes sp.*, Campos dos Goytacazes city, deposit of fabrics

[4115] *CULEX SALTANENSIS* EGG AND IMMATURE MORPHOMETRICS OBTAINED IN LABORATORY AND FIELD

J. A. C. Zequi [1]& J. Lopes [2], [1] Fellowship by CAPES UEL, C.P. 6001, 86051-970, Londrina/Paraná-Brazil. E-mail: joao.zequi@usa.net. [2] Departamento de Biologia Animal e Vegetal UEL, C.P. 6001, 86051-970, Londrina/Paraná-Brazil. E-mail: jea@uel.br.

Culex saltanensis, is a mosquito that has been found colonising sewage sedimentation and factory effluent treatment lagoons, competing, at the same time, with *Culex quinquefasciatus* in urban areas. This study is part of a major biological and biological control study about that species using the *Bacillus thuringiensis*. Larvae from the first stage, at the beginning of their development, and at the end of the first, second, third and fourth stages, were measured with the help of ocular micrometrics. Egg length and that of their operculi were measured as well. The length (l/s) and width (w/s) of the respiratory siphon, the longitudinal cephalic capsule (l/c) and the transversal cephalic capsule (t/c) of the immature were also measured. Mean data in millimetres (mm) and their respective standard deviations were as follows: 1st instar absolute (l/s=0,11 *S*=0.01; w/s=0.06 *S*=0.01, l/c=0.16 *S*=0.03; t/c=0.24 *S*=0.02); 1st late (l/s=0.23 *S*=0.03; w/s=0.09 *S*=0.01, l/c=0.21 *S*=0.01; t/c=0.287 *S*=0.02); 2nd instar (l/s=0.54 *S*=0.03; w/s=0.17 *S*=0.02, l/c=0.32 *S*=0.02; t/c=0.42 *S*=0.03); and 3rd instar (l/s=0.78 *S*=0.03; w/s=0.28 *S*=0.02, l/c=0.54 *S*=0.03; t/c=0.72 *S*=0.03). For the fourth stage, however, larvae exemplification from both laboratory and field were used. Results from the fourth field exemplification stage were as follows : (l/s=1.37 *S*=0.05; w/s=0.29 *S*=0.02, l/c=0.59 *S*=0.04; t/c=1.09 *S*=0.06); and from the fourth lab exemplification stage were: (l/s=1.36 *S*=0.04; w/s=0.33 *S*=0.04, l/c=0.66 *S*=0.05; t/c=1.14 *S*=0.04).The mean egg (e/l) and operculum (o/l) length were (e/l)=0.70 *S*=0.01; (o/l)=0.19 *S*=0.01 for the field exemplification and (e/l)=0.70 *S*=0.05; (o/l)=0.20 *S*=0.01 for the laboratory exemplification respectively. Eighty of these mosquito egg raft-shaped batches were counted. An average of 193 eggs per float ,with a *S*= 63.63, were counted in the laboratory floats For those collected in the fields, an average of 257 eggs per float, with a *S*= 55.87,were found. A significant growth was observed in the first stage larvae from the beginning of the development to the end of this stage. The average number of eggs per field float was significantly greater than that found per lab float, whereas no difference was found when sizes were compared. The increase in the number of eggs per field float can be due to several factors such as the host for the blood repast, among others. From the size of the siphon as well as from the measurements of the cephalic capsules, it was possible to separate four stages.
Index terms: culicidae, morphometrics, larvae

[4116] EDIBLE COLEOPTERA OF THE WORLD

J. Ramos-Elorduy B, Instituto de Biología, UNAM, A.P. 70-153, México, D.F., C.P. 04510, E-mail: relorduy@mail.biologia.unam.mx.

Coleoptera Order embraces the biggest biodiversity among insects. In the research line "Insects as a Source of Proteins in the Future" we studied the edible insects consumed by different cultures over the planet. In this order, no a days, we have recorded 443 species of edible insects, among these 84% belong to the Polyphaga suborder, the rest (16%) to the Adephaga suborder. In the first one we found represented the superfamilies Bostrichoidea, Cerambycoidea, Elateroidea, Curculionidea, Chrysomeloidea, Cleroidea, Dryopoidea, Cucujoidea, Hydrophilioidea, Scarabaeoidea, Lymexiloidea, Meloidea, Staphylinoidea and Tenebrionoidea. In the suborder Adephaga are represented the superfamilies Caraboidea and Gyrinoidea. The mentioned species belongs to 26 families, where the Scarabaeidae and the Cerambycidae are the most consumed, the first one with 122 edibles species recorded and the second one with 107 species recorded, here it exists also the biggest an the most succulents species, follows the aqyatic family Dytiscidae (42 species), after come the Curculionidae (35 species), the Tenebrionidae (21 species), the Carabidae (19 species), the Passalidae (17 species), the Buprestidae (14 species) the Elateridae and Hydrophilidae with 11 species each one and Lucanidae with 10 species, among the most ingested. Concerning the genus, we recorded 201, the best represented are *Cybister* (23), the genus *Rhyncophorus*, *Angosoma* and *Batocera*, *Dytiscus*, *Passalus* and *Goliathus*. The 49.75% of the genus are monospecific, the 24.38% bispecific, the 2.94% threespecific, the rest (22.93%) have more species, that goes from 4 to 23 in each of them. The 96.94% of the species belong to a one continent, only the 3.06% of them are eaten in various continents. Some beetles are eaten in adult stage, but the majority are consumed in immatures stages. The most important Coleopterophagic countries are founded in Africa (39%), the 23% in Asia, the 20% in America, the 11% in Australia and the 7% in Europe. Also are eaten in Africa the 33% of the species, the 30% of the families are eaten in America, the 22% in Africa and Asia, the 12% in Australia and 5% in Europe. Regarding the genus, the 32% of them are eaten in Africa, the 31% in America, the 23% in Asia, the 12% in Australia and the 2% in Europe. These insects are eaten principally in the rural areas of the world by individuals of all races, ages, sexes, beliefs and religions, where these species play an important rol in their nutrition, as they posses important quantities of proteins and fats.

Index terms: Edible insecta, Coleoptera, world

[4117] NEW BIOMATERIALS FROM SILK PROTEINS IN THE MEDICAL FIELD

M.Tsukada, National Institute of Sericultural and Entomological Science, Owashi, Tsukuba, Ibaraki, 305-8634, Japan, E-mail mtsukada@nises.affrc.go.jp

In this presentation, examples for the utilization of silk proteins in the medical field will be discussed. These examples show the potential possibility of extending sericulture into new fields including biotechnology and biomaterials. and how to meet the increasing demand of new materials with selected functionalities for application in the biotechnological and biomedical field. The unique processing characteristics of silk proteins as an industrial (bio)material can be summarized as follows: (1) Pure silk proteins can be obtained from silkworms. (2) Silk fibers from Bombyx mori silkworms can be dissolved in concentrated neutral salt solutions such as calcium chloride at elevated temperatures. After dialyzing against water a pure silk fibroin solution can be obtained. (3) Various forms of silk proteins, such as silk powders, silk gels, and silk films can be produced controlling the cast-dry speed of the silk fibroin solution. (4) Silk protein can be protected from dissolving by immersing it in alcohol solutions. (5) Silks can be chemically modified utilizing chemical reactive sites in the amorphous region, such as basic amino acid residues. Recently, the interest in silk fibroin morphology and structure have increased due to its attractiveness for bio-related applications. Silk fibers have been used as sutures for a long time in the surgical field, due to the biocompatibility of silk fibroin fibers with the human living tissue. In addition, it has been demonstrated that silk can be used as a substrate for enzyme immobilization in biosensors and silk fibroin is presently being tested for blood compatible materials. A more complete understanding of silk structure would provide the possibility to further exploit silk fibroin for a wide range of new uses, such as the production of oxygen-permeable membranes and biocompatible materials. Silk fibroin based membranes and films could be utilized as substrates for disease detecting biosensors, and soft tissue compatible polymers and as drug delivery systems for various medical applications. Composite materials made of silk fibroin and ethylene glycol have potential as matrices for controlled cell attachment and cell proliveration.

Index terms: *silk proteins, chemical modification, biopolymer, oxygen-permeable silk*

[4118] HIGH PROTEIN, HIGH ENERGY FEED AND CHITIN PRODUCTION FROM MANURE AND FOOD WASTE BY INSECTS

D. C. Sheppard, Dept. of Entomology, Univ. of Georgia, P. O. Box 748, Tifton, GA, 31793, USA, E-mail sheppard@tifton.cpes.peachnet.edu.

Insects are important in recycling manure and food wastes in nature. These valuable "waste handlers" are usually excluded in agricultural systems. Nature has no "wastes" because utilization is complete. Recoupling insects recyclers will benefit us in agricultural systems, especially for managing manure and food wastes. Insects could be especially valuable for handling the tremendous volume of manure produced in confined animal feeding operations (CAFO). In areas of intense animal production, more manure is produced than can be used in nearby crop production. Many researchers have studied the use of fly larvae produced on wastes, to feed animals. Scientists in China, USSR, USA, Mexico and Eastern Europe have fed these to poultry, swine, shrimp, fish, turtles and frogs. These studies have focused on house flies, face flies and blow flies. These systems generally require moving the manure to a production facility and then require energy to harvest the larvae or pupae to be used as feed. These operations greatly increase the cost of producing the insect feedstuff. The author is developing an inexpensive waste management system using the black soldier fly (*Hermetia illucens)* which digests the manure directly under the animals. With this soldier fly driven system house flies are eliminated, manure residue is eliminated by half and a 42% protein, 35% fat feedstuff is produced. This feedstuff is high in lysine, calcium, and the essential fatty acids, oleic and linoleic. Chitin and other valuable products may be recovered, as well. The black soldier fly can be used directly under the animals with minor modifications to standard animal housing. This is possible due to the migratory habits of the prepupae of this non-pest, wasp-like fly. Prepupae self-harvest as they exit the manure basin under the poultry or swine. No external energy is used and there are no moving parts for the continuous "harvest". A large (100,000 hen) caged layer house can produce 58 tons of prepupae (44% dry matter) in 5 months. Environmentally responsible utilization of animal manures is receiving more attention with higher environmental awareness and population growth. Better utilization of this resource will allow greater productivity without more land. Global demand for meat is expected to increase 60% by 2020, and will more than double in developing countries. Using insects to recover manure nutrients in the form of high quality feedstuffs could significantly increase meat production and increase environmental quality. Specific systems of insect feedstuff production from manure and food wastes will be discussed along with amino acids, fatty acids, Chitin and other valuable products produced by insects. Feeding studies and systems using insects to produce food animals will be reviewed.

Index terms: *Hermetia illucens, Musca domestica*, waste management, feedstuff

[4119] INSECT-MODEL BASED ROBOTICS

Y. Kuwana, Laboratory of Biomimetics, National Institute of Sericultural and Entomological Science, 1-2 Ohwashi, Tsukuba, Ibaraki, JAPAN 305-8634, E-mail kuwana@nises.affrc.go.jp.

In robotics research, living creatures close to us, such as dogs, human beings and also insects, have been used as models of robots. Scientists are especially focused on insects as good models for small-sized robots. Indeed, over several hundreds millions of years, insects have reduced the size of their body design, control methods, and actuators to the smallest conceivable size. An insect looks very intelligent and behavior appears complex to the external observers. But, because of the limitation of its body volume, it does not involve highly complex sensorimotor system. That is why insect behavior is innately programmed in its neural system and both fixed and reflexive. In that way, several investigators have been appealed by the challenge of designing autonomous robots. In their small body, insects have many functions. A lot of researchers are focused on locomotion, such as six-legged walking, flapping flight and jumping. Six-legged walking is especially popular and researchers have made several types of hexapod robots. Compared to quadruped and biped robots, they have advantages to maintain their dynamic balance. A neural network of cockroach was applied to a six-legs coordinator. Flapping mechanisms mimicking a mosquito or a moth were developed by using the micro-fabrication techniques. They were used for analyzing the flapping flight aerodynamically. Moreover sensory organs, such as antennae, compound eyes and cerci, were also highlighted as robotic sensors. A simple vision system modeled on a fly's compound eye was used in mobile robot navigation and obstacle avoidance. As one of biosensors, we attached a living antenna of a male silkworm moth to a mobile robot and it was used for a pheromone gas sensor. Our pheromone-guided mobile robot could trace a pheromone plume and locate the pheromone source like a male moth does. A simple artificial neural network was used to control the pheromone tracing behavior of our robot and the neural network generated moth-like behavior while interacting with the environment. This robot is a hybrid system that combines living organisms and artificial machines. Therefore it is a new type of robot that allows clarifying the behavior emergent mechanism of insects. Furthermore real-world experiments with living organisms will also greatly contribute to insect neuroethology.

Index terms: insect-model based, robot, sensor, locomotion, and neuroethology.

[4120] ALTICINAE DIVERSITY OF COSTA RICA

D. G. Furth, Dept. of Entomology, Smithsonian Inst., Washington, D. C. 20560, USA. E-mail: furth.david@nmnh.si.edu

Currently only 106 species in 41 genera of Alticinae are recorded in the literature from Costa Rica. The current study of museum specimens from a selection of recent surveys in Costa Rica have preliminarily yielded over 200 species (many undescribed) in more than 76 genera. Of these at least 29 genera are new to Costa Rica and 7 are new to Central America: *Andiroba; Chaparena; Loxoprosopus; Palmaraltica; Paralactica; Roicus; and Stenophyma*. This diversity is still considered lower than expected both in comparison to recorded species in surrounding countries (e.g., Panama with 270 species in 70 genera and Mexico with 391 species in 75 genera) and actual diversity in nature. All the Central American countries certainly have a much higher actual diversity and when museum collections are surveyed the known diversity will increase. Actual field surveys will add even more new records and a realistic idea of the true generic and specific diversity.

[4121] THE DIVERSITY OF THE CHRYSOMELIDAE FAUNA IN COSTA RICA: INSIGHTS FROM A MALAISE TRAPLINE

R. W. Flowers[1] & P.E. Hanson[2],[1]Agricultural Research Programs, Florida A&M Univ., Tallahassee, FL 32307 USA, E-mail: rflowers@famu.edu; [2]Museo de Insectos, Escuela de Fitotecnia, Univ. de Costa Rica, San Pedro, San Jose, Costa Rica, E-mail: cgodoy@inbio.ac.cr

A network of Malaise traps has been operated in Costa Rica at over 40 sites in various forested and semi-forested habitats. Originally set up by the Natural History Museum (British Museum) as a project to inventory the Hymenoptera of Costa Rica and a Rapid Ecological Assessment of the Osa Peninsula, these traps have produced great variety of other insects including Chrysomelidae. This preliminary report focuses on the Chrysomelidae fauna from five localities: the La Selva field station; cloud forest on the edge of Braulio Carillo National Park; a montaine forest in the Talamancas; Cerro de la Muerte; and the Osa Peninsula. Altitudes range from 10 to 2800 meters. Traps were sited on small privately owned parcels by agreement with the owners. Lengths of individual samples varied but were generally one month. Most traps were located at the edges of fields and old growth or late second growth forest. However, some of the Osa sites were in highly disturbed agricultural areas where no forest cover remains. Although Malaise traps are not a generally favored technique for collecting Chrysomelidae, the Costa Rican traps have produced many new country records and many apparently undescribed taxa. Size of individual samples varies greatly, but under favorable conditions these traps collected long series of taxa that are only infrequently collected by the more traditional sweeping methods. Of the five localities examined in this report, the Braulio Carillo site had the highest diversity, while an Osa site in an agricultural area had the lowest. Predictably, among Osa sites, sites with some remaining forest patches had significantly higher diversity than open sites. Species overlap between sites was insignificant. Flea beetles were the most numerous group within the Chrysomelidae at most sites, both in terms of species and individuals. The flea beetle genera *Acalleptrix, Heikertingerella*, and *Longitarsus* were the most abundant genera encountered, sometimes numerically dominating the samples.

[4122] NEPAL AS A CENTER OF SPECIATION FOR HIMALAYAN CHRYSOMELID FAUNA

E. Sprecher-Uebersax, Museum of Natural History, Augustinergasse 2, CH - 4001 Basel, Switzerland. E-mail: eva.sprecher@bs.ch

Nepal is a very interesting country for faunistical questions because zoogeographically it is situated just between the paleartic and the oriental region. The distance from the north to the south of the country is only 250 kilometers, but the altitude differs by nearly 8800 meters. No other country shows such an extreme contrast over such a short distance and, consequently, the fauna is extremely interesting. A catalogue of the Chrysomelidae of Nepal, published in 1999, includes 797 species. Since then, additional species have been reported, e.g. *Trachyaphthona hunchulii* nov. sp. In general, the Nepalese fauna is typically oriental, but some paleartic elements are known, such as *Phratora vitellinae*, a species widely distributed in the whole paleartic region, and *Cryptocephalus polymorphus* and *Novofoudrasia rufiventris*, both known from Central Asia. Until now 13 paleartic genera were found, all with local species, e.g. *Thelyterotarsus, Sclerophaedon* or *Galeruca*. Only 24 species were found at altitudes of more than 4000 m, among them 15 endemic species. The number of endemic genera is unusually large, 14 such genera were found: *Nepalogaleruca, Nepalolepta, Zangastra, Aphthonaria, Ascuta, Chabriella, Himalalta, Martensomela, Paraminota, Schawalleria, Yetialtica, Aphthonotarsa, Asiorella* and *Lipraria*. Nearly all are found on very high altitudes, they are mostly apterous and belong mainly to the Alticinae. There are also several endemic species of *Phaedon* and *Sclerophaedon* which replace each other from east to west. The isolation in the mountain regions, the extreme altitudes and the reduction of wings may explain this high number of endemic genera and species. The very high mountains and the deep river valleys separate the region into isolated habitats and offer good conditions for isolating populations and generating new species. At altitudes over 3000 m only 6 subfamilies are reported, above 4000 m only 1 Cryptocephalinae, 7 Chrysomelinae, 6 Galerucinae and 11 Alticinae were found. The large number of Alticinae at high altitudes is quite remarkable: 27% of all Alticinae were found above 3000 m, 39% of all Chrysomelid species at this altitude are Alticinae. Several species are differentiated into western and eastern subspecies, e.g. *Chrysolina dhaulagirica dhaulagirica* and *Meristata pulunini occidentalis* in the west and *C. dhaulagirica arunensis* and *M. pulunini pulunini* in the east of Nepal. *Nepalogaleruca* is known with 4 species, *N. angustilineata* has a more western distribution, *N. elegans* a more eastern one, 2 additional species were found in the central zone.
Index terms: Chrysomelidae, Nepal, distribution, endemics.

[4123] LEAF BEETLE FAUNA (COLEOPTERA: CHRYSOMELIDAE *SENSU LATO*) OF THE CARPATHIAN BASIN. WHAT DO WE REALLY KNOW? HISTORICAL BACKGROUND AND PERSPECTIVES

K. Vig, Savaria Museum, Dep. Nat. Hist., Kisfaludy S. u. 9., Szombathely, Hungary, H-9700

First papers concerning the beetle fauna of the Carpathian Basin (Central Europe) are from the XVIII century (Scopoli, 1772; Conrad, 1782; Townson, 1797). Due to the flourishing scientific interest, the exploration of the fauna accelerated in the XIX century. The result accumulated made possible to elaborate the unique volumes of the catalogue entitled *Fauna Regni Hungariae* published between 1897 and 1920. Authors of the catalogue presented all faunistical data for all animal taxa known from the Carpathian Basin at that time. In the paper concerning the beetle fauna one can find locality data of 508 leaf beetle species (Kuthy, 1897). In the middle decades of the XX century a huge project, the series of *Fauna Hungariae* was launched. As a part of this monumental work the late Zoltán Kaszab revised the leaf beetle material of the Carpathian Basin preserved in the Hungarian Natural History Museum (Budapest) and published the result as a 63. volume of the series (Kaszab, 1962). According to Kaszab's work the fauna of the Carpathian Basin includes 628 species and subspecies of Chrysomelidae. It is necessary to note, that Kaszab incorporated more than 50 species into his key which could occur on the recent territory of Hungary. During the seventies and nineties exhaustive collections were carried out in the territory of Hungarian National Parks and other protected areas of the country. The results of these investigations added new species to the check-list of the Chrysomelidae of the area and a lot of localities meant new records to the distribution of some rare species.
Summarizing the new evidences eighteen species are to be added to the check-list, so the fauna of the Carpathian Basin includes 644 species and subspecies of Chrysomelidae today. Recently similar considerable collections are being concluded in Hungary, though their results still have not been published yet. We do hope that these investigations will enrich the fauna with new species or at least some new distribution records.
In this paper author defines the territory of the Carpathian Basin as a biogeographical unit and outlines the faunistical researches are to be done on the area in the future.

[4124] PRELIMINARY PHYLOGENY AND EVOLUTION OF MIMICRY IN THE OEDIONYCHINE FLEA BEETLES (CHRYSOMELIDAE) BASED ON MOLECULAR CHARACTERS

C. N. Duckett[1] & K. M. Kjer[2], [1] Dept. of Biology, Univ. of Puerto Rico, P.O. Box. San Juan Puerto Rico,00931-3360, E-mail: catherineduckett@hotmail.com; [2] Dept. of Entomology, Rutgers Univ. New Brunswick, N.J. 08901-8524, USA

The flea beetle sub-tribe, Oedionychina (Chrysomelidae: Galerucinae: Alticini), is a large monophyletic group of 23 genera, distributed primarily in South America, Africa and India (ancient Gondwana minus Australia). The phylogenetic relationships among these genera are not understood. These beetles are diverse, colorful and involved in numerous mimicry complexes throughout their range. These mimicry complexes may have influenced the generic concepts in the Oedionychina and certainly complicate discovery of phylogenetic relationships if only external characters are used. We are also concerned with the frequency of parallelism vs. convergence in the evolution of Oedionychina, and in discovering the role of mimicry in our generic concepts of the group generally.Our resent investigations produced a preliminary phylogenetic analysis of the Oedionychina using DNA sequence data (COI & EF-alpha) with the aim of investigating the roles of mimicry, dispersal and continental drift in the evolution of the group. This research indicates that genus *Alagoasa* is not monophyletic and in need of taxonomic revision, it also suggests that mimicry among species in Genus *Omophoita* has resulted in highly convergent evolution between two lineages, whereas in Genus *Asphaera* parallelism between two closely related lineages is implicated. This research suggests that additional characters both morphological and molecular made need to be used in order to resolve the phylogeny of the group. Because the Oedionychina is the only clearly defined suprageneric group of Alticini that is distributed in more than one continent, the biogeography of this group has been suggested to be of value in elucidating the origins of the Alticini and the great radiation of flea beetles in the new world tropics. In future research we are especially interested in the relationships among New World and Old World genera and to the congruence of their phylogeny to the age of the areas where they are distributed. Investigation of larval and adult morphology is in progress to describe undocumented immatures and for further phylogenetic analysis in addition to the molecular data.

Index Terms: Coleoptera, Galerucinae, Alticini, Convergence

[4125] PHYLOGENY AND BIOGEOGRAPHY OF THE GENUS *PROCALUS* (COLEOPTERA: CHRYSOMELIDAE)

V. Jerez, Departamento de Zoología, Facultad de Ciencias Naturales y Oceanográficas, Universidad de Concepción, Casilla 160-C.Concepción. CHILE. e-mail: vjerez@udec.cl.
Grant: 96.113.036-1.2

The genus *Procalus* is a small genus of flea beetles represented by nine species: *P. mutans* , *P. viridis* , *P. lenzi* , *P. reduplicatus* , *P. malaisei* , *P. silvai* , *P. artigasi* , *P. ortizi* and *P. vilosensis*. This genus is endemic to Austral South America associated to the genera of Anacardiaceae , *Lithrea* and *Schinus*. The area of distribution of *Procalus* and its host plants, is included in the ecoregion named Mediterranean zone or Central Chile. This area is characterized by a high percentage of endemic fauna and flora. The objectives of this article, are to test the monophyly of *Procalus*, to identify characters shared by two or more species within the genus and to discuss biogeographic distribution. In this work, a phylogenetic analysis of *Procalus* was done by Hennig 86 (Farris,1988) using morphological and biological characters of adults, eggs and larvae stage of all species. The cladistic analysis resulted in a parsimonious tree of 114 steps. (CI: 0.56, RI: 0.42). This allows to establish the monophylly of *Procalus*, supported by eight synapomorphies: (1) association with Anacardiaceae, (2) mandibles of males with a tuberculate mola, (3) sternite VIII of males with a fosete, (4) metafemoral spring simplified, (5) egg shell constituted by a simple extrachorion (6) mycropyle indistinct , (7) larvae with the anterior margin of labrum emarginate and (8) egg bursters present in mesothorax. By means of PAE (Parsimonious analysis of endemicity), it was determined that some species present large distribution ranges, comprising all the Mesomorphic zone of Chile; on the other hand, other species have more restricted distribution areas constituting endemic areas. It is hypothesized that the diversification of *Procalus*, could be due to speciation mechanisms generated in the last glacial period and that the current distribution of the genus could reflect in part their evolutionary history.

Index terms: *Procalus*, Anacardiaceae, phylogeny, biogeography, Chile.

[4126] BIOGEOGRAPHY OF AFROTROPICAL *MONOLEPTA* AND RELATED TAXA (CHRYSOMELIDAE; COLEOPTERA)

T. Wagner, Zoologisches Forschungsinstitut und Museum Alexander Koenig, Adenauerallee 160, D-53113 Bonn, Germany.

In recent studies on canopy arthropods in East African forests, *Monolepta* and related taxa (Galerucinae, Chrysomelidae), were found as an abundant and species rich group of canopy dwelling leaf beetles. Classification and taxonomic status of this group is very unsatisfactory, and a revision was started. About 300 species were described in *Monolepta*, *Candezea*, and *Barombiella*, mostly between 1880 and 1940. Genus names were not used constistently by the plural authors, and consequently previous allocation was para- and polyphyletic. The phylogenetic revision also allows insights into biogeographical aspects of this group. Highest species richness and high degree of endemism was found along the Central and East African Rift system, and especially in the Ethiopian Highlands. Lower centres of endemism are the Cape Region and the montane area of Cameroon. Speciation processes were probably strongly influenced by habitat disjunction during the strong quarternary climatical change in Africa.

Index items: Africa, revision, speciation.

[4127] SYSTEMATIC POSITION OF TWO POLYMORPHIC SPECIES OF CHELYMORPHA BOH. (COLEOPTERA: CHRYSOMELIDAE: CASSIDINAE)

J. Vasconcellos-Neto [1], D. Windsor [2], Z. J. Buzzi [3] & V. Rodriguez [2], [1] Universidade Estadual de Campinas - Inst. Biologia - Depto. Zoologia. Campinas, SP, Brazil, 13083-970. E-mail: jvascont@obelix.unicamp.br; [2] Smithsonian Tropical Research Institute, Apartado 2072, Balboa, Panama.; [3] Universidade Federal do Paraná, Dpto de Zoologia, 80000 Curitiba,PR,Brazil.

The genus *Chelymorpha*, first mentioned by Chevrolat Dej. Cat., was created by Boheman (18544 in the second volume of *Monographia Cassidarum*. According to Spaeth (1909) the essential characteristics of the genus are " the head not totally hidden under pronotum; conformation of antennal groove and the ventral side of the pronotum adjacent; the conformation of pronotal bases, the tooth of the tarsal claws and the absense of one line of punctuations separating the discal margin form the disc. The strange conformation of the prosternum cannot be considered as essential character of the genus because there exist modifications in some species as in some individuals". *Chelymorpha* has 101 species, distributed between Patagonia and Canada ((Blackwelder, 1946) the genus received relatively little asttention ; only five studies on the biology os species in this group are known. Some valid species are really chromatic forms within a single highly polymorphic species. Zollessi (1968) and Vaio et al. (1975) described the morphological variability existing within *C. variabilis*. Vasconcellos-Neto (1987, 1988) studied the genetic bases of eight morphological forms of c. cribraria. Windisor also studied three forms of C. alternans occuring in Panama. Utilizing information from genetic crosses, external morphology and internal gennitalic morphology, we found at least 14 *Chelymorpha* species existing in diverses localities of south America should be united under a single name, *Chelymorpha cribraria* F. 1775. We also found three species in Central America should be unified, at least temporarily, under the name *Chelymorpha alternans* Boh. 1854 . Interespecific mating was easily obtain under laboratory conditions, and both species of femeles laid infertile eggs.

[4128] SYSTEMATIC POSITION OF THE SUBFAMILIES MEGALOPODINAE AND MEGASCELINAE (CHRYSOMELIDAE) BASED ON THE COMPARATIVE MORPHOLOGY OF THE INTERNAL REPRODUCTIVE SYSTEM

K. Suzuki, Dept. of Biology, Fac. of Science, Toyama Univ., Toyama, 930-8555 Japan. E-mail: suzuki@sci.toyama-u.ac.jp.

At the Smithsonian Tropical Research Institute, Panama, in July 1997, in the laboratory of D. M. Windsor, I had an opportunity to dissect fresh materials of several species of three phylogenetically important subfamilies Aulacoscelinae, Megalopodinae, and Megascelinae. The result of the first subfamily showed that the internal reproductive system was one of the most important phylogenetic characters; i.e., the subfamilies Aulacoscelinae and Orsodacninae have several characteristics in common and were regarded as sister groups of one monophyletic group without doubt (Suzuki & Windsor, 1999). Here, I report the results of other two subfamilies. The male and female internal reproductive systems of the subfamily Megalopodinae has been reported so far for only one Japanese species *Colobaspis* japonica (Baly, 1873) (Suzuki, 1988). The internal reproductive system of three genera (*Megalopus*, *Mastosthetus*, *Agathomerus*) of this subfamily are reported for the first time. The internal reproductive systems of these three genera have fundamentally the same characteristics as those of *Colobaspis japonica*. I could find several common stable characters for these four genera and *Zeugophora* (Zeugophorinae). This indicates that the subfamilies Megalopodinae and Zeugophorinae (and Australasian Parophaginae established by Kuschel and May, 1990) should be sister groups of one monophyletic group suggested by Suzuki (1988, 1994, 1996) and Suzuki & Windsor (1999). The Megascelinae is a unique group which has evolved in Central and South America. I could dissect many fresh specimens of *Megascelis* sp. Both male and female reproductive systems of this species clearly indicate a close relationship to those of the subfamily Eumolpinae. As already pointed out by several workers these two subfamilies should be sister groups of a single monophyletic group. Here, I discuss the systematic position of each of these two subfamilies based mainly on the results of comparative morphology of the internal reproductive system and other several phylogenetically important morphological characters like the hind wing venation, male external genitalia, and etc.

Index terms: systematic position, Megalopodinae, Megascelinae, Chrysomelidae, internal reproductive system

[4129] CHEMICAL SIGNALLING BETWEEN HOST PLANT AND EGG PARASITOID OF A GALERUCINE LEAF BEETLE

T. Meiners & M. Hilker, Institut für Biologie, Freie Universität Berlin, Haderslebener Str. 9, D-12163 Berlin, Germany, e-mail meito@zedat.fu-berlin.de

Eggs of the elm leaf beetle *Xanthogaleruca (Pyrrhalta) luteola* (Coleoptera, Chrysomelidae) experience heavy parasitization by the egg parasitoid *Oomyzus gallerucae* (Hymenoptera, Eulophidae) in the field. We investigated the tritrophic interactions between the elm leaf beetle, its host plant, the field elm (*Ulmus minor* = *U. campestris* = *U. procera*), and its egg parasitoid. We found that oviposition of *X. luteola* induces the elm leaves to release volatiles that attract the egg parasitoid (induced symonones). Studies on the mechanism of this synomone induction revealed that neither intact elm leaves nor leaves damaged by feeding beetles released attractive volatiles. But oviduct secretion of *X. luteola* which glues the eggs onto the leaves was proved to elicit the emission of the attractive synomones. The eggs are always glued onto a small epidermal wound, which is inflicted to the lower leaf surface by the female prior to oviposition. The oviduct secretion only functions as synomone elicitor when applied onto such a wound. Scratching a leaf by a scalpel to mimic the wound and application of oviduct secretion results into the release of synomones. Our studies on the specificity of the synomone induction show that the attractiveness of induced volatiles was specific both for the *Ulmus* species and the herbivore species depositing eggs. Further steps in the egg parasitoid's host location process are mediated by kairomones from host faeces and egg masses. These kairomones were also shown to be host specific, since O. *gallerucae* clearly discriminates between host and non-host (e.g. *Galerucella lineola*) cues during host finding and host recognition. The tritrophic system studied here is characterized by oligophagous and monophagous relationships on the second and the third trophic level. These intrinsic characteristics of the tritrophic system might have been a prerequisite for the development of such selective responses of a parasitoid towards specific infochemicals and of the specific indirect defense reaction of the plant to oviposition of the chrysomelid host.

Index terms: elm leaf beetle, *Oomyzus gallerucae*, oviposition behavior, synomones

[4130] CHEMICAL DEFENSE IN NEOTROPICAL LEAF BEETLES

J.M. Pasteels[1], D. Windsor[2], N. Plasman[3], D. Daloze[3], J.C. Braekman[3] & T. Hartmann[4] [1] ULB, Animal and Cellular Biology, Av. F.D. Roosevelt, 50, 1050 Brussels, Belgium, E-mail:jmpastee@ulb.ac.be; [2] STRI, Balboa-Aucon, Panama; [3] ULB, Organic Chemistry; [4] Pharmaceutical Biology, Technical. Univ., D-38106 Braunschweig, Germany.

Elytral and pronotal defensive secretions were investigated in the genera *Platyphora*, *Desmogramma*, *Calligrapha*, *Zygogramma* and *Stylodes*. Triterpenic saponines are secreted by *Platyphora* spp. and *Desmogramma conjuncta* together with idiosyncratic compounds. Besides, several *Platyphora* spp. feeding either on Asteraceae, Boraginaceae or Apocynaceae, sequester from their host-plants pyrrolizidine alkaloids of the lycopsamanine type.The secretions of *Calligrapha*, *Zygogramma* and *Stylodes* spp. are characterized by the presence of cardenolides.The biosynthetic origins of these compounds are discussed. The evolution of host-derived and autogenous defense in Neotropical leaf beetles and the evolution of host-shifts are discussed and compared to those recognized in European Chrysolinina. The current classifications of Chrysomeline leaf beetles are assessed in the light of these results.

Index terms: Chrysomelidae, chemical defense, sequestration, host-plant relationship, evolution.

[4131] THE ABDOMINAL SHIELDS OF TANSY FEEDING CASSIDINE SPECIES – DEFENCE VERSUS ATTRACTION

C. Müller[1, 2] & M. Hilker[2,1] Boyce Thompson Inst., Tower Road, Ithaca, NY 14850, USA, e-mail cm227@cornell.edu; [2] Freie Univ. Berlin, Inst. für Zoologie, Haderslebener Str. 9, 12163 Berlin, Germany.

Faeces of herbivorous insects are known both to reject predators and parasitoids and to emit kairomones that may attract them. Many cassidine larvae (Coleoptera, Chrysomelidae) collect their exuviae and faeces at their abdominal tips and form a so-called abdominal shield. In laboratory bioassays, we examined whether larvae of *Cassida* spp. feeding on tansy (*Tanacetum vulgare*, Asteraceae) are protected against generalist predators by their shields as is known for numerous other cassidine larvae. While the abdominal shield of *C. stigmatica* consists of exuviae only (exuvial shield), *C. denticollis* larvae carry a complex faecal shield. The efficacy of both shield types towards predators was compared. Our results show differences between both the predator species and the two shield types. Adult ladybirds (*Coccinella septempunctata*) treated both larvae in a different way. They were not deterred by larvae of *C. stigmatica* with exuvial shields, but avoided larvae of *C. denticollis* with faecal shields. Other predators were affected by larvae with both shield types in a similar way. While both shield types deterred adult earwigs (*Forficula auricularia*), they both were ineffective against lace wing larvae (*Chrysoperla carnea*). In contrast, exuvial and faecal shields motivated foragers of the ant *Myrmica rubra* to attack their prey larvae. Possible chemical and physical characteristics responsible for the ants' behaviour were studied in further olfactometer and contact bioassays. Volatiles of faecal shields attracted the ants, while odour from exuvial shields did not. Faecal shields emitted host plant derived mono- and sesquiterpenes in much higher quantities. Also contact cues of faecal shields were proved to motivate the ants to attack the larvae. We conclude, that chemical and visual stimuli are involved in the interaction between the predators and the cassidine larvae with their shields and cause different reactions in the various species.

Index terms: *Cassida denticollis*, *Cassida stigmatica*, *Tanacetum vulgare*, faeces, defense, kairomone.

[4132] POLYMORPHISM IN A CASSIDINAE SPECIES

Macedo, M. V., Gonçalves, R.O. & Vasconcellos-Neto, J.

ABSTRACT NOT RECEIVED

[4133] MOLECULAR PHILOGENY OF THE GENUS *CYRTONUS* (COLEOPTERA: CHRYSOMELIDAE)

I. Garneria, C. Juan & E. Petitpierre, Lab. Genètica, Dept. Biologia, UIB, 07071 Palma de Mallorca (Spain). e-mail: dbaigp4@clust.uib.es.

The genus *Cyrtonus* comprises some 40 species mainly inhabiting the Iberian Peninsula, three of which can also be found in France. Furthermore, one species lives in Morocco and another on the Balearic Islands. There is not a phylogenetic hypothesis available for this genus. The objective of this research is to elucidate the phylogenetic relationships within the genus *Cyrtonus*. A fragment of 509 bp of mitochondrial 16S rDNA was sequenced in 14 species. Two species were used as outgroups, one of *Chrysolina* and another of*Timarcha*. Phylogenetic trees were constructed using methods of maximum parsimony and maximum likelihood. The results were compared with the chromosomal data available for 11 species. In general, the chromosomal number is congruent with the phylogenetic tree except for *C. cylindricus* and *C. contractus*, both with 2n = 28 chromosomes but related to taxa with 2n = 40. Thus, the diploid number seems to have evolved from 28 to 40 chromosomes.

Index terms: 16S rDNA

[4134] GENETIC PATTERNS IN PHYTOPHAGOUS BEETLES OF THE GALÁPAGOS ARCHIPELAGO

P. Verdyck[1,2], K. Desender[1] & Dhuyvetter, H., [2, 1] Dept. Entomology, RBINSc, Vautierstr. 29, B-1000 Brussels, Belgium, E-mail: verdyck@kbinirsnb.be; [2] Dept. of Biology, Univ. of Antwerp, RUCA, Groenenborgerlaan 171, B-2020 Antwerpen.

The Galápagos islands lie in the Pacific Ocean about 1000 km from the South American coast and straddling the Equator. There are 13 large volcanic islands, 6 smaller ones and 107 islets and rocks, with a total land area of about 8000 square kilometes. 97% of their land area was designated national park, and the islands are also recognised internationally as a Man and the Biosphere Reserve and a Unesco World Heritage Site. The Galápagos are also known as a living laboratory for the study of evolution because they are home to many examples of radiated endemic groups (e.g. Darwin finches, giant tortoises, mockingbirds, Opuntia cacti, Lava lizards). Also the most biodiverse group of organisms, the insects, show several cases of radiated genera, but these have been studied to a much lesser extent. Here we compare results of population genetic and evolutionary studies on a variety of phytophagous beetle genera from the families Chrysomelidae, Oedemeridae and Curculionidae, and with special emphasis on the flea beetles beetles (Alticinae, Chrysomelidae). The techniques used are allozyme electrophoresis, RAPD's and mtDNA sequencing. One of the more striking results is the detection of a metapopulation structure with recurrent extinctions and recolonisations in the endemic chrysomelid beetle *Nesaecrepida darwini*.

Index terms: Coleoptera, population genetics, evolution, islands

[4135] SUBAQUATIC CHRYSOMELIDAE

P. Jolivet ,67 Blvd. Soult, 75012 Paris, France. E-mail: pjolivet_timarcha@csv.com

Some Chrysomelidae (non-Donaciinae) live near water, such as chrysomelines, galerucines and alticines, and some even spend their entire life in the middle of rivers and pounds, like *Galerucella nymphaeae* (L.), *Galerucella birmanica* (Jacoby) or *Neolochmaea boliviensis* Bechyne, on the leaves of floating macrophytes (Nymphaeaceae, Trapaceae, Onagraceae, Cabombaceae). All these leaf beetles are adapted to temporary submersion, especially the larvae, and their development in certain cases, can be highly specialized. Adults of certain species can retain oxygen through a pile of hydrofuge hairs or plastron situated on the abdomen or on the thorax. They can even retain air under the elytra or remain inside an air bubble. Some species of Hispinae, like *Cephaloleia*, can also live inside water-tanks (bracts, phytotelmata) of the inflorescences of *Heliconia* spp., using similar adaptations and, at least one species of *Longitarsus* (*L. nigerrimus* (Gyllenhal)) feeds on *Utricularia vulgaris* L., a carnivorous plant, and seems to live partly under and outside water in bogs, in Middle and Northern Europe, among Sphagnum. *Exosoma lusitanica* (L.) larvae live inside semi-liquid decomposed magma within bulbs of Amaryllidaceae. If the adaptation of the adults seem sometimes imperfect, often the larvae (*Galerucella nymphaeae, G. birmanica, Cephaloleia puncticollis*) are very well adapted to submersion. The biology of these semi-aquatic leaf-beetles has been mostly ignored in the literature, the only recognized truly aquatic leaf-beetles being the Donaciinae, even if, they have an aerial adult period (reproduction), which is sometimes short (*Neohaemonia* and relatives) or long, including the adult feeding phase, as for *Donacia* and *Plateumaris*.

Index terms: ***Galerucella, Neolochmaea, Cephaloleia, Longitarsus, Exosoma.***

[4136] VERTICAL STRATIFICATION OF CHRYSOMELID FAUNAS IN PANAMA

E. Charles, Tropenbos-Guyana Programme, 12E Garnett St, Campbelville, Georgetown, Guyana. Email: tropbos@guyana.net.gy

A community study of Chrysomelidae was conducted at a wet and a dry forest in Panama, in the canopy and understorey. Canopy access was facilitated by a construction cranes at both sites. In both forests, a projected area of 8100m^2 area was surveyed in the understorey and canopy. During 8 months, sampling effort with beating (n=1000 samples), flight-intercept traps (n=10) was similar in each stratum of each forest type. Chrysomelids collected with beating were tested for feeding on the foliage of the plant from which they were collected. All insects were sorted to morphospecies. In total, 5412 individuals were collected representing 286 species. Although the species richness was similar at the two forest types (176 and 165 species at the dry and wet sites, respectively), their abundance and species diversity differed significantly between the two sites (3313 individuals collected in the dry forest). Thirteen subfamilies were represented with Alticinae, Eumolpinae, Cryptocephalinae and Galerucinae being the most abundant and diverse groups. Cassidinae, Cryptocephalinae, Eumolpinae and Hispinae were more abundant in the dry forest. Over 70% of the number of individuals at each site were collected from the canopy, which was more diverse than the understorey at both sites. At the dry site, Hispinae and Megascelinae were more abundant within the understorey than in the canopy, whereas Cryptocephalinae and Lamprosomatinae showed the reverse. Out of 29 common species (n ³ 16 individuals), 13 species were more abundant in the canopy, 8 species were more abundant in the understorey, and 8 species were indifferent with regard to the strata. At the wet forest site, Alticinae, Chlamisinae, Crytocephalinae, Eumolpinae, and Lamprosomatinae were more abundant in the canopy than in the understorey. Out of 26 common species, 18 species were more abundant in the canopy, 3 species were more abundant in the understorey, and 5 species were indifferent with regard to the strata. Some of the species collected were host-specific, whilst others were generalists. The production of young leaves and flowers was significantly higher in the canopy than the understorey at both forest sites. This may explain some of the differences observed in chrysomelid faunas between the two strata. At both forest sites, the proportion of non-feeding individuals was significantly higher in the understorey than in the canopy. This suggests that food resources may be more scattered in the understorey than in the canopy and the implications for chrysomelids resident in the two strata are shortly discussed.
Index terms: Canopy; Chrysomelidae; Species diversity ; Stratification

[4137] CHALLENGING THE INSECT CONSERVATION CHALLENGE

J. L. Bossart[1] **& C. E. Carlton**[2], [1]The College of New Jersey, Dept. of Biology, PO Box 7718, Ewing, NJ, 08628-0718, USA, E-mail bossart@tcnj.edu; [2]Louisiana State University, Dept. of Entomology, 402 Life Sciences Bldg., Baton Rouge, LA, 70803, USA, E-mail ccarlto@unix1.sncc.lsu.edu.

Insects, more than any other taxa, best embody the attributes necessary to serve as effective bioindicators and harbingers of environmental degradation by virtue of their abundance, diversity, endemism, ubiquity and rapid evolution. But insect taxa have not enjoyed the same conservation attention as plant and other animal species in part because lack of monetary and expert resources apparently compound the obvious conservation challenge of widespread low regard for insects. With the importance of insects in conservation and endangered species management in mind we conducted a survey of the status of insect conservation activities in the United States. We compiled a national database of insect species of concern drawn from a state-by-state survey of Natural Heritage Programs in order to evaluate how particular insect species come to the attention of conservation biologists and regulatory units and which taxa are listed in each state and why. Our findings support the perception that conservation lists of insect taxa are less definitive and less often based on consensus or evenly applied standards and priorities than corresponding lists for other taxa. Just as charismatic megafauna garner a disproportionate amount of conservation attention and dollars, the charismatic microfauna are disproportionately represented on conservation lists. California receives excessive federal attention with half of the 37 insect species receiving federal legal protection listed solely by this state and constituting 90% of state-listed species in California. In general, most federally protected species are precinctive populations of more widespread species, suggesting that patchy populations of viable species are more likely to receive legal recognition than are historically more contiguous, broadly-distributed species suffering from range collapse. We also found that 'edge' taxa, i.e., species listed by states that fall at the natural range limit of the species, disproportionately characterize listed Lepidoptera and that particular taxonomic groups are also more likely to be included on conservation lists in states where specialists of that group reside. Lack of available expertise is commonly voiced as a primary causal explanation for the existing information deficit and data set ambiguities that permeate conservation schedules of insect taxa. We challenge this commonly held view, however, and provide support for the perspective that ample expertise is available (in the U.S. at least) to significantly address these deficiencies, but that this expertise unfortunately remains focused on less urgent issues.
Index terms: bioindicator, national survey, charisma, endemic, edge

[4138] INSECTS IN WESTERN ART

Marcel Dicke, Lab. of Entomology, Wageningen Univ., P.O. Box 8031, NL-6700 EH Wageningen, The Netherlands. E-mail: marcel.dicke@users.ento.wag-ur.nl.

There has been an increasing interest in cultural entomology over the past 15 years. However, there is a limited number of publications that explicitly deal with insects in western art. In September 1996 I have initiated a comprehensive study of the occurrence of insects in Western art. This study comprises both quantitative and qualitative aspects. It has provided a wealth of examples of artists that used insects as source of inspiration, as symbol, or as clearly visible material in their artwork. When visiting a city I would go to the art museums I could find, irrespective of the art period or movement covered and I would screen all works displayed on the presence of insect representations. In addition, I have studied a large number of exhibition catalogues and books on painters and I recorded all works in which insects were present. This resulted in a dataset that comprised a total of ca. 2200 pieces of art in February 2000. This dataset is not biased by my personal preference for certain artists or movements, as my visits to museums were based on my travel schedule and any known art museum at my travel destinations would be visited. This study has provided an overview of the history of art from an entomological viewpoint. In this presentation I will show an analysis of the representation of insects in art in different epochs and movements, which is based on this database of ca. 2200 works. The study is restricted to western art, i.e. art from Europe and North America.
Index: insects, butterflies, dragonflies, flies, art, painting

[4139] FIRST RECORD OF BELOSTOMATIDAE AS INTERMEDIATE HOSTS OF DIGENETIC TREMATODES

M. C. Digiani[1] **& J. F. Petrulevicius**[2], [1]Depto. Zoología Invertebrados, Facultad de Ciencias Naturales y Museo, Universidad Nacional de La Plata, Paseo del Bosque s/n (1900) La Plata, ARGENTINA, E-mail mdigiani@museo.fcnym.unlp.edu.ar; [2]Depto. Paleozoología Invertebrados, Facultad de Ciencias Naturales y Museo, Universidad Nacional de La Plata, E-mail levicius@museo.fcnym.unlp.edu.ar.

Species of Belostomatidae have been reported to be definitive hosts of endoparasitic Nematoda and commensal Temnocephala; however they were hitherto unknown as intermediate hosts of digenetic trematodes. During a study on aquatic insects as potential intermediate hosts of bird parasites, large encysted metacercariae were found and collected from the body cavity of adult *Belostoma elegans* and *Belostoma oxyurum* at Zapata stream (Buenos Aires province, Argentina). The cysts were recovered mainly from the abdominal cavity; some were found in the thoracic muscles. The prevalence was low (5.86%) and the intensities of infection ranged from 1 to 14 metacercariae per host. Either males, even carrying eggs, and females were infected. The cysts were large and rounded, whitish in colour when alive, and provided of a thick wall, flexible and transparent. Metacercariae were identified, even before excystation, as belonging to some species of *Stomylotrema* (Trematoda, Stomylotrematidae), easily recognizable by the characteristic shape of the excretory vesicle, highly ramified and easily observable through the cyst wall. In the studied area, members of *Stomylotrema* have several species of birds as definitive hosts, i.e. Ciconiiformes, Charadriiformes, Gruiformes, Cuculiformes and Passeriformes. Records of larval stages of Stomylotrematidae are rare. Cysts of *Laterotrema*, the other genus of the family, were found in nymphs of Anisoptera. Metacercariae of *Stomylotrema* were previously recorded from adults of Nepidae, the sister group of the Belostomatidae; however, as they were also recorded from larvae of Dytiscidae they seem not to be highly specific to the second intermediate host.
Index terms: *Belostoma* spp., metacercariae, *Stomylotrema* spp., Trematoda

[4140] BIOLOGICAL AND ECOLOGICAL STUDIES ON OMASPIDES TRICOLORATA (COLEOPTERA: CHRYSOMELIDAE: CASSIDINAE)

F. A. Frieiro-Costa [1] **& J. Vasconcellos-Neto** [2] , [1] Curso de Pós-Graduação em Ecologia.Universidade Estadual de Campinas - Inst. Biologia - Depto. Zoologia. Campinas, SP, Brazil, 13083-970. [2] Universidade Estadual de Campinas - Inst. Biologia - Depto. Zoologia. Campinas, SP, Brazil, 13083-970. E-mail: jvascont@obelix.unicamp.br.

We studied a population of *Omaspides tricolorata* Boh. 1854, a species with maternal care at Serra do Japi, Jundiaí, São Paulo state, Brazil (23° 11' S; 46° 52' W) during almost three years (1988-1990). The life cycle of this species is closed tied to seasons and the fenology of its host plant, *Ipomoea alba* (Convolvulaceae). Adults appeared in October (spring) and remained active until April, when entered diapause, and remained hidden during the dry winter season; and the next reproductive cyle started again in the next spring. The first egg cluttches were found in October (1988) or November (1989), showing two peaks of egg-clutches abundance, one in December and other in February. The last egg clutches were observed in April (1989) and March (1990), and the females and theirs offsprings need at least two months to complet their life cycle. At this time (May) starts the cold dry season and the host plant shows old leaves, wich fall during the winter. The egg-clutch size varied form 28 to 80 egss with an average of 55.1 ± 12.2 eggs (n = 56 clutches). The incubation period of the egg stage was 15.5 ± 4.4 days (n = 120 cluthces); the mean duration of larval stage, containing five instars, was 28.0 ± 5.2 days (n = 86 larval groups) and the pupal stage lasted 13.7 ± 5.3 days (n = 48 pupal groups). The imature life cyle lasted 57.3 ± 5.7 days (n =48) and during these two months the female take care its offspring. All these biological dates were obtained in field conditions The females fed only during larval development of theirs offsprings or before laid eggs. One female can take care only two generations each reproductive period. Maternal care and cycloalexy are important behavior against natural enemies.

[4141] INTERSPECIFIC DIFFERENTIATION IN EGGS AND FIRST INSTAR LARVAE OF GENUS *PROCALUS* (COLEOPTERA: CHRYSOMELIDAE)

V. Jerez, Departamento de Zoología, Facultad de Ciencias Naturales y Oceanográficas, Universidad de Concepción, Casilla 160-C. Concepción. CHILE. e-mail: vijerez@udec.cl.
Grant: 96.113.036-1.2

In Chrysomelidae, the chorionic microsculpture and the morphology of the first instar larva, are important diagnostic characters for subfamilies, genera, and may be used as a taxonomic character for specific differentiation. However, the structure and ornamentation of chorion, mycropyle, head, localization of egg bursters, and other structures in first instar larvae has not been considered currently in taxonomic and phylogenetic analysis. The aim of this work is to describe the ultrastructure of egg shell and larvae, at first instar, of six species of *Procalus*, a genus endemic to Austral South America associated to Anacardiaceae. Pairs of *P. mutans, P. reduplicatus, P. silvai, P. viridis , P. artigasi* and *P. ortizi* were collected in the field and maintained in rearing cages in order to obtain the eggs and larva. Chorion ultrastructure and egg bursters was studied with scanning electron microscopy. For each species, the structure of chorion, mycropyle, cephalic capsule, labrum, mandibles, labium , egg bursters and tarsungulus were examined and described. The results of the present study demonstrate that the eggs of *Procalus* species are cylindrical with an exochorion sculptured into poligonal cells; the mycropyle is rounded, slightly invaginated with interspecific differences on the height, number and diameter of aeropyles. The egg bursters are present on top of mesothoracic sclerites and interspecific differences are observed between to the position, form, and length of the hatching spine and setae. Finally, differences are observed in the anterior margin of labrum, chaetotaxie, tasungulus, and mandible teeth at first instar larva.
Index terms: Chrysomelidae, *Procalus* , egg shell, first instar larvae.

[4142] SOCIOECONOMIC ANALYSIS OF THE IMPACT OF *PLATYPUS SULCATUS* CHAPUIS AT A FOREST FARM IN THE DELTA BONAERENSE

M. C. Moya[1] **& R. Frank**[2], [1]Cátedra de Terapéutica Vegetal, Facultad de Agronomía, Univ. de Buenos Aires, Av. San Martín 4453, Buenos Aires (1417), Argentina. E - mail: moyamari@mail.agro.uba.ar, [2]Cátedra de Administración Rural, , Facultad de Agronomía, Univ. de Buenos Aires, Av. San Martín 4453, Buenos Aires (1417), Argentina. E - mail: rfrank@mail.agro.uba.ar

The farm is a Familiar Company defined conceptually as a system integrated by a group of elements, subsystems, which interact themselves in order to procure their objectives of production in an agro forestry scheme. The farm is located in the fourth section of Carabela´s river in Campana (Province of Buenos Aires). In the area there are 20.000 a 30.000 hectares forested with Salicaceae. The mean area is 300 hectares, the 90 % of the area is forested with poplar and the 10 % with willow. The poplar annual production is 24 m^3 and it is destined to paper industry, to serrate and to carpentry. The willow wood is destined to paper industry and to board making. During the last years the wood production was seriously menace by the damage of *Nematus desantis* Smith and *Platypus sulcatus* Chapuis which diminish the wood quality and production. In order to determinate the economic result of the activities we used Gross Margin. For the analysis we took the data of the last economic exercise and also we considered that ones which suppose improvement in the short time like a reduction of the 50 % in the damage of Platypus at the poplar orchards. For the analysis of the results the yield was calculated, and with this measure we could determinate the yield of the money destined to the production. In social aspects, other components of the system, like endogenous and exogenous factors, were analysed which impose conditions to the economic result. Observations and essays in the farm of the Company were made in order to: determinate the real economic incidence of the pest, choose strategies for managing of the pest, establish rules for the adequate use of pesticides in order to choose those with less environmental impact. The objective of this analysis is the community to be conscious about the seriousness of the socio-economic and ecological problems. It's fundamental for the farmer to learn about that in order to obtain Rural Development. One important channel of communication is between the farmers and the other members of the community. There are lots of things that each one may learn from the others. A result of this is that farmers learn to be more efficient and have a better quality of life. Dwellers of that community can be informed, transmit that knowledge and this leads to the economical and social growth.
Index terms: Ambrosia beetle, Salicaceae, forestry products, familiar company

[4143] USE OF INSECTS AS BIOTRANSFORMERS

J. Ramos & Elorduy B, Instituto de Biología, UNAM, A.P. 70-153, México, D.F., C.P. 04510, E-mail: **Erro! Indicador não definido.**.

Insects constitute the biggest animal group over the planet, their big biodiversity permit that they have an enormous variety of alimentary hosts. On the other hand, now a days its exists a big quantity of wastes due to the modern life way, that causes pollution and make improductive the land. Some of them are organic wastes from vegetal or animal origin that allow big quantities of nutrients. We used four insects to recycle them as flies, crickets, yellow worms and roaches the wastes were manure of the pig, cattle and sheep, or vegetal wastes coming from houses, restaurants, or also subproducts as those of sugar cane, coffee or juice industries. We shown the results of these experiments where insects transform the carbohydrates coming from wastes in proteins of better biological value, because from 5-8% of proteins that allow the vegetals, insects transform these in 44% to 63% of proteins. We discuss their productivity, efficiency conversion and time to recycle them. The biomass obtained were used in animal nutrition, elaborating balanced diets, where insects are included in 5% to 30%, as a source of proteins instead of soya beans, in the first steps of growth of poultry, fish, pigs.
Index terms: Insects, recycle, organic, wastes

[4144] MEDICINAL INSECTS

J. Ramos-Elorduy B.[1] & E. Motte-Florac[2], [1] Instituto de Biología, UNAM, A.P. 70-153, México, D.F., C.P. 04510, E-mail: relorduy@mail.biologia.unam.mx; [2] Univ. Montpellier 1, Francia.

In many parts all over the world insects are used in traditional medicine, they occupied a place in the local pharmacy to obtain drugs that alleviate their diseases among various ethnic groups. We shown the insects belonging to different orders used in this field recorded in Mexico, China, India, Cuba and Brazil. Until now they are 411 medicinal insects species recorded. Thirteen insects order are recorded, most of them terrestrial. The most utilized are Coleoptera, Hymenoptera, Orthoptera and Homoptera. In some species are used only a part of their body, in others the whole body, some are powdered, other are mixed with other resources as herbs, mold, or honey, some are fixed as infusions, drops, ointments or poultice. The 92.6% of them are utilized to relieve internal diseases, being used in 352 disorders as follows, for skin (57), digestive (58), respiratory (34), kidney (22), reproductive (31), circulatory (31), nervous (28), eyes (21), neuromuscular (13), bones (19), inmunological (6), hearing (4), endocrinological (4) and other diseases (43). It happens that one species is used as remedy in various troubles in the same way that an antibiotic of wide spectre does, nevertheless, the biodynamic compounds that they allow, are most of them unknown, only it exists some already isolated as those of some wasps and beetles. Some species are used in homeopathical medicine and very few in alopahtical medicine.

Index terms: Insects, medicine, traditional, uses

[4145] BIOLOGICAL DATA AND POPULATION ABUNDANCE OF THREE SPECIES OF CASSIDINAE (COLEOPTERA: CHRYSOMELIDAE) IN A TROPICAL FOREST AREA IN BRAZIL

F.N. Sá[1] & J. Vasconcellos-Neto[1], [1] Universidade Estadual de Campinas - Inst. Biologia - Depto. Zoologia. Campinas, SP, Brasil, 13083-970. E-mail: fnsa@obelix.unicamp.br.

Few information is available on the biology and phenology of Chrysomelidae, unless if they are of economic interest. In this work we have followed the populations of *Stolas chalybea*, *S. areolata* and *Anacassis phaeopoda* for two years in order to obtain basic biological data on them and to know their occurrence throughout the year. We collected the data in fortnightly visits at the studied site by censusing host plants of studied Cassidinae. During each census, we have recorded the group sizes and position of egg and larval clusters and adults on their host plants. We also recorded their numbers. In an attempt to recognize the factors that influence the abundance of Cassidinae, we correlated that with temperature and rainfall at the study area, with some plant size parameters and also considered the relative abundance of different pheno-phases of the host plants. We observed that after emerging from the eggs, larvae of the three studied species remained aggregated, although the size of the groups decreased as the larvae developed. Egg clusters and larvae of the two *Stolas* species were more frequently found on the underside of leaves of their host plants; nevertheless, mature larvae of *S. areolata* were only observed on the upper side of leaves. Adults of the three species were always isolated and both *Stolas* species were more frequently found on the upper side of leaves. *S. chalybea* and *S. areolata* seemed to have the same pattern of occurrence throughout the year: they became active with the end of the dry season, reproduced more intensely during the rainy season and reduced their activity around June, during the beginning of the period of lower temperature and rainfall. *A. phaeopoda* showed a similar pattern, but it could be observed at the field earlier than the other two species. The three species also showed a lower peak of egg laying at the end of diapause of adults, what can suggest that females overwinter fertilized already. Larvae could be observed approximately from november until April or May. This pattern of occurrence was very similar to the occurrence of leaves on their host plants. Significant positive correlations between Cassidinae numbers and temperature showed that this parameter can influence ovipositing and mating activities. The number of new branches on the host plant was the most common trait that was significantly related to Cassidinae presence. Other parameters like number of branches and number of leaves were also related to the abundance of Cassidinae.

[4146] INFLUENCE OF NATURAL ENEMIES ON THE POPULATIONS OF TWO STOLAINI SPECIES (COLEOPTERA: CHRYSOMELIDAE: CASSIDINAE) IN A BRAZILIAN TROPICAL FOREST

F.N. Sá[1] & J. Vasconcellos-Neto[1], [1] Universidade Estadual de Campinas - Inst. Biologia - Depto. Zoologia. Campinas, SP, Brasil, 13083-970. E-mail: fnsa@obelix.unicamp.br.

Natural enemies of Chrysomelidae are represented by organisms of many different taxa that can cause heavy impact on them. In this work, we followed populations of *Stolas chalybea* and *S. areolata* for two years, looking for natural enemies and investigating their influence on mortality of those Cassidinae populations. For the three studied species, we observed highest mortality rates during egg phase (87.5%, 66.98% and 65.65% for *S. areolata*, *S. chalybea* and *A. phaeopoda* respectively) provided by hymenopteran parasitoids, predation and infection by fungi. We obtained eight parasitoid species accounting for *S. chalybea* eggs (with total parasitism rate of 51.93%) and two accounting for *S. areolata* (with total parasitism rate of 28.57%). Larvae were harmed by predators like spiders and Pentatomidae hemiterans and by two Tachinidae species parasitizing them. Tachinidae parasitism rates was of 46.15% for *S. areolata* and 19.39% for *S. chalybea*. Larvae in earlier stages showed highier mortality than more mature larvae of the same species. We obtained the parasite nematode *Hexamermis* sp. (Memithidae) in adults of *S. chalybea* and we also observed some acari on their elytrum, but we could not be sure if they were acting as parasites or comensals. Adults of this Cassidinae species were also sometimes observed attached to spider webs. A one-year census on *Bidens segetum* and *Mikania cordifolia*, host plants of *Stolas chalybea* and *S. areolata* respectively, revealed, by significant positve correlations, that the abundance and richness of potential predators was synchronous with the abundance of the eggs and larvae of the beetles, sometimes showing a lag period in response. Ants, spiders and heteropterans were the most frequent predators found on host plants. We believe that this result may suggest the influence of the populations of invertebrate predators which forage on Cassidinae host plants their populations.

[4147] THE ITALIAN PEST CONTROL ASSOCIATION - CHALLENGES FOR THE NEW MILLENIUM

A. Talbalaghi [1], [1] consultant for Italian Pest Control Association, Campoleone St. , 1400014 Ariccia (RM) I , E-mail talbalaghi@libero.it

The problem of urban pests has grown dramatically; as a result, urban pest management has been recognised as a branch of pest control in its own right, requiring pest control operatives, (PCOs) to have specialist skills suited to the urban environment. The general trend of trying new approaches to pest control has made it necessary for operatives to be more knowledgeable in the different pest management techniques which are developed, as well as be competent in the use of new pest control technology as it becomes available. The guidelines PCOs should be using, when developing new pest control strategies, need to be based on careful consideration of possible effects on human and animal welfare, as well as the environment. Also, it is important to build up efficient systems which take account of public opinion and requirements laid down by legislators. These are quite demanding requirements of pest control officers; so much so that, as in many developed countries, pest control operatives in Italy felt the need for a strong PCO network and a professional organisation to assist them in their work. This need motivated them to set up the Italian Pest Control Association (IPCA). Italian PCOs realised that there was no point in canvassing new clients, collaborating with customers' associations, environmental organisations and public health authorities, or dealing with public opinion on pest control problems, unless their own professionalism was not developed to a high standard, as achieved in many other countries. This is why the IPCA lays particular emphasis on the adequate and good quality training of PCOs before they are able to offer their skills to clients. Other functions of the IPCA are : to monitor the effectiveness of pesticide sprays; while still recognising that chemical insecticides are important tools in urban pest management, to encourage efforts to reduce their use. to emphasise the need for careful, pre-treatment feasibility studies to ensure that improvisation in pest control is a thing of the past; to advise on the use of classical biological control agents, such as parasites and predators; to encourage operatives to build in continuous monitoring of pesticide resistance into their control strategies. As well as acting as a lobby organisation, championing the needs of Italian PCOs, providing them with the necessary scientific, technical, medical, legal and insurance information to support their work, the IPCA will aim to set operational standards for the Italian pest control industry and to assess the professional competency of PCOs; the ability to use new spray technology is an important part of a PCOs work and would be an important element in any IPCA-organised PCO training and qualifications.

Index terms: pest control, Italian PCOs, new organisation, aims, future action.

[4148] POPULATIONAL DENSITY ADJUSTMENT TO FOOD-PLANT RESOURCES IN LEPIDOPTERA: THE EVIDENCE OF *CHLOSYNE LACINIA SAUNDERSI*

M. Lopes da Silva, Biological and Agrarian Science Department. University of Cruz Alta – UNICRUZ. P.0. BOX 858, Cruz Alta, RS, Brazil.

Several lepidoptera species lay eggs in clusters. According to the scientific literature, this behavior is necessary for protection against parasitism, egg desiccation and for the future food-plant exploration efforts by the larvae under gregarious conditions. There is an evidence that species which lay eggs in groups have gregarious behavior, at least in the early instars. *Chlosyne lacinia saundersi* is a nymphalid butterfly commonly found in disturbed areas in southern Brazil. This species is closely associated to asteraceae plants, which are used as larvae food resources. During the reproductive season of this species egg groups were sampled in the field. The number of eggs found per group and per host-plant was counted. Statistical tests clearly showed differences in the number of eggs per group according to the plant species involved. There are significant differences in the size of egg groups laid. The minimum and the maximum number of eggs found per group were the following: the minimum number of eggs was found in *Galinsoga parviflora* DC and the maximum number of eggs per group was found in *Xanthium cavanilesii*. After this field study, a laboratory assay was carried out aiming to assess the survival rate of larvae in two food-plant species where the maximum number of eggs per group was found. Again, the results put into evidence the existence of population density adjustment with survival purposes. Larvae groups of the same size have differential survival rates according to the food-plant species where larvae were reared. In the case of *Galinsoga parviflora DC, gregariousness* is not that important as a survival factor, because the survival rate is independent of larvae group size, which demonstrate to have only small differences. On the other hand, in *Xanthium cavanilesii*, it seems to be a key factor for survival since the survival rate is higher in large larvae groups and mortality increases as the size of the group diminishes. It seems to be associated to differential physical resistance of leaf surface to chewing work efforts of young larvae. Chemical factors were not considered in this study.
Index terms: *Chlosyne lacinia saundersi*, population density, egg laying, survival rate.

[4149] RESISTANCE OF POTATO GENOTYPES (*SOLANUM* SPP.) TO *DIABROTICA SPECIOSA* AND THE MECHANISMS ENVOLVED

M. Poletti [1] & F. M. Lara [2], [1]Deptº. de Fitossanidade, Faculdade de Ciências Agrárias e Veterinárias (FCAV), Universidade Estadual Paulista (UNESP), Rodovia Carlos Tonanni, km 5, 14870-000 - Jaboticabal, SP, BRAZIL, E-mail: poletti@hotmail.com, [2]Deptº. de Fitossanidade, Faculdade de Ciências Agrárias e Veterinárias (FCAV), Universidade Estadual Paulista (UNESP), Rodovia Carlos Tonanni, km 5, 14870-000 - Jaboticabal, SP, BRAZIL, E-mail: fmlara@fcav.unesp.br.

The resistance of potato genotypes to Diabrotica speciosa and the mechanisms envolved were evaluated in field and laboratory conditions. The field test was developed in FCAV - UNESP at Jaboticabal, SP, by using the following genotypes: Achat, NYL 235-4, 288.759-16, 288.771-6, 288.776-3, 288.776-6, 288.787-5, 288.801-8 e 288.814-7. The leaf area consumption by adults was evaluated in two ages: 70 and 90 days after planting. The resistance to larvae was verified evaluating the tubers damage. In laboratory it was proceeded feeding preference tests (free choice and no choice), attractivity and longevity tests. The feeding preference tests were made 40 days after the emergency in no choice tests, working with all nine genotypes, and at 47 and 68 days, in no choice and free choice tests, working with five genotypes. Two atractivity tests were made. The first, evaluated three potato genotypes and a pumpkin, and in the second test the pumpkin was switched with the Achat. Ten replications were used. In relation to the adults longevity tests, the genotypes evaluated were: Achat, Bintje, NYL 235-4, 288.776-6, 288.801-8, 288.814-7, using ten adults per plot and six replications. In the field test the genotypes 288.759-16, 288.776-3, 288.776-6, 288.787-5 e 288.814-7 were less attacked by adults. However, 288.759-16 and 288.776-6 did not show this performance in laboratory conditions. NYL 235-4 and 288.801-8 were resistant to larvae tubers damage. The feeding preference tests showed that feeding nonpreference is the resistance mechanism of 288.776-3 to adults. It was verified that pumpkin leaves were more attractive than the leaves of potato genotypes and Achat were more attractive among the potatoes. Adults longevity was not affected by the potato genotypes; the NYL 235-4 genotype caused a higher adult mortality rate than Achat: 40.28% against 5.56% in 15 days.

[4150] EFFECT OF DIFFERENT TEMPERATURES ON THE BIOLOGY OF *TAKECALLIS TAIWANUS* (HOMOPTERA: APHIDIDAE) AND THERMAL REQUIREMENTS

L. V. Foureaux[1], C. M. Kato[1], A. M. Auad[2], [1]Instituto Mineiro de Agropecuária - IMA, BR-040 km527, 32.145-900, Contagem, MG, Brazil, E-mail foureaux@acesso.com.br; [2]UNESP, Faculdade de Ciências Agrárias e Veterinárias de Jaboticabal, Rodovia Carlos Tonnani, km5, 14.870-000, Jaboticabal, SP, Brazil, E-mail amauad@fcav.unesp.br.

The biology of *Takecallis taiwanus* was studied at 20, 25 and 30 ºC, 70 ± 10% relative humidity and 12 hours photophase. *T. taiwanus* was colected on leaves and shoots of bamboo *Phyllostachys* cf. *aurea*. The duration of nymphal instars was reduced from 8.08 days at 20ºC to 5.5 days at 25ºC. At 30ºC there was a significant increase of the average duration of all instars and of the pre-reproductive period compared to 25ºC. The average adult life span of 24.69 days at 20ºC decreased to 9.98 at 30ºC. Temperature also affected the total fecundity, which decreased from 85.17 nymphs/female at 20ºC to 6.75 nymphs/female at 30ºC. There was a significant reduction in the average duration of the biological cycle with increasing temperature. Mortality was low at 20ºC increasing significantly at 30ºC when 74% of the individuals died before reaching the adult stage. The lower threshold temperature for development of *T. taiwanus* was 8.1ºC for the complete biological cycle and the thermal constant was 389.00 degree-days.
Index terms: bamboo aphid, *Takecallis taiwanus*, *Phyllostachys* cf. *aurea*.

[4151] ENHANCEMENT OF *ANTICARSIA GEMMATALIS* (LEPIDOPTERA: NOCTUIDAE) BACULOVIRUS ACTIVITY BY OPTICAL BRIGHTENERS

L. Morales[1], F. Moscardi[2] & D. R. Sosa-Gomez[2], [1]EMATER-Paraná - P. O. Box 763, Londrina, Paraná, Brazil. 86001-970. E-mail: morales@sercomtel.com.br; [2]Embrapa-Soja - P.O. Box 231, Londrina, Paraná, Brazil. 86001-970.

The nucleopolyhedrovirus of the velvetbean caterpillar *Anticarsia gemmatalis* (AgMNPV) has been used as a microbial pesticide in Brazil since the 1980/81 and in the 1998/99 season, more than 1.0 million ha have been treated with the pathogen. Some intrinsic characteristics of nucleopolyhedrovirus such a slow action in killing the hosts limit farmers acceptance of the virus as well as the expansion of their use as microbial insecticides. In addition, Brazilian populations of *A. gemmatalis* submitted to selective pressure under laboratory conditions, developed high resistance to the virus denoting possibility for resistance when used extensively in the field. Among the strategies to reduce time to kill the hosts or to counteract resistance, mixing substances that enhance viral activity seems to be a viable one. Optical brighteners (= fluorescent brighteners) used in papers, laundry detergents, plastics, and coating industries, demonstrated to protect nucleopolyhedrovirus against ultraviolet light and also, affected larval mortality rates. Four optical brighteners were evaluated in combination with *A. gemmatalis* nucleopolyhedrovirus in both, susceptible and resistant insects. The brighteners Tinopal UNPA-GX, Tinopal DMS, Leukophor DUB, and BRY 10 D2 100 were used at a 0.5% concentrations and added to the AgMNPV in concentrations ranging from 10 to 1×10^9 occlusion bodies (OBs)/ml. The most effective brightener (Tinopal UNPA-GX) reduced the LC_{50} from 7083.0 OBs/ml to 77.8 OBs/ml (ca. 90-fold) in susceptible insects and from 3.7×10^7 OBs/ml to 6×10^2 OBs/ml (ca. 62,000-fold) in resistant insects. The mean time to mortality was reduced ca. 30% with AgMNPV/Tinopal UNPA-GX group. The four brighteners all belonging to the stilbene group, significantly enhanced the *A. gemmatalis* larvae mortality by AgMNPV- in resistant *A. gemmatalis* larvae, optical brighteners were more effective than in susceptible ones-, reduced the mean time of mortality and none showed negative effects against *A. gemmatalis* larvae, when used alone. These results indicate that these brighteners may be useful substances to be included in formulations of the AgMPNV, either to increase activity and speed of kill of this biological insecticide or to counteract cases of resistance of *A. gemmatalis* to the AgMNPV that eventually may develop in field population of this insect.
Index terms: Velvetbean caterpillar, fluorescent brightener, microbial control, entomopathogenic virus

[4152] DIFFERENTIAL DISPLAY PCR WITH NON-RADIOACTIVE DETECTION OF DIFFERENTIALLY EXPRESSED mRNAs IN APHIDS.

J. T. Margaritopoulos[1], D. Kouretas[2] and J. A. Tsitsipis[1], [1]Lab. of Entomology and Agricultural Zoology, [2]Lab. Animal Physiology, Univ. of Thessaly, P. O. Box 38334, Pedion Areos, Volos, Greece, E-mail tsitsipi@mail.uth.gr.

The use of molecular techniques in the discrimination of closely related aphid species, host races and clones of the same species have been reported by some investigators. To our knowledge the information gained has been based on Allozyme or DNA analysis. In this report we took advantage of the application of the differential display PCR method to detect differences in the mRNA expression among clones of two host races of aphids. In the vast majority of the reports radioactive dNTPs are used, and analysis of the differentially expressed genes is based on autoradiography of the resolved DNA bands. In this report we omitted radioactive dNTPs and we resolved the differentially expressed mRNAs in a non-denaturing polyacrylamide gel and stained the DNA bands with silver. Two green holocyclic clones of Myzus pesicae (Sulzer) (Homoptera: Aphididae) collected from tobacco in North Greece and two green holocyclic clones from pepper collected far away from tobacco-growing regions were examined. From each clone 100 young adult apterous virginoparous females of about the same age were tested. Reverse transcription was carried out with an oligo-dT primer without the two nucleotides overhang that is conventionally used. This eliminates the need of using multiple (dT)11NN primers, which saves time and reduces cost. In a second step, upstream primers with arbitrary sequence (25mers) were used together with downstream 5'-CAT TATGCTGAGTGATATC$(T)_9$NN'-3' primers. In this step cDNA underwent amplification with three low-stringency cycles and 45 high stringency cycles. Low stringency cycles were made in order to achieve imprecise binding of upstream primer to various cDNAs. Downstream 5'-CAT TATGCTGAGTGATATC$(T)_9$NN'-3' was used since it has been shown to lead to higher yield of specific products, lower background and high reproducibility. Using the downstream primer with AA in the 3' end and after silver staining of the amplified products we identified three bands of 950, 900 and 280 kb that are not expressed in clones from pepper and expressed in clones from tobacco. In addition, we identified one band of 470 kb that is present in clones from pepper and missing in clones from tobacco. As is shown the results were reproducible. Summarizing, using the above described modifications in the conventional DD-PCR method together with silver staining of the amplified cDNAs, we show that this method is a useful tool to identify differentially expressed genes in clones of very closely related aphid races. Possibility of discriminating of aphid host races is discussed.

Index terms: Differential display PCR, mRNA

[4153] SEASONAL FLUCTUATION OF *SHEVTCHENKELLA PETIOLULA* FERES AND *PHYLLOCOPTRUTA SERINGUEIRAE* FERES (ACARI: ERIOPHYIDAE) ON SEVEN CLONES OF RUBBER TREE (*HEVEA BRASILIENSIS* MUELL. ARG.)

M. R. Vieira[1] & T. R. B. Silva[1], [1]Dept. of Biology, UNESP, P.O. Box 31, 15385-000, Ilha Solteira, SP, Brazil, E-mail marineid@bio.feis.unesp.br.

In a recent work were described the eriophyids species *Shevtchenkella petiolula* and *Phyllocoptruta seringueirae* from material collected on rubber trees in the states of São Paulo, Mato Grosso e Mato Grosso do Sul. The *S. petiolula* occurs in petioles and petiolules and the *P. seringueirae* develops in the leaves lower surface. The seasonal fluctuation of these two species were studied on the clones RRIM 600, PB 235, GT1, IAN 873, RRIM 701, RRIM 527 E PR 261, in Buritama city (20° 08' S, 50° 04' W, 395 m), localized in Araçatuba region, São Paulo state, from August 1997 to June 1999. The *S. petiolula* have occurred in the period of leaves production with the peak population in September or October. Mites were able to develop in all the clones, and the highest average in the peak period was 17,4 mites/leaf (petiole and petiolules), registered on clone PB 235. The *P. seringueirae* occurrence was in the period between October and May with peaks varying due to clone and period of study. The RRIM 600 clone was the most suitable to this species with peak of 8,3 mites/cm^2 in March and 8,2 mites/cm^2 in January, in the 1997/98 and 1998/99 periods, respectively. The least populations were detected on the GT1 (0,4 mites/cm^2), RRIM 701 (1,1 mites/cm^2) and RRIM 527 (1,3 mites/cm^2). For the two species, in the registered population levels, no symptoms was observed on infested leaves.

Index terms: occurrence, eriophyids, symptoms.

[4154] GOMESIN, AN ANTIMICROBIAL PEPTIDE OF THE SPIDER HEMOCYTES: SPECTRUM OF ACTIVITY AND cDNA CLONING

D. Lorenzini[1], P. I. Silva Jr[1,2], P. Bulet[3] & S. Daffre[1]. 1Dep. Parasitologia, I.C.B., Universidade São Paulo, P.O.Box 66208, CEP 05389-970, São Paulo, Brasil; 2Lab. Artrópodes, Instituto Butantan, São Paulo, Brasil; 3Institut de Biologie Moléculaire et Cellulaire, 15 rue RENÉ DESCARTES, 67084, Strasbourg, France. *E-mail: sidaffre@icb.usp.br.

We have purified a small-size antimicrobial peptide, named gomesin, from the hemocytes of the unchallenged tarantula spider Acanthoscurria gomesiana. Gomesin has a molecular mass of 2270.4 Da, with 18 amino acids, including a pyroglutamic acid as the N-terminus, a C-terminal arginine (-amide, and four cysteine residues forming two disulfide bridges. This peptide shows marked sequence similarities to antimicrobial peptides from other arthropods such as tachyplesin and polyphemusin from horseshoe crabs, and androctonin from scorpions. Interestingly, it also shows marked sequence similarities to protegrins, antimicrobial peptides from porcine leukocytes. To analyze the antimicrobial spectrum activity of gomesin, we have made a synthetic peptide. Gomesin strongly affects bacterial growth, as well as the development of filamentous fungi and yeast. In addition, gomesin affects the viability of the parasite Leishmania amazonensis and has low hemolytic activity. Amino terminal sequencing of gomesin allowed us to design a degenerated gene-specific primer for 3'-RACE amplification of hemocytes cDNAs. A PCR amplified fragment (378 bp) was cloned and sequenced, and the deduced protein sequence was indentic to that obtained by Edman degradation. Analysis of the deduced amino acid sequences revealed that the mature peptide is processed from a precursor molecule. This cDNA clone will be used to determine the gene expression in different tissues and expression levels in infected animals.

Index terms: antimicrobial, peptide, cDNA, cloning, tachyplesin

[4155] PHYLOGENY OF THE TRIBE POMACHILIINI CANDÈZE

E. T. Arias, Essig Museum of Entomology, University of California, Berkeley, California 94720, e-mail: etarias@uclink4.berkeley.edu

The tribe Pomachiliini (Candèze 1859) originally included over 25 genera which occur in the Holarctic, Nearctic, and Neotropical Regions, and in New Zealand. A systematic analysis revealed that a number of these genera do not belong to Pomachiliini. A phylogenetic analysis using PAUP revealed that only the following taxa are true Pomachiliini: *Alyma* new genus, *Cosmesus* Candéze, *Deromecus* Solier, *Gabryella* new genus, *Lynnyella* new genus, *Mecothorax* Solier, *Medonia* Fleutiaux, *Nancyarena* new name, *Podonema* Solier, and *Pomachilius* Eschscholtz. The following genera are removed from Pomachiliini: *Anius* Candèze, *Agriotella* Brown, *Bedresia* Solier, *Betarmon* Kiesenwetter, *Betarmonides* Schwarz, *Chesotraxus* Fleautiaux, *Dulius* Fleautiaux, *Heschsatroxus* Candèze, *Idiotarmon* Binaghi, *Isidus* Mulsant and Rey, *Leptoschema* Horn, *Panspoeus* Sharp, *Psiloniscus* Candèze, *Smilicerus* Candèze, and *Somomecus* Solier.

[4156] FOOD PRODUCTION SEASONALLY ADJUSTED FOR THE BROOD REARING IN THE LEAF-CUTTING ANT, *ACROMYRMEX BALZANI*

K. Ichinose[1], L. C. Forti[2] & D. R. Pretto[2] 1)Kyushu National Agricultural Experiment Station, Suya 2421, Nishigoshi, Kikuchi-gun, Kumamoto-ken, 861-1192 Japan E-mail: ichis@knaes.affrc.go.jp 2)Dep. Plant Protection, UNESP, Botucatu, SP, CEP 18603-960, Brazil

We excavated 121 nests of *Acromyrmex balzani* in a pasture located in the São Paulo State, southern Brazil, from 23 July 1993 to 20 January 1995. We measured the size of each chamber and collected all ant members together with fungus medium in it. Separating the ants and medium from soil, we counted the ants and measured the dry weight of the medium. We distinguished 13 categories in the ant according to its castes and/or developmental stages: queen, major worker, medium one, minor one, worker pupa of the major, that of the medium, that of the minor, larva, egg, alate female, its pupa, alate male, and its pupa. Both the chamber volume and its number per nest were small for the attine ant group with means (± SEM) of the of 310.3 ± 13.6 (ml) and 3.08 ± 0.12, respectively. The chamber volume was significantly different among months ($F_{10, 362} = 5.233$, $P < 0.01$), increasing a little in October and becoming largest in March, 518.3 ± 65.3 (ml), while the chamber number was not ($F_{10, 110} = 1.0347$, $P > 0.05$). Immatures were reared from October to March. Sexuals were developed from October to November and departed the nest on nuptial flight in December. Production of workers was preceded by that of sexuals and undertaken later than the nuptial flight. The number of adult workers began to increase in December but decreased after April. Thus, the ant number per chamber was significantly different from month to month ($F_{10, 362} = 2.726$, $P < 0.01$) with a mean of 347.2 ± 19.2 and reaching the maximum in March, 592.8 ± 97.3. The weight of the fungus medium cultured in the chamber was significantly different among months ($F_{10, 362} = 3.078$, $P < 0.01$) with a mean of 1.51 ± 0.11 (g), being heaviest in March, 3.00 ± 0.58 (g). However, the fungus increased once in October when more sexuals were raised, decreased a little in December to January, and increased towards March again. A multiple regression analysis revealed that the quantity of the medium is closely related with the volume of the chamber and the number of ants ($r^2 = 0.682$, $F_{14, 358} = 54.814$, $P < 0.001$). It indicates that since the ant feeds on the fungus it adjusts the quantity of food production on the demand for the food by the nest members. Furthermore, the ant enlarges the space in the nest by swelling chamber volume, not by constructing additional chambers, when the medium increased which was caused by that of the members.

Index term: *Acromyrmex balzani*, ant, Brazil, food production, fungus, nest member

[4157] MALE-TO-FEMALE RATIO IN PTEROSTICHUS OBLONGOPUNCTATUS (CARABIDAE, COL.) AS A INDICATOR OF FOOD CONDITION IN FOREST HABITATS.

J. Szyszko, Unit of Assessment and Valuation of Natural Resources, Warsaw Agricultural Univ., 02-528 Warsaw Poland Rakowiecka 26/30, E-mail: szyszko@delta.sggw.waw.pl

Observation were made of the Carabid fauna in more than a dozen stands in Holland, Poland and Germany. Special attention was paid to P. oblongopunctatus. Everywhere for this species the male-to-female ratio in pitfall traps was estimated. Differences in this characteristic were found between the groups of individuals from different stands. Frequently there were differences between neighboring stands, and these were more pronounced than those between stands some hundred kilometers apart. It is suggested that, with successional changes of habitat P. oblongopunctatus changes its different activity of males and females giving rise to differences in the sex ratio in the pitfall traps. The supposition is advanced that the main factor governing this index is food. An estimate of food conditions for adults may be derived from the ratio of males to females in pitfall traps.

[4158] TIMBER HARVESTING IN MANAGED FORESTS AND THE POSSIBILITIES FOR RAISING THE RESISTANCE OF PINE STANDS AND PROTECTING THREATENED SPECIES

J. Szyszko, Unit of Assessment and Valuation of Natural Resources, Warsaw Agricultural Univ., 02-528 Warsaw Poland Rakowiecka 26/30, E-mail: szyszko@delta.sggw.waw.pl

The three basic problems confronting Poland's forests are: 1. the disappearance (dying-out) of certain species over extensive forest areas, 2. the increasing area of forest predisposed to mass outbreaks of organisms harmful to stands, and thus the necessity for ever greater use to be made of chemical compounds, 3. a decrease in bulk wood production. Treated as indicators of soil processes ongoing in the forest environment, selected groups of soil macrofauna have been the subject of long-term research which has provided a basis for the proposal and pratical employment of actions seeking to bring a halt to the unfavourable phenomena mentioned in the introduction. This may be achieved by implementing such cultivational measures as enriching stand species composition, varying the ages at which trees are felled and stimulating natural renewal in stands. However, the effectiveness of these actions, and hence the achievement of the goals, is dependent on the status (biological condition) of forest soils. This may be defined either with the aid of the traditional, highly capital-intensive methods of soil res
earch, or equally well by applying selected, easy-to-use synthetic indices relating to both selected groups of soil fauna and some characteristics of the populations of common species within the predatory epigeic fauna.

Index terms: Carabidae

[4159] INSECT PHYSIOLOGY ONLINE

T. A. Miller, Entomology Department, University of California, Riverside, CA 92521, email: thomas.miller@ucr.edu

Insect Physiology Online is being developed as a resource for teaching and research. The developers are Dr. Thomas Miller, University of California at Riverside, and Dr. Elaine Roberts, Colorado State University with funding from the U.S. Department of Agriculture. The web site can be reached at http://lamar.colostate.edu/~insects/ or http://www.faculty.ucr.edu/~insects/ These sites will be mirrored in the near future. The site currently provides links to resources such as Insect Physiology Courses, Laboratory Materials; Animations of physiological principles; Textbooks and Journal the list server at Kansas State University; Professional Societies; Journal links; Links to funding sources; Finding Colleagues; Sources of Insects as well as materials for use in teaching insect physiology courses. The site also announces scientific meetings with insect physiology content. A Bulletin Board is being developed to help colleagues keep in contact and a Forum section is being developed for airing of current issues and topics in insect physiology. New positions will be posted in the future.

[4160] SEXUAL BEHAVIOR AND DAILY ACTIVITY OF CITRUS BORER MOTH *ECDYTOLOPHA AURANTIANA* (LEPIDOPTERA: TORTRICIDAE)

J. M. S. Bento[1], J. R. P. Parra[1], E. F. Vilela[2], J. M. Walder[3] & W. S. Leal[4], [1]Dep. Entomol., Fitop. e Zool. Agrícola, ESALQ-USP, 13418-900, Piracicaba-SP, Brasil, E-mail jmsbento@carpa.ciagri.usp.br; [2]Depto. Biologia Animal, UFV, 36571-000, Viçosa-MG, Brazil; [3]CENA, 13418-900, Piracicaba-SP, Brazil; [4]Laboratory of Chemistry Prospecting, NISES, Tsukuba, Ibaraki 305-8634, Japan. Financial support: Fundecitrus

Males and virgin females of citrus borer moth *Ecdytolopha aurantiana* Lima (Lepidoptera: Tortricidae), displayed two flight peaks during a 24 h period, one at dawn and the other at dusk on orange grove. During the day, when temperatures were highest and relative humidity lowest, most individuals rested on the leaves in the lower and middle crown. Moths rapidly moved higher in the crown after sunset and many were observed flying above the tree canopy. This behavior was mainly associated with mating. Males and virgin females marked with fluorescent powder of different colors were observed in the dark with the aid of a black light. All copulation couples was observed in the upper crown of citrus trees from 6:00 to 9:00 PM, with more than 64.0% occurring between 7:00 and 8:00 PM. Males of *E. aurantiana* were attracted to virgin females from a long distance by sex pheromone and were captured in traps baited with virgin females or natural extracts. When close (1 to 2 cm), males and females displayed a short range communication behavior, with males exposing hairpencils and vibrating their wings. The females were frequently stimulated to contact the body of a male before copulation follows. The mean time during which a pair remained *in copula* was 1 h and 40 min.

Index terms: sex pheromone, attraction, mating, hairpencils.

[4161] GLANDULAR TRICHOMES IN PLANTS CAN ATTRACT HERBIVORE INSECTS

J. M. S. Bento[1], J. R. P. Parra[1], B. A. da Glória[2], A. S. do Nascimento[3] & P. W. Paré[4], [1]Dep. Entomol., Fitop. e Zool. Agrícola, ESALQ-USP, 13418-900, Piracicaba-SP, Brasil, E-mail jmsbento@carpa.ciagri.usp.br; Dep. Ciências Biológicas, ESALQ-USP, 13418-900, Piracicaba-SP, Brasil;; [3]CNPMF, EMBRAPA, Cruz das Almas-BA, 44380-000, Brazil; [4]Dep. of Chemistry and Biochemistry, Texas Tech University, Lubbock-TX, 79409-1061, USA.

Glandular trichomes of plants of different families produce exudates that may act as first line of defense against pest injury and, in some cases, as insulation protectants. Field observations in the State of Bahia, northeastern Brazil, indicated a significant positive correlation between catches of *Cratosomus flavofasciatus* Guerin (Coleoptera: Curculionidae) and transpiration levels of *Cordia curassavica* DC. (Boraginaceae), a weed commonly found in citrus groves. Rise in transpiration levels has been shown by different authors to be correlated with the production of insulation protectants in plants. Scanning microscopy examination showed that up to 80,000 glandular trichomes are present per cm^2 of young leaves of *C. curassavica*. Such trichomes produce and release an exudate that might act primarily as a plant insulator of this plant. The response of *C. flavofasciatus* to chemicals produced by those trichomes was tested under laboratory and field conditions. The borer *C. flavofasciatus* is a serious citrus pest in northeastern Brazil. Olfactometer bioassays indicated the attraction of *C. flavofasciatus* to different plant parts and to hexane extracts obtained from the glandular trichomes. Positive response was also obtained with the same hexane extracts from the glandular trichomes in the electroantennogram (EAG). The work reported here supports the hypothesis that phytophagous insects may evolve abilities to detect and to be attracted to volatiles released by plants for defense against other phytophagous species or for insulation purposes. Characterization of the development of glandular trichomes of *C. verbenacea*, including the precise secretion phase was also conducted.

Index terms: *Cordia curassavica*, *Cratosomus flavofasciatus*, glandular trichomes, attraction.

[4162] THE ACTIVITY OF GENITAL MOTONEURONS DURING REPRODUCTIVE BEHAVIOR IN THE MALE CRICKET

M. Kumashiro & M. Sakai, Dept. Biol., Fac. Sci., Okayama Univ., Tsushima-Naka-3-1-1, Okayama 700-8530, Japan, E-mail masack@cc.okayama-u.ac.jp

During copulation, the male insect performs genitalia coupling, spermatophore extrusion and spermatophore transfer to the female. To understand the neural control of sequential copulatory motor actions, the morphology and physiology of the genital motoneurons were investigated in male cricket *Gryllyus bimaculatus*. We first identified motoneurons innervating five genital organs including the guiding rod, dorsal pouch, epiphallus, ventral lobes and median pouch by backfilling with nickel, and then performed extracellular recording from nerve branches emanating from the terminal abdominal ganglion during tethered copulation. Copulation actions were induced by artifical stimulation of the epiphallic sensory hairs with a model mimicking the female copulatory papilla. During stimulation, the guiding rod was projected by contraction of its two muscles innervated by 4-5 motoneurons. The dorsal pouch was deformed by simultaneous contraction of four muscles innervated by only one motoneuron, which resulted in the ejection of the attachment plate of the spermatophore, i.e., spermatophore extrusion. These motoneurons became vigorously active at 120-170 Hz just prior to motor actions. Nearly at the same time, the epiphallus skeleton was deformed by contraction of three epiphallus muscles, which caused the opening of the passages for the bodily fluid to enter the ventral lobes and median pouch from the abdominal cavity. The expansion of these two membraneous structures pushed up the spermatophore to insert it to the female copulatory chamber. During this spermatophore transfer, one of the two ventral lobe motoneurons tonically increased its spike activity which may be involved in relaxing muscle fibers in the membranes via inhibitory actions. In addition, 7-9 median pouch motoneurons consisting of two groups, which had independent rhythmic bursts, decreased their discharges. These results allowed us to estimate the manners of the neural control over muscles in genital organs and to speculate on the neural organization of the reproductive center for spermatophore extrusion and transfer in the terminal abdominal ganglion.

Index terms: reproduction, genitalia, neural activity, spermatophore extrusion.

[4163] BIOLOGICAL CONTROL IN THE NETHERLANDS WITH SPECIAL REFERENCE TO BOTANIC GARDENS

J.P. Kaas, Bio Pre biological pest control, Geerweg 65 2461 TT Langeraar, the Netherlands.

Biological control in commercial greenhouse crops in the Netherlands dates back to 1965 when the greenhouse whitefly, *Trialeurodes vaporariorum*, and the two spotted spider mite, *Tetranychus urticae*, both key pests in cucumber and tomato greenhouse crops were controlled biologically. Extensive studies by the University of Wageningen and the Government experimental stations fine-tuned these originally British and German organisms. The use of encarsia formosa and *Phyutoseiulus persimilis* for control of the whitefly and spider mite pests are now common use. Currently over 30 species of natural enemies of pests are used commonly. Greenhouse vegetable and ornamental growers participate in a program minimizing environmental stress parameters as energy, wasre products and pesticides. Next to the now normal use of beneficials in greenhouse vegetable production increasingly cut flowers (roses, gerbera and others) and pot plants are under a regime of integrated pest management with stress to biological factors. Crops as gerbera, poinsettia, cymbidium and chrysanthemum have been on a biological schedule. In the Netherlands half of the over 1000 hectares greenhouses are assigned to greenhouse ornamentals. Nearly ¾ of the over 40 pest species are introduced, with new pests continuously added to the spectrum. Recently the detection of Thrips palmi in.. Has caused controversy. Also a recent introduction is Echinothrips. The scattered nature and varied species composition of greenhouse ornamentals renders this field economically less suitable for research. Biological control in these situations relies on experience in other cultures. Botanic gardens in the Netherlands started in 1983 using natural enemies for pest control. Currently most Northwest European botanic gardens as well as a substantial amount of interior plantings use biological control for pest suppression. Greenhouses in botanic gardens contain a wide variety of plant species in many climatic situations. Subsequently many generalist greenhouse pests may find a haven in these greenhouses. Also specialist plant pests may be introduced and reach local pest staus in the ecological islands. Live plant material from many parts of the world is received. Many species of pests have been first described for science from botanical collections despite quarantine regulations and occasional checking by government agencies unusual and new pests have been intercepted several times over the years. Bureaucratic restrictions severely hamper serious research into the use of new natural enemies and handicap the control of new pest organisms that are continuously introduced.

Index terms: Greenhouse pests, *Trialeurodes vaporariorum*, Host plant relations.

[4164] WHAT HAPPENS WITH THE OVIPOSITION WHEN THE FEMALES OF *ZABROTES SUBFASCIATUS* STAY A DETERMINED PERIOD WITHOUT HOST?

L. A. A. Sperandio[1] & F. S. Zucoloto[1], [1]Dept. of Biology, FFCLRP-USP. Av. Bandeirantes, 3900, CEP 14040-900, Ribeirão Preto, SP, Brazil. E-mail: luziale@usp.br

Z. subfasciatus (Coleoptera, Bruchidae) is one of the main predator species of stored grain and other leguminosae when there are no limiting climatic factors. This work had as objective to study the oviposition behavior of the females of *Z. subfasciatus*, when the same stay a determined period without host: 1, 3 and 5 days. The oviposition variation was studied during all life of the females. Four groups were structured: 1-Control group (0 day without host), the others: 2, 3 e 4 stayed 1, 3 and 5 days without host respectively. The *Z. subfasciatus* used were collected in beans infected in warehouses, which began the creation in laboratory. Only a variety of *P. vulgaris* was used: rosinha. In each of ten tubes 5 grains of rosinha bean and a newborn couple of *Z. subfasciatus* (0-24 h) were placed. The creation and the tubes were kept in stove with a constant temperature of 29 ± 2°C and a relative humidity of 70-80%. The total number of eggs in the beans was counted daily and the grains were changed until all the females died. It was observed that the number of eggs produced by day was different statistically, the groups 1 and 2 showing a similar standard distribuition of eggs, only with different peaks in the third and fourth days, respectively; and the groups 3 and 4 showed a standard of distribuition different from the control group, with peaks in the days fourth and sixth respectively. When the time of deprivation was of 1 day, the peak of oviposition (fourth day) corresponded to third day with host, and when the time of deprivation was of 3 and 5 days the peak of oviposition (fourth and sixth day) corresponded to the first day with host, indicating that from 3 days of host deprivation the behavior of *Z. subfasciatus* oviposition is modified.
Index terms: Bruchidae, deprivation, oviposition variation, behavior.

[4165] FIELD EVALUATION OF A 0,5% HEXAFLUMURON BAIT (RECRUIT* II) FOR COLONY ELIMINATION OF SUBTERRANEAN TERMITE *HETEROTERMES TENUIS* (ISOPTERA : RHINOTERMITIDAE).

F.J. Zorzenon[1], M.R. Potenza[1], J. Justi Junior[1] & S.L. de Almeida[2]. Instituto Biológico, SP. Av. Cons. Rodrigues Alves, 1252, CEP 04014-002 - São Paulo, SP, BR. E-mail: zorzenon@biologico.br; [2] Dow AgroSciences, R. Alexandre Dumas, 1671, CEP 04717-903 - S. Paulo, SP, BR. E-mail: salmeida@dow.com.

Heterotermes tenuis is an important subterranean termite in the agriculture environment in Brazil, and is now being recognized in the urban environment as an important structural wood-destroying pest. In this study, the efficacy of a bait containing the IGR, hexaflumuron, was evaluated for colony elimination of this termite species. For this purpose, we used a colony located in the Hebraica Club, in São Paulo City, Brazil, with an estimated foraging population of ca. 800,000. This target colony of *H. tenuis* was characterized using the Triple, Mark Release and Recapture Method (TMR) with a weighted mean model (Begon 1979, Su and Scheffrahn 1988). After characterizing the colony dynamics a bait containing hexaflumuron was introduced through in-ground stations active with termites known to be from the characterized colony, located within the foraging area of the colony. Bait consumption (visual estimate) and termite activity was monitored. Baiting was initiated on January 04, 1999. *H. tenuis* foraging in unbaited monitoring stations had ceased completely on May 03, 1999. Continuous monitoring showed that no termite activity were verified in the foraging territory 180 days after control suggesting that the *H. tenuis* colony was eliminated in a period of 119 days after first baiting. Bait consumption was estimated at about 160 g of 0.5% bait matrix containing hexaflumuron.
Index terms: termites, *Heterotermes tenuis*, baits, control, hexaflumuron.

[4166] THE SCARABAEINAE FAUNA (COLEOPTERA: SCARABAEDAE) OF THE CERRADO OF BRASÍLIA, DF, BRAZIL

M. S. Milhomem [1] & I. R. Diniz [1], [1] Dept. de Zoologia, Inst. de Biologia, Univ. de Brasília, CEP 70910 – 900, Brasília, DF, BRASIL, Email ninami@yahoo.com, ivone@rudah.com.br.

Knowledge over the Scarabaeidae fauna in Brazil is still very scarce, with less than 10 inventories of this group having been made. For the Federal District, there is only a list of 40 species, based on sporadically collected specimens, deposited in the collection of F. Z. Vaz-de-Mello at the Federal University of Viçosa. The collections were made within a 1 ha area of cerrado of the IBGE (Brazilian Institute of Geography and Statistics) ecological reserve, Brasília, DF (15°55'S, 47°51'W), from April 1997 until March of 1998, using a window interception trap, which was kept in the field for 365 days, with monthly samples. One hundred ninety-one individuals of 13 genera and 30 species were collected. Of the 40 aforementioned species, our sampling adds 6 more as new occurrences: *Canthidium decoratum, Canthon unicolor, Dichotomius ascanius, D. bicuspis, Onthophagus bucculus* and *Pedaridium louzadaourum*. The genera with the greatest abundance of individuals was *Coprophanaeus* (31% of the individuals), followed by *Anomiopus* (19%) and *Canthidium* (18%), which also presented the greatest species richness (7 species each). All other genera presented less than 7% of the individuals in each. The most abundant species was *Coprophanaeus spitzi*, with 24% of all individuals, followed by *Canthidium* sp. 1 with 12%. The peak in species richness (77%) and of abundance of individuals (65%) occurred form November to December. The beginning of the dry season (May) presented the lowest abundance (1% of individuals) and richness (7% of collected species). Scarabaeinae presented a clustered temporal distribution, occurring in the beginning of the rainy season a present a positive correlation with pluviometric indices, following the same pattern as the order Coleoptera, in the cerrados. This distribution may be explained in part by the diet of Scarabaeinae. Carcasses and feces (ephemeral resources) are more abundant during the transition periods from dry to wet seasons. To the degree that the rains accelerate the degradation of these resources, the abundance of these beetles likewise decreases. In addition, adults are apparently not very resistant to the dry period, remaining active and nesting during the rainy season.
Index terms: Scarabaeidae, coprophage, necrophage, seasonality, diversity.

[4167] CLIMATE SCENARIOS AND MODELING OF VECTOR-BORNE DISEASES

P. Jorgensen

ABSTRACT NOT RECEIVED

[4168] THE CONCEPT OF TICK-SPIROCHETE SPECIFICITY REVISITED

R. S. Lane & E. O.-Olsen. Division of Insect Biology, Univ. of Calif., 201 Wellman Hall, Berkeley, CA 94720, USA, E-mail blane@nature.berkeley.edu.

The notion that each soft-tick vector harbors its own distinct species of *Borrelia* gained wide acceptance among borreliologists by the 1950s. Indeed, the vector specificity of the relapsing-fever borreliae is high, i.e., these spirochetes usually are associated with one tick species in the genus *Ornithodoros*. In striking contrast, the Lyme disease spirochete (*Borrelia burgdorferi*) and closely related spirochetes have been isolated from or detected in more than 20 species of hard ticks. The primary hard-tick vectors of *B. burgdorferi* worldwide belong to the genus *Ixodes*, e.g., *I. pacificus* and *I. scapularis* in western and eastern North America, respectively. The objectives of this pilot study were to compare the vector competence of *I. pacificus*, *O. coriaceus* and *O. parkeri* for *B. burgdorferi*, plus that of *I. pacificus* and *O. parkeri* for the relapsing fever spirochete *B. parkeri*. Several vector-competence trials were conducted using mice and rabbits as animal models and thousands of xenodiagnostic ticks. *B. burgdorferi* occasionally infected one of the 2 soft-tick species evaluated (*O. coriaceus* but not *O. parkeri*) as well as *I. pacificus*, whereas *B. parkeri* readily infected *O. parkeri* but not *I. pacificus*. In 2 trials, for instance, 2.5% of 159 *I. pacificus* nymphs that had fed as larvae on mice inoculated with *B. burgdorferi* became infected versus zero of 214 *O. parkeri* that had fed on the same mice; conversely, *B. parkeri* was detected in 4.3% of 184 *O. parkeri* nymphs that had fed as larvae on mice injected with this spirochete versus none of 145 *I. pacificus* fed on the same animals. These findings support the longstanding concept of tick specificity for *B. parkeri*. They also concur with more recent evidence demonstrating that *B. burgdorferi* is infective for a wide range of tick species and therefore has a much lower vector specificity.
Index terms: *Ixodes pacificus*, *Ornithodoros coriaceus*, *Borrelia*, vector.

[4169] BEHAVIORAL VARIANTS OF *DIABROTICA VIRGIFERA* IN MAIZE SOYBEAN ROTATIONS

E. Levine

ABSTRACT NOT RECEIVED

[4170] DIABROTICINE IN MEXICAN AGROECOSYSTEMS

M. Urias-Lopez

ABSTRACT NOT RECEIVED

[4171] NEMATODES ADVANCEMENTS AND SUCCESSES

B. Fridlender

ABSTRACT NOT RECEIVED

[4172] COEVOLUTION OF RESISTANCE AND VIRULENCE: INSECT HOSTS AND THEIR PARASITOIDS

HCJ Godfray, NERC Centre for Population biology, Imperial College at Silwood Park, Ascot, Berkshire SL5 7PY, United Kingdom.

I will review experiments on the coevolution of host resistance and parasitoid virulence using *Drosophila melanogaster* and its parasitoids as a model system. Using artificial selection experiments we find considerable additive genetic variation in host resistance to parasitoids, and that there appears to be a trade-off between resistance and larval competitive ability. Higher resistance is associated with slower rates of feeding, and higher densities of circulating haemocytes. I will also report on ongoing experiments on selecting for parasitoid virulence, and on the genetic basis for resistance in the host. The work I shall describe has been done in collaboration with Lex Kraaijeveld and Mark Fellowes,

[4173] HIGIENIC BEHAVIOR AND TOLERANCE TO *VARROA JACBOSONI*

R. Vandame

ABSTRACT NOT RECEIVED

[4174] PHYLOGENY AND PHYLOGEOGRAPHY OF THE MARINE WATER STRIDER *HALOBATES* (HETEROPTERA, GERRIDAE)

L. Cheng[1], J. Damgaard[2], N. M. Andersen[2] & F.A.H. Sperling[3], [1]Scripps Inst. of Oceanography, Univ. of California in San Diego, La Jolla,CA. 92093-0202, U.S.A, [2] Zoological Museum, Univ. of Copenhagen, Universitetsparken 15, DK-2100 Copenhagen, Denmark, [3]Dept. of Biol. Sci., Univ. of Alberta, Edmonton, Alberta. T6G 2E9, Canada.

The genus *Halobates*, with 45 described species, is almost exclusively marine. Five species of this genus (*H. micans, H. sericeus, H. germanus, H. sobrinus* and *H. splendens*) are the only insects which have successfully colonised the open ocean. We asked how and where the genus evolved, and how the five oceanic spp. are related. We examined phylogenetic relationships by using molecular as well as morphological data. The molecular data set was 780 bp DNA sequence data from the 3' half of the mitochondrial gene encoding cytochrome oxidase subunit I from 19 species of *Halobates,* and one species from each of three related genera, *Asclepios annandalei, Austrobates rivularis*, and *Eurymetra natalensis*. The morphological data set consisted of 64 characters as defined by Andersen. Parsimony analyses of the combined molecular + morphology data sets gave a better resolved and better supported tree than did analyses of any single data set. Our results indicated that ancestral *Halobates* lived in coastal marine habitats and that there were at least two separate transitions from coastal to oceanic environments. To investigate genetic variation within the five oceanic species and to estimate the amount of gene flow between populatons, we sequenced a total of 66 specimens. We found 27 separate halplotypes for *H. micans*, and none occurred in more than one ocean. Haplotypes from the Atlantic, Pacific and Indian oceans have sequences containing 5-7 unique base substitutions. We conclude that there is no gene flow between populations of *H.micans* from the three oceans and hypothesize that these populations have been separated for at least 3 Myr. There may be limited gene flow between *H. germanus* populations from the Pacific and Indian Oceans and between *H. sericeus* populations inhabiting the northern and southern parts of the Pacific Ocean.

Index terms: Gerridae, *Halobates*, mtDNA, Phylogeny, marine

[4175] EFFECTS OF LITCHI ORCHARD GROUNDCOVER ON ARTHROPOD COMMUNITIES

R. Zhang & D. Liu, Institute of Entomology & State Key Lab for Biocontrol, Zhongshan University, Guangzhou 510275, P.R. China

A litchi-herbage complex system was established through planting *Desmodium intortum* (Mill. Urb.) in litchi orchards as groundcover in Dongguan city of Guangdong Province, China in 1997. A simple system containing only litchi plants was selected as control. The investigations of arthropod communities in both complex and simple systems were conducted from 1997 to 1998. The Berger-Parker index of ecological dominance, the Simpson index of dominant concentrat

[4176] OVIPOSITION BEHAVIOR OF THE AUTOPARASITIC ENCARSIA PERGANDIELLA

J. Walker

ABSTRACT NOT RECEIVED

[4177] SPATIAL AND TEMPORAL PATTERNS OF MITOCHONDRIAL DNA IN FERAL HONEY BEES: IMPACT OF AFRICANIZATION

M. A. Pinto[1], K. Baum[1], W. Rubink[2], S. Johnston[1] & R. N. Coulson[1],[1] Dept. of Entomology, Texas A&M Univ., College Station, Tx 77843-2475, USA, E-mail apinto@tamu.edu; [2] USDA/ARS/BIRU Honey Bee Research, 2413 East Highway 83 Bldg 213 Weslaco, Tx 78596, USA.

There are two controversial views about the genetic nature of the Africanized honey bee in the Americas. One view reports that Africanized honey bees have spread by maternal migration of African swarms and the population has retained an African genetic integrity. The other one states that the population of Africanized honey bees consists of African/European hybrids. In the present study the genetic interaction between Africanized and European honey bees is investigated. From 1991 to 2000, honey bee workers have been collected from feral colonies on the Welder Wildlife Refuge (Texas) covering a pre and post Africanization period. Two hundred and eighty two colonies, representing swarms and spatially referenced tree cavities, were analyzed for mitochondrial DNA. The temporal and spatial mitotypes distribution will be shown. Also, the level of Africanization will be compared with the number of active and inactive cavities each year, and this information related to the arrival of the Varroa mite.

Index terms: *Apis mellifera*, Africanized honey bees, spatial analysis.

[4178] INFLUENCE OF TEMPERATURE ON DEVELOPMENT OF IMMATURE *Pentilia egena* MULSANT (COLEOPTERA : COCCINELLIDAE).

J. C. Guerreiro[1], A. C. Busoli[2]. [1]Dept. de Entomologia, Fitopatologia e Zoologia Agrícola, Escola Superior de Agricultura "Luiz de Queiroz", Univ. de São Paulo, Av. Pádua Dias, 11, 13418-900 Piracicaba, SP, Brasil, E-mail jcguerre@esalq.usp.br [2]Univ. Estadual Paulista, Faculdade de Ciências Agrárias e Veterinárias, Via de Acesso Prof. Paulo Donato Castellane, s/n. Jaboticabal, São Paulo, Brazil. 14870-000.

The experiment was conducted at Insects Biological Control Laboratory, Department of Plant Protection, Faculty of Agricultural and Veterinary Science, UNESP- Campus of Jaboticabal, from January to December of 1999. To determine the influence of temperature on the biological development of *Pentilia egena*, the lady beetle was raised at three different temperatures, 19, 24 and 29ºC. The insects were kept in chambers (DBO) with relative humidity of 70±10% and photophase of 12 hour, and fed with armored scale *Aspidiotus nerii* (raised on pumpkin fruits). The embryo period varied according the treatments. The eggs maintained at 29ºC hatched the larvae in shorter period (5.43 days) with 47.14% mortality compared to 13.74 days and 21.90% of mortality when eggs were maintained at 19ºC. At 24ºC hatching period and mortality showed intermediary values. For the larval-adult period it was verified different values and viability at the three different temperatures. Following the previous tendency, at 29ºC was verified the lower period and viability (13.97 days and 75%), and for 19ºC the highest values (31.74 days and 95.83%). At 24ºC the values were 78.26% and 15.94 days for viability and period, respectively, indicating the temperature near these values is ideal for *P. egena*, development.

Index terms: Temperature, lady beetle, immature development, biological control

[4179] TASTE OF NOXIOUS LIPOPHILIC SUBSTANCES: AVERSIVE BEHAVIOR AND TASTE RESPONSE TO LIMONENE IN THE BLOWFLY, PHORMIA REGINA.

M.Ozaki, Y.Kawahara, K.Shiraishi, A. M.Kakiuchi, A.Wada & R.Yamaoka, Lab. of Chemical Ecology, Kyoto Institute of Technology, Kyoto, 606-8585 Japan E-mail mamiko@ipc.kit.ac.jp

Limonene, a monoterpene component in lemon or bergamot oil, has been used for olfactory studies, because it evokes a characteristic olfactory sensation. Its odor is not hatable or harmful for humans. However, the blowflies, when exposed to the odor of limonene for a few days, showed long lasting sever appetite reduction. Thus, the appetite reduction may be one of the defensive reactions against toxicity of limonene via their olfactory system. As oral administration of limonene is actually fatal for the blowflies, we presumed that their taste system could also detect noxious lipophilic substances to avoid swallowing them as a fail-safe. However, studies on taste reception to lipophilic and toxic substances have not been reported so much because of difficulties in preparing stimuli with lipophilic substances and in keeping animals in good condition during the experiments with toxic stimuli. The fly has taste organ on the outer surface of the labellum in a shape of sensillum having a tiny opening at the tip. We could stimulate the taste cell with even a toxic substance through this tip pore with no chance to death by oral administration. Stimulating the contact chemosensilla with the limonene that was dispersed into aqueous solution with dimethyl sulfoxide (DMSO), we observed aversive behavior and recorded the taste response of the fly. When we touched the labellar chemosensilla with the limonene-dispersing solution, the fly exhibited irritating proboscis extension with regurgitation. It looked a defensive behavior against toxic substances. In our electrophysiological experiments, the impulses induced by limonene were specifically generated from the fourth taste receptor cell, whose specific function had not been defined. Thus, we suggested that the fourth taste cell responds to lipophilic substances and that one of its important functions is generation of warning impulses to noxious substances like limonene. This study was supported by HFSP grant to M.O.

Index terms: limonene, lipophilic substance, taste aversion, blowfly

Sub-titles: (HB=Hotel Bourbon) - (HM=Hotel Mabu) - (CC=Convention Center) - (Bol=Foz Boulevard) - (PS=Poster Session) - (PL=Plenary Lecturer)

AUTHOR	Nº	TITLE	Book	Page	Date	Time	Local	Room	Session	Symp	New Session
A. Paucar C.	3673	A PRELIMINARY OVERVIEW OF THE NEOTROPICAL GENUS EPECTINASPIS (COLEOPTERA: SCARABAEIDAE: RUTELINAE: ANOMALINI)	II	927	24/08/00	15:05	HB	E	21	7	21
Aava, B. E.	1898	BODY SIZE DISTRIBUTION OF CARABIDAE IN RELATION TO PRIMARY PRODUCTIVITY IN THE BOREAL FOREST OF NORTHERN SWEDEN	I	478	21/08/00	16:30	CC		10	PS	10
Abdelhay, E.	3177	EARLY EMBRYOLOGY AND SEGMENTATION GENES EXPRESSION IN THE TEPHRITID FLY ANASTREPHA SP. 2 (DIPTERA; TEPHRITIDAE)	II	801	24/08/00	16:30	CC		16	PS	16
Abdel-Razek, A.	2133	POTENCY OF BACILLUS THURINGIENSIS AGAINST INSECTS OF STORED PRODUCTS	I	538	24/08/00	16:30	CC		11	PS	11
Abdel-Razek, A.	2136	THE USE OF BACILLUS THURINGIENSIS TO CONTROL LEPIDOPTEROUS INSECTS ON POTATO CULTIVATIONS IN EGYPT	I	539	24/08/00	16:30	CC		11	PS	11
Abd-Rabou, S.	492	WHITE FLIES FAUNA OF WILD PLANTS AND THEIR ABUNDANCE IN EGYPT	I	125	22/08/00	16:30	CC		3	PS	3
Abe, F.	3552	TERMITICIDAL SUBSTANCES FROM THE HEARTWOOD OF CRYPTOMERIA JAPONICA D. DON	II	896	25/08/00	16:30	CC		19	PS	19
Abe, H.	13	PHYLOGEOGRAPHY OF RHOMBOGNATHINE MITES	I	4	21/08/00	16:30	CC		1	PS	1
Abe, S.	3565	ADHESIVE STRENGTH OF THE GLUE SUBSTANCES IN THE COLLETERIAL GLANDS OF THE JAPANESE WILD SILKMOTHS	II	899	22/08/00	16:30	CC		19	PS	19
Abe, T.	559	SPECIES DIVERSITY AND FUNCTIONAL DIVERSITY OF TERMITES IN EASTERN ASIA	I	141	25/08/00	16:30	CC		3	PS	3
Abe, T.	2429	POSSIBLE DIGESTIVE FUNCTION OF LYSOZYME IN A WOOD-FEEDING TERMITE, RETICULITERMES SPERATUS	II	614	22/08/00	16:30	CC		13	PS	13
Aber, A.	4061	RETICULITERMES LUCIFUGUS IN URBAN HOUSEHOLDS IN URUGUAY	II	1025	21/08/00	16:30	CC		23	PS	23
Abercrombie, J.	3314	BIOLOGY OF SEPEDONEA, A NEOTROPICAL GENUS OF SNAIL-KILLING FLIES (DIPTERA: SCIOMYZIDAE)	II	837	21/08/00	16:30	CC		18	PS	18
Abercrombie, J.	3662	BIOLOGY OF SEPEDONEA, A NEOTROPICAL GENUS OF SNAIL-KILLING FLIES (DIPTERA: SCIOMYZIDAE)	II	925	24/08/00	10:50	HB	E	21	6	21
Abou-Fakhr Hammad, E. M.	1899	RESPONSES OF THE PINE PROCESSIONARY MOTH THAUMETOPOEA WILKINSONI TO EXTRACTS OF THE CHINABERRY TREE, MELIA AZEDARACH	I	479	21/08/00	16:30	CC		10	PS	10
Abou-Zaid, M. M.	1857	THE BIOCHEMICAL MECHANISM FOR THE RESISTANCE OF RED MAPLE TREES TO FOREST TENT CATERPILLAR FEEDING	I	468	24/08/00	11:50	HB	M	10	5	10
Abraham, D.	3708	MOLECULAR PHYLOGENY OF THE SUBFAMILIES IN GEOMETRIDAE (GEOMETROIDEA: LEPIDOPTERA)	II	936	21/08/00	16:30	CC		21	PS	21
Abraham, E.	3265	RECENT PROGRESS IN THE TRANSGENESIS OF SILKWORM, BOMBYX MORI AND APPLICATION TO THE GENOME PROJECT	II	825	22/08/00	10:35	HB	K	18	2	18
Abrahamovich, A. H.	3444	GEOGRAPHIC RANGE OF THE SPECIES OF BOMBUS LATREILLE (HYMENOPTERA, APIDAE) IN ARGENTINA	II	869	21/08/00	16:30	CC		19	PS	19
Abrahamson, W. G.	832	TEMPORAL VARIATION IN HOST-PLANT PREFERENCE AND OFFSPRING PERFORMANCE: CONSTRAINTS ON HOST-PLANT SPECIALIZATION	I	210	23/08/00	11:20	HB	D	6	5	6
Abrahão, M.	3248	SEROLOGY FOR BABESIA BOVIS IN HUMAN PATIENTS WITH LYME- LYKE DISEASE SYNDROME, SYPHILIS, SEPTICEMIA AND AUTOIMMUNE DISEASES	II	820	25/08/00	16:30	CC		17	PS	17
Abreu, E.	539	SOCIEDAD ENTOMOLÓGICA DE PUERTO RICO	I	136	24/08/00	16:30	CC		3	PS	3
Abreu, R. M. M.	3445	CYTOCHEMICAL AND HISTOPHYSICAL ASPECTS OF APIS MELLIFERA (HYMENOPTERA, APIDAE) WORKER VENOM GLAND SECRETION	II	870	21/08/00	16:30	CC		19	PS	19
Achterberg, C. van	460	THE BIOGEOGRAPHY OF THE GENUS AUSTROZELE (HYMENOPTERA: BRACONIDAE: MACROCENTRINAE)	I	117	21/08/00	16:30	CC		3	PS	3
Acosta, N.	2958	ISOENZYMATIC CHARACTERIZATION OF TRIATOMA INFESTANS POPULATIONS FROM EASTERN AND WESTERN REGIONS OF PARAGUAY	II	746	21/08/00	16:30	CC		15	PS	15
Acosta, N.	3154	MORPHOMETRIC DIFFERENCES OF TRIATOMA INFESTANS FROM THE EASTERN AND WESTERN REGIONS OF PARAGUAY	II	796	23/08/00	16:30	CC		16	PS	16
Adams, M.	2942	IDENTIFICATION OF FORENSICALLY-IMPORTANT AUSTRALIAN BLOWFLIES	II	742	26/08/00	10:20	Bol	R	15	11	15
Adams, R. M. M.	3429	USURPERS AND MARAUDERS: THE SOCIAL PREDATOR MEGALOMYRMEX SP. NOV. (FORMICIDAE: SOLENOPSIDINI) PILLAGES BOTH GARDEN AND BROOD FROM FUNGUS-GROWING ANTS (ATTINI)	II	866	23/08/00	10:35	HM	Q	19	4	19
Adams, T. S.	2369	THE REPRODUCTIVE BIOLOGY OF PERILLUS BIOCULATUS	II	598	24/08/00	11:05	HB	I	13	6	13
Addante, R.	3592	IMPORTANCE OF SOME PLANTS OF THE MEDITERRANEAN FLORA IN THE BIOLOGY OF FRANKLINIELLA OCCIDENTALIS (THYSANOPTERA THRIPIDAE)	II	906	21/08/00	16:30	CC		20	PS	20
Addison, M. F.	2545	STATUS OF CODLING MOTH MANAGEMENT AND CURRENT CONTROL PROGRAMS: SOUTHERN HEMISPHERE	II	643	21/08/00	13:50	HB	B	14	2	14
Addison, M. F.	111	THE POTENTIAL EFFECT OF UNITED STATES LEGISLATION, THE FOOD QUALITY PROTECTION ACT, ON SOUTH AFRICAN FRUIT EXPORTS	I	29	23/08/00	11:15	HB	A	2	5	2
Adhami, F.	3001	TOWARD INTERRUPTING MALARIA TRANSMISSION BY GENETIC MANIPULATION OF THE MOSQUITO VECTOR	II	757	23/08/00	16:30	CC		15	PS	15
Adis, J.	392	DUNG BEETLES OF CENTRAL AMAZONIAN FLOODPLAINS	I	100	22/08/00	13:35	HB	C	3	2	3
Adis, J.	390	DIVERSITY AND LIFE HISTORY TRAITS OF TIGER BEETLES (COLEOPTERA: CICINDELIDAE) FROM CENTRAL AMAZONIA (BRAZIL)	I	99	22/08/00	11:20	HB	C	3	2	3
Adis, J.	391	GROUND BEETLE COMMUNITIES (COLEOPTERA, CARABIDAE) AT FRUIT FALLS IN A TERRA FIRME RAINFOREST NEAR MANAUS (AMAZONIA) - A FIRST REVIEW	I	99	22/08/00	11:35	HB	C	3	2	3
Adis, J.	3605	ARTHROPODS OBTAINED BY CANOPY FOGGING FROM VOCHYSIA DIVERGENS (VOCHYSIACEAE) IN PANTANAL OF BRAZIL	II	910	24/08/00	16:30	CC		20	PS	20
Adis, J.	2457	RELATION BETWEEN WEIGHT AND VOLUME OF CORNOPS AQUATICUM (ORTHOPTERA: ACRIDIDAE) IN THE SURROUNDINGS OF RIO CLARO, BRAZIL	II	621	23/08/00	16:30	CC		13	PS	13
Adis, J.	2458	RESPIROMETRIC STUDIES OF CORNOPS AQUATICUM (ORTHOPTERA: ACRIDIDAE) IN THE SURROUNDINGS OF RIO CLARO, BRAZIL	II	621	23/08/00	16:30	CC		13	PS	13
Adler, C	3910	ASSOCIATION OF PHYSICAL CONTROL MEANS FOR THE CONTROL OF INSECTS IN CEREAL INDUSTRIES AND PRODUCTS	II	987	24/08/00	15:00	HB	H	22	6	22
Adler, C	4029	MODIFIED ATMOSPHERES FOR PYRALID MOTH CONTROL AT LOW TEMPERATURES	II	1017	23/08/00	9:45	HB	J	23	6	23
Adler, C	4051	USE OF PHYTOCHEMICALS IN INTEGRATED STORED PRODUCT PROTECTION	II	1023	24/08/00	13:30	HB	J	23	9	23
Adler, C.	4030	EFFICACY OF CONTROLLED ATMOSPHERES ON CIMEX LECTULARIUS (HET., CIMICIDAE) AND ARGAS REFLEXUS (ACARI, ARGASIDAE)	II	1018	23/08/00	10:00	HB	J	23	6	23
Adler, P. H.	2254	CYTOTAXONOMY AND HOMOSEQUENTIAL SPECIES OF THE SIMULIUM PERFLAVUM SPECIES GROUP (DIPTERA: SIMULIIDAE) FROM BRAZIL AND VENEZUELA	I	569	22/08/00	16:30	CC		12	PS	12
Adrian, R. T.	2832	TOWARDS THE INTEGRATED PEST MANAGEMENT OF THE SMALL RICE STINK BUG IN GUYANA: MONITORING	II	715	25/08/00	16:30	CC		14	PS	14
Adrian, R. T.	2833	THE EFFICACY OF NEEM SEED EXTRACTS AND COMMERCIAL NEEM PRODUCTS IN CONTROLLING THE SMALL RICE STINK BUG	II	715	25/08/00	16:30	CC		14	PS	14
Aenmey, T.	3446	ALLODAPINE BEES GAIN NESTING OPPORTUNITIES FROM AN ANT-ACACIA MUTUALISM	II	870	21/08/00	16:30	CC		19	PS	19
Afonina, V. M.	362	ALLOCATION OF ARTHROPODS IN WINTER WHEAT CROP AND AROUND IT	I	92	25/08/00	16:30	CC		2	PS	2
Afonso, A. P.	2091	GROWTH OF FUNGI CULTIVATED BY CUTTING ANTS ON MURASHIGE & SKOOG NUTRIENT SOLUTION IN DIFFERENT pH	I	527	24/08/00	16:30	CC		11	PS	11
Afonso, A. P.	2092	EFFICIENCY OF DIFFERENT CULTURE MEDIA IN THE IN VITRO GROWTH OF FUNGI CULTIVATED BY DIFFERENT LEAF CUTTING ANT SPECIES	I	528	24/08/00	16:30	CC		11	PS	11
Afzelius, B. A.	3091	THE CENTRIOLE IN INSECT SPERMATOZOA	II	780	26/08/00	9:35	HB	G	16	9	16
Aghamirkarimi, A.	2612	THE EFFECT OF STUFFING POMEGRANATE NECK (CEELYX) ON REDUCTION OF POMEGRANATE NECK WORM SPECTROBATES CERATONIAE (LEP. PYRALIDAE: PHYCITINAE) DAMAGE	II	660	21/08/00	16:30	CC		14	PS	14

Sub-titles: (HB=Hotel Bourbon) - (HM=Hotel Mabu) - (CC=Convention Center) - (Bol=Foz Boulevard) - (PS=Poster Session) - (PL=Plenary Lecturer)

AUTHOR	Nº	TITLE	Book	Page	Date	Time	Local	Room	Session	Symp	New Session
Agrizzi, E. J.	3981	THREAT ON THE GREEN BELT AT COMPANHIA SIDERÚRGICA DE TUBARÃO – CST	II	1005	24/08/00	16:30	CC		22	PS	22
Aguiar- Menezes, E. L.	1946	EFFICIENCY OF GRANULATED SYSTEMIC INSECTICIDES TO ELIMINATE THE COPTOTERMES HAVILANDI COLONIES ATTACKING ROOTS OF TREES	I	490	23/08/00	16:30	CC		10	PS	10
Aguiar, A. P.	3709	GENERIC REVISION AND PHYLOGENY OF THE FAMILY STEPHANIDAE (HYMENOPTERA)	II	936	21/08/00	16:30	CC		21	PS	21
Aguiar, C. M. L.	3710	ABUNDANCE, TEMPORAL PATTERNS OF ACTIVITY AND FLORAL PREFERENCES OF CENTRIS BEES (HYMENOPTERA, APIDAE) FROM BRAZILIAN CAATINGA.	II	937	21/08/00	16:30	CC		21	PS	21
Aguiar, M. S.	2103	PATHOGENICITY OF NEW ISOLATES OF BACILLUS THURINGIENSIS AGAINST LEPIDOPTERAN AND DIPTERAN PESTS	I	530	23/08/00	16:30	CC		11	PS	11
Aguiar, M. S.	2102	A CULTURE COLLECTION OF BACILLUS THURINGIENSIS AND BACILLUS SPHAERICUS PATHOGENIC TO INSECTS	I	530	23/08/00	16:30	CC		11	PS	11
Aguiar-Menezes, E. L.	3455	PRELIMINARY SURVEY AND SPECIES COMPOSITION OF TERMITES IN SOME SITES OF THE CAMPUS OF THE "UNIVERSIDADE FEDERAL RURAL DO RIO DE JANEIRO", IN SEROPEDICA (RJ), BRAZIL	II	872	21/08/00	16:30	CC		19	PS	19
Aguiar-Menezes, E. L.	875	CHARACTERIZATION OF THE POPULATIONS OF FRUIT FLIES (DIPTERA: TEPHRITIDAE) COLLECTED IN SEROPEDICA CITY (RJ), BRAZIL BY THE FAUNISTIC ANALYSIS	I	221	21/08/00	16:30	CC		6	PS	6
Aguiar-Menezes, E. L.	876	PHANUROPSIS SEMIFLAVIVENTRIS (HYMENOPTERA, SCELIONIDAE), AN EGG PARASITOID OF THE STINK BUG ANTITHEUCUS SEPULCRALIS (HETEROPTERA, PENTATOMIDAE) IN SEROPEDICA CITY (RJ), BRAZIL	I	221	21/08/00	16:30	CC		6	PS	6
Aguiar-Menezes, E. L.	238	PRELIMINARY SURVEY OF TEPHRITID FRUIT FLIES IN THE NORTHWEST OF THE RIO DE JANEIRO STATE, BRAZIL	I	61	22/08/00	16:30	CC		2	PS	2
Aguiar-Menezes, E. L.	3479	MAINTENANCE OF SECONDARY NEST OF COPTOTERMES HAVILANDI IN LABORATORY	II	878	22/08/00	16:30	CC		19	PS	19
Aguiar-Menezes, E. L.	4089	OCCURRENCE OF RHINOTERMES MARGINALIS(ISOPTERA: RHINOTERMITIDAE) IN URBAN AREAS OF RIO DE JANEIRO CITY	II	1032	24/08/00	16:30	CC		23	PS	23
Aguiar-Menezes, E. L.	3466	FORAGING BEHAVIOR OF THE SUBTERRANEAN TERMITE COPTOTERMES HAVILANDI (ISOPTERA: RHINOTERMITIDAE) IN RESIDENTIAL AREAS	II	875	21/08/00	16:30	CC		19	PS	19
Aguiar-Menezes, E. L.	3465	ERADICATION OF THE COPTOTERMES HAVILANDI COLONIES BY CURATIVE AND PREVENTIVE TREATMENT OF INFESTED RESIDENTIAL BUILDINGS IN URBAN AREAS IN THE CITIES OF NITEROI AND RIO DE JANEIRO (RJ), BRAZIL	II	875	22/08/00	16:30	CC		19	PS	19
Aguiar-Menezes, E. L.	4113	CONTROL OF NASUTITERMES SP. IN A HISTORICAL PATRIMONY IN THE CONTRYSIDE OF RIO DE JANEIRO	II	1038	24/08/00	16:30	CC		23	PS	23
Aguiar-Menezes, E. L.	4114	CONTROL OF NASUTITERMES SP. ATTACKING A STORE OF FABRICS IN THE COUNTRYSIDE OF RIO DE JANEIRO STATE	II	1039	25/08/00	16:30	CC		23	PS	23
Aguiar-Menezes, E. L.	3504	ADAPTATION OF THE SUBTERRANEAN TERMITE COPTOTERMES HAVILANDI (ISOPTERA: RHINOTERMITIDAE) TO THE INTERIOR OF BRAZIL	II	884	22/08/00	16:30	CC		19	PS	19
Aguillera, M. M.	2130	ULTRASTRUCTURAL ASPECTS OF THE COLONIZATION PROCESS OF ECDYTOLOPHA AURANTIANA BY THE ENTOMOPATHOGENIC NEMATODE STEINERNEMA GLASERI	I	537	24/08/00	16:30	CC		11	PS	11
Ahmad, I.	3835	THE CLASSIFICATION AND DISTRIBUTION OF HYDARINAE (HEMIPTERA: COREIDAE), AND THE SYSTEMATIC POSITION OF THE GENUS HAIDARA DISTANT	II	968	25/08/00	16:30	CC		21	PS	21
Ahmad, M.	1291	INSECTICIDE RESISTANCE IN HELICOVERPA ARMIGERA AND STRATEGIES FOR ITS MANAGEMENT IN PAKISTAN	I	326	21/08/00	16:30	CC		7	PS	7
Ahmad, Z.	1291	INSECTICIDE RESISTANCE IN HELICOVERPA ARMIGERA AND STRATEGIES FOR ITS MANAGEMENT IN PAKISTAN	I	326	21/08/00	16:30	CC		7	PS	7
Ahmed, A.	2917	ENGINEERING BLOOD MEAL-ACTIVATED SYSTEMIC IMMUNITY USING FAT BODY-SPECIFIC GENES IN THE MOSQUITO VECTOR	II	736	24/08/00	15:05	Bol	R	15	8	15
Ahmed, A. D.	2358	GENOMIC STRUCTURE AND ECDYSONE REGULATION OF THE PROPHENOLOXIDASE 1 GENE IN THE MALARIA VECTOR ANOPHELES GAMBIAE	II	596	23/08/00	14:20	HB	I	13	5	13
Ahmed, A. M.	3218	THE EFFECT OF MALARIA INFECTION ON MOSQUITO VITELLOGENESIS	II	812	22/08/00	16:30	CC		17	PS	17
Ahmed, N.	492	WHITE FLIES FAUNA OF WILD PLANTS AND THEIR ABUNDANCE IN EGYPT	I	125	22/08/00	16:30	CC		3	PS	3
Ahn, K. K.	3216	CYTOPATHOLOGY AND DOUBLE MEMBRANE-BOUND VIRUS-LIKE PARTICLES ASSOCIATED WITH HIGH PLAINS DISEASE AND OTHER DISEASES CAUSED BY ERIPHYID MITE-BORNE AGENTS OF UNKNOWN ETIOLOGY	II	812	22/08/00	16:00	Bol	U	17	2	17
Aide, T. M.	893	DISTURBANCE EFFECTS ON INSECT COMMUNITIES ALONG A SUCCESSIONAL GRADIENT	I	226	21/08/00	16:30	CC		6	PS	6
Aihartza, J. R.	996	INSECTS AS BATS' PREY: A CASE STUDY ON KUHL'S PIPISTRELLE (PIPISTRELLUS KUHLII)	I	251	22/08/00	16:30	CC		6	PS	6
Aizawa, J. S.	1357	AGRONOMIC EFFICIENCY OF THE INSECTICIDE THIAMETHOXAN FOR CONTROL OF THE PINEAPPLE MEALYBUG AND THE TERMITE	I	342	23/08/00	16:30	CC		7	PS	7
Akai, H.	1748	DEVELOPMENT AND UTILIZATION OF ANAPHE INFRACTA	I	440	21/08/00	16:30	CC		9	PS	9
Akai, H.	3415	DEVELOPMENT AND UTILIZATION OF ANAPHE INFRACTA	II	862	22/08/00	13:45	HM	Q	19	3	19
Akai, H.	3416	FUNCTION OF WILD COCOONS AND ITS UTILIZATION	II	862	22/08/00	14:00	HM	Q	19	3	19
Akam, M.	3067	CLEAVAGE AND BLASTODERM FORMATION IN SHORT GERM BAND INSECTS	II	774	24/08/00	10:15	HB	G	16	6	16
Akemo, C.	2825	SURVEY OF PRACTICES AND PERCEPTIONS OF SMALL HOLDER FARMERS RELATING TO PEST MANAGEMENT ON VEGETABLE CROPS IN EASTERN AFRICA	II	713	23/08/00	16:30	CC		14	PS	14
Åkerman, K.	2344	DIFFERENTIAL ACTIVATION OF AN INSECT G PROTEIN-COUPLED PEPTIDE RECEPTOR BY INSECTATACHYKININ-LIKE AGONISTS	II	592	21/08/00	14:35	HB	I	13	2	13
Akhurst, R.	1261	NATURE'S SELECTION: GENETICS AND EVOLUTION OF RESISTANCE IN HELICOVERPA ARMIGERA	I	318	24/08/00	14:20	HM	N	7	8	7
Akopyan, A. S.	2228	ABOUT GENETICAL VARIABILITY OF CODLING MOTH POPULATIONS INHABITING IN DIFFERENT CONDITION	I	562	21/08/00	16:30	CC		12	PS	12
Akopyan, A. S.	2228	ABOUT GENETICAL VARIABILITY OF CODLING MOTH POPULATIONS INHABITING IN DIFFERENT CONDITION	I	562	21/08/00	16:30	CC		12	PS	12
Alatorre, R.	1316	RESPONSE OF PLUTELLA XYLOSTELLA (LEPIDOPTERA: PLUTELLIDAE) TO THE SELECTION WITH BACILLUS THURINGIENSIS	I	332	22/08/00	16:30	CC		7	PS	7
Albano, S.	167	FORAGING ACTIVITY OF BUMBLEBEES IN GREENHOUSE MUSKMELON CROP	I	43	21/08/00	16:30	CC		2	PS	2
Albano, S.	168	GENERAL PATTERN OF BUMBLEBEE VISITS TO TOMATO FLOWERS IN GREENHOUSE CONDITIONS	I	43	21/08/00	16:30	CC		2	PS	2
Albano, S.	169	INFLUENCE OF CROPPING SEASON IN FORAGING ACTIVITY OF BUMBLEBEE IN GREENHOUSE TOMATO CROP	I	43	21/08/00	16:30	CC		2	PS	2
Albano, S.	286	COMPARATIVE STUDY OF BUMBLEBEES AND HONEYBEES EFFICIENCY IN GREENHOUSE MUSKMELON CROPS	I	73	23/08/00	16:30	CC		2	PS	2
Albano, S.	287	POLLINATION OF GREENHOUSE TOMATO CROP BY BUMBLEBEES	I	73	23/08/00	16:30	CC		2	PS	2
Albano, S.	333	BUMBLEBEE FORAGING ACTIVITY AT GREENHOUSE TOMATO CROP WITH DIFFERENT POLLINATOR DENSITY	I	84	25/08/00	16:30	CC		2	PS	2
Albano, S.	334	PATTERN OF BUMBLEBEE VISITS TO GREENHOUSE MUSKMELON FLOWERS	I	85	25/08/00	16:30	CC		2	PS	2
Albariño, R. J.	877	DECAY OF LEAF LITTER BY AQUATIC INSECTS IN ANDEAN LOW ORDER STREAMS	I	222	21/08/00	16:30	CC		6	PS	6
Albegaria, N. M. M. S. S.	2419	EVALUATION OF VELVETBEEN CATERPILLAR SUSCEPTIBILITY TO ETANOLIC EXTRACTS ISOLATED FROM SEEDS OF CRYPTOCARIA MOSCHATA	II	611	21/08/00	16:30	CC		13	PS	13
Albelo, L. R.	3595	THE INTRODUCED INSECT PROBLEM IN THE GALÁPAGOS ISLANDS	II	907	22/08/00	16:30	CC		20	PS	20
Albelo, L. R.	878	THE LEPIDOPTERA OF THE GALAPAGOS ISLANDS, PATTERN OF DISTRIBUTION AND ECOLOGY	I	222	21/08/00	16:30	CC		6	PS	6

Sub-titles: (HB=Hotel Bourbon) - (HM=Hotel Mabu) - (CC=Convention Center) - (Boi=Foz Boulevard) - (PS=Poster Session) - (PL=Plenary Lecturer)

AUTHOR	Nº	TITLE	Book	Page	Date	Time	Local	Room	Session	Symp	New Session
Albergaria, N. M. M. S.	1524	ACARICIDES SELETIVITY EVALUATION ON CHRYSOPERLA EXTERNA (NEUROPTERA: CHRYSOPIDAE)	I	384	23/08/00	16:30	CC		8	PS	8
Albergaria, N. M. M. S.	2426	TROUBLES ABOUT THE USAGE OF ANGOUMOIS GRAIN MOTH EGGS TO FEEDING CHRYSOPID LARVAE	II	613	22/08/00	16:30	CC		13	PS	13
Albergaria, N. M. M. S. de	1479	HOST SPECIES AND AGE SELECTION BY TRICHOGRAMMA PRETIOSUM IN GREEN LACEWING SPECIES	I	373	21/08/00	16:30	CC		8	PS	8
Albergaria, N. M. M. S. de	955	GREEN LACEWINGS OCCURENCE ON WEEDS IN CROP CORN	I	241	22/08/00	16:30	CC		6	PS	6
Albernaz, K. C.	225	EFFECT OF THE INSECT GROWTH REGULATOR DIFLUBENZURON ON REPRODUCTION OF EUSCHISTUS HEROS (FABR.) (HETEROPTERA: PENTATOMIDAE)	I	57	22/08/00	16:30	CC		2	PS	2
Albert, S.	2322	FROM GENE OF HONEY BEE (APIS MELLIFERA) TO MOLECULAR PROPERTIES AND FUNCTION OF MAJOR PROTEINS OF ROYAL JELLY	I	586	25/08/00	16:30	CC		12	PS	12
Albrecht, C.	3950	NUTRITIONAL REQUIREMENTS OF MEDITERRANEAN FRUIT FLY	II	997	21/08/00	16:30	CC		22	PS	22
Albrectsen, B. R.	879	DENSITY DEPENDENT DISPERSAL OF A TEPHRITID FLY	I	222	21/08/00	16:30	CC		6	PS	6
Albres, R. S.	3234	MIGRATION AS A STRATEGY FOR SURVIVAL OF DALBULUS MAIDIS (HEMIPTERA: CICADELLIDAE) DURING CORN OVERSEASON IN CENTRAL BRAZIL	II	816	23/08/00	16:30	CC		17	PS	17
Albright, S. N.	3300	CONTROL OF DROSOPHILA REPRODUCTION BY MALE-DERIVED PROTEINS IN THE SEMINAL FLUID	II	833	25/08/00	13:35	HB	K	18	7	18
Albuquerque, A. L.	623	UTILIZATION OF PCR FOR DETECTION OF WUCHERERIA BANCROFTI IN BARRA DE GUABIRABA - PE, NON-EDEMIC CONSIDERED AREA	I	158	21/08/00	16:30	CC		4	PS	4
Albuquerque, E. S.	554	DIVERSITY OF HYMENOPTERA IN AREAS OF PRIMARY FOREST FRAGMENT, REGENERATION FOREST AND PASTURE AT THE SOUTHEAST OF ACRE, BRAZIL	I	140	25/08/00	16:30	CC		3	PS	3
Albuquerque, E. S.	560	DIVERSITY OF COLEOPTERA IN A FOREST FRAGMENT, SECONDARY FOREST AND PASTURE IN THE SOUTHEAST OF ACRE , BRAZIL	I	142	25/08/00	16:30	CC		3	PS	3
Albuquerque, F. A.	170	AGRONOMIC EFFICIENCY OF INSECTICIDES AT DIFFERENT RATES TO THE CONTROL OF APHIS GOSSYPII IN COTTON CROP	I	44	21/08/00	16:30	CC		2	PS	2
Albuquerque, F. A.	171	AGRONOMIC EFFICIENCY OF INSECTICIDES AT DIFFERENT RATES TO THE CONTROL OF STERNECHUS SUBSIGNATUS IN SOYBEAN	I	44	21/08/00	16:30	CC		2	PS	2
Albuquerque, F. A.	172	EFFICIENCY OF DIFFERENT INSECTICIDES IN THE CONTROL OF THRIPS, FRANKLINIELLA SCHULTZEI, IN LETTUCE	I	44	21/08/00	16:30	CC		2	PS	2
Albuquerque, F. A.	173	EFFICIENCY OF INSECTICIDES IN THE CONTROL OF PECTINOPHORA GOSSYPIELLA IN COTTON CROP	I	44	22/08/00	16:30	CC		2	PS	2
Albuquerque, F. A.	174	EFFICIENCY OF INSECTICIDES IN THE CONTROL OF THRIPS, FRANKLINIELLA SCHULZEI, IN COTTON CROP	I	45	22/08/00	16:30	CC		2	PS	2
Albuquerque, F. A.	175	SURVEY OF THE ARTHROPODS ASSOCIATED TO MALPIGHIA GLABRA IN ANGULO, PARANA, BRAZIL	I	45	22/08/00	16:30	CC		2	PS	2
Albuquerque, G. S.	3299	EVOLUTION OF PREY SPECIFICITY IN CHRYSOPA (NEUROPTERA: CHRYSOPIDAE): LIFE-HISTORY ADAPTATIONS AND REPRODUCTIVE COSTS	II	833	25/08/00	16:05	HB	K	18	6	18
Albuquerque, G. S.	3840	DESCRIPTION OF THE NYMPHS AND ADULT GENITALIA OF ACROSTERNUM (CHINAVIA) UBICUM (HETEROPTERA, PENTATOMIDAE)	II	969	25/08/00	16:30	CC		21	PS	21
Albuquerque, P. M. C.	461	PRELIMINARY LIST OF STINGLESS BEES (APIDAE, MELIPONINAE) OCURRING IN ECOSSYSTEMS OF MARANHÃO STATE, BRAZIL	I	117	21/08/00	16:30	CC		3	PS	3
Alburquerque, C. M. R.	1569	EFFECT OF THE FILARIAL PARASITE WUCHERERIA BANCROFTI (NEMATODA: FILARIDAE) ON THE REPRODUCTION OF CULEX QUINQUEFASCIATUS (DIPTERA:CULICIDAE)	I	396	23/08/00	16:30	CC		8	PS	8
Alburquerque, C. M. R.	2396	CELLULAR IMMUNE RESPONSE OF THE MOSQUITO CULEX QUINQUEFASCIATUS (DIPTERA-CULICIDAE) TO CANDIDA ALBICANS INFECTION.	II	605	21/08/00	16:30	CC		13	PS	13
Alcaide, E.	3394	TERMITE DAMAGE TO BUILDINGS IN THE PROVINCE OF CORDOBA	II	857	21/08/00	11:50	HM	Q	19	1	19
Alcazar, J.	2012	AN INTEGRATED APPROACH TO MANAGE THE ANDEAN POTATO WEEVIL, PREMNOTRYPES SPP. (CURCULIONIDAE)	I	508	23/08/00	11:35	HM	P	11	5	11
Aldrich, J. R.	589	SEMIOCHEMICAL COEVOLUTION BETWEEN HETEROPTERA AND THEIR TACHINID FLY PARASITOIDS: GAS CHROMATOGRAPHY-ELECTROANTENNOGRAM DETECTION AND BEHAVIOR	I	149	22/08/00	11:20	Boi	S	4	2	4
Aldrich, J. R.	740	LOOKING AT PESTS THROUGH THE ANTENNAE OF THEIR PARASITES: HOST PHEROMONES AND BIOCONTROL	I	187	25/08/00	16:30	CC		4	PS	4
Alekseev, E.	2137	MICROBIAL CONTROL OF TICKS	I	539	24/08/00	16:30	CC		11	PS	11
Alemany, A.	698	MASS TRAPPING EXPERIENCE OF CERATITIS CAPITATA(DIPTERA: TEPHRITIDAE) WITH SYNTHETIC FEMALE FOOD ATTRACTANTS IN A CITRUS ORCHARD (MALLORCA. SPAIN)	I	176	24/08/00	16:30	CC		4	PS	4
Alemany, A.	880	SPACE-SEASONAL DISTRIBUTION OF CERATITIS CAPITATA (DIPTERA: TEPHRITIDAE) IN A MASS TRAPPING EXPERIENCE IN A CITRUS ORCHARD IN MALLORCA (SPAIN)	I	222	21/08/00	16:30	CC		6	PS	6
Alemany, A.	3103	PRACTICAL APPLICATION OF A CLASSIFICATION FUNCTION TO DETERMINE WING MORPHOLOGY DIFFERENCES BETWEEN WILD AND STERILE MALES OF CERATITIS CAPITATA (DIPTERA: TEPHRITIDAE).	II	783	21/08/00	16:30	CC		16	PS	16
Alencar, J. A. de	1294	EFFECT OF CHEMICAL CONTROL OF BEMISIA ARGENTIFOLII (HEMIPTERA: ALEYRODIDAE) ON THE INCIDENCE OF BEAN GOLDEN MOSAIC VIRUS IN COMMON BEANS AND ITS YIELD	I	327	21/08/00	16:30	CC		7	PS	7
Alencar, J. A. de	2626	INTEGRATED MANAGEMENT OF THE APHID, APHIS GOSSYPII, IN INDIAN CHERRY TREE, IN IRRIGATED AREAS OF THE SÃO FRANCISCO VALLEY	II	663	22/08/00	16:30	CC		14	PS	14
Ale-Rocha, R.	3711	PHYLOGENETIC ANALYSIS OF THE HYBOTINAE (DIPTERA: EMPIDOIDEA)	II	937	21/08/00	16:30	CC		21	PS	21
Al-Eryan, M. A. S.	1480	TETRASTICHUS PHYTOMYZAE (HYMENOPTERA: EULOPHIDAE), AN INTERNAL PARASITOID ON THE BROOMRAPE FLY, PHYTOMYZA OROBANCHIA (DIPTERA : AGROMYZIDAE)	I	373	21/08/00	16:30	CC		8	PS	8
Alexander, L. C.	2391	CHARACTERIZATION OF THREE MEMBRANE-BOUND AMINOPEPTIDASES ISOLATED FROM STOMOXYS CALCITRANS (DIPTERA: MUSCIDAE) MIDGUTS	II	604	21/08/00	16:30	CC		13	PS	13
Alfaro, R. I.	1853	MECHANISMS OF RESISTANCE IN TREES TO SHOOT INSECTS	I	467	24/08/00	10:20	HB	M	10	5	10
Alfaro, R. I.	1883	MANAGEMENT OF THE WHITE PINE WEEVIL IN NORTH AMERICA	I	475	26/08/00	10:35	HB	M	10	9	10
Alfaro, R. I.	1900	MANAGEMENT OF REFORESTATION INSECTS: FIRST STEP OF SUSTAINABLE FORESTRY	I	479	21/08/00	16:30	CC		10	PS	10
Alfonso, M.	1256	USE AND PERSPECTIVES OF BOTANICAL PESTICIDES IN CUBA	I	317	24/08/00	11:05	HM	N	7	7	7
AL-Houty, W.	3447	THE INFLUENCE OF TERMITES ON DESERT SOIL PROPERTIES	II	870	21/08/00	16:30	CC		19	PS	19
Ali, A.	4062	LABORATORY AND FIELD STUDIES ON LARVAL CONTROL OF CULEX QUINQUEFASCIATUS MOSQUITOES INHABITING URBAN AND SUBURBAN DHAKA, BANGLADESH	II	1026	22/08/00	16:30	CC		23	PS	23
Ali, A.	786	A PRELIMINARY COMPUTER MODEL OF GLYPTOTENDIPES PARIPES (DIPTERA: CHIRONOMIDAE) LARVAL DISTRIBUTION IN LAKES OF CENTRAL FLORIDA, USA	I	198	21/08/00	16:30	CC		5	PS	5
Ali, A.	2986	AN ANNOTATED CHECKLIST OF THE CHIRONOMIDAE (DIPTERA) OF EGYPT	II	753	22/08/00	16:30	CC		15	PS	15
Ali, S. R. A.	84	MANAGEMENT OF RHINOCEROS BEETLES IN MALAYSIA	I	22	21/08/00	11:05	HB	A	2	1	2
Aliabadi, A.	624	IDENTIFICATION OF CHEMICAL DEFENSE SECRETION OF A DUNG BEETLE	I	158	21/08/00	16:30	CC		4	PS	4
Aliakbar, A.	2715	THE EFFICACY OF CERTAIN AQUEOUS PLANT EXTRACTS FROM GUILAN PROVINCE AGAINST ELM LEAF BEETLE XANTHOGALEAROCELLA LUTEOLA (COL; CHRYSOMELLIDAE)	II	686	23/08/00	16:30	CC		14	PS	14
AliNiazee, M. T.	2032	SYNERGISM OF ENTOMOPATHOGENS AND CHEMICAL INSECTICIDES: THEORY AND APPLICATION	I	513	21/08/00	16:30	CC		11	PS	11
Al-Kirshi, A. G.	1749	ANALYSIS OF SOME IMPORTANT FACTORS AFFECTING OVIPOSITION AND LONGEVITY OF THE ECTOPARASITIC WASP LAELIUS PEDATUS (HYMENOPTERA: BETHYLIDAE), A PARASITOID OF DERMESTIDE PESTS	I	441	21/08/00	16:30	CC		9	PS	9

Sub-titles: (HB=Hotel Bourbon) - (HM=Hotel Mabu) - (CC=Convention Center) - (Bol=Foz Boulevard) - (PS=Poster Session) - (PL=Plenary Lecturer)

AUTHOR	N°	TITLE	Book	Page	Date	Time	Local	Room	Session	Symp	New Session
All, J. L.	3948	ASSESSMENT OF TRANSGENIC Bt RESISTANCE FOR CONTROL OF FALL ARMYWORM AND CORN EARWORM INFESTATIONS AND REDUCING AFLATOXIN CONTAMINATION OF CORN	II	996	21/08/00	16:30	CC		22	PS	22
Allee, L. L.	2009	BEHAVIORAL RESPONSE OF SOIL ARTHROPODS TO FUNGAL PATHOGENS	I	507	23/08/00	10:05	HM	P	11	5	11
Allen, G. R.	1896	THE SPATIAL AND TEMPORAL IMPACT OF ENDEMIC NATURAL ENEMIES ON THE MORTALITY OF CHRYSOMELID BEETLES IN EUCALYPT PLANTATIONS	I	478	26/08/00	16:05	HB	M	10	10	10
Allen, G. R.	2027	THE SPATIAL AND TEMPORAL IMPACT OF ENDEMIC NATURAL ENEMIES ON THE MORTALITY OF CHRYSOMELID BEETLES IN EUCALYPT PLANTATIONS	I	511	21/08/00	16:30	CC		11	PS	11
Allen, J. A.	2274	MOLECULAR ANALYSIS OF THE EVOLUTIONARY DYNAMICS OF THE AFRICAN QUEEN BUTTERFLY DANAUS CHRYSIPPUS.	I	574	23/08/00	16:30	CC		12	PS	12
Allen, J. C.	786	A PRELIMINARY COMPUTER MODEL OF GLYPTOTENDIPES PARIPES (DIPTERA: CHIRONOMIDAE) LARVAL DISTRIBUTION IN LAKES OF CENTRAL FLORIDA, USA	I	198	21/08/00	16:30	CC		5	PS	5
Allen, K. K.	1942	IMPACTS OF DOUGLAS-FIR BEETLE ON FOREST OVERSTORY AND UNDERSTORY CONDITIONS OF THE GREATER YELLOWSTONE AREA	I	489	23/08/00	16:30	CC		10	PS	10
Allen-Williams, L. J.	372	SPATIAL RELATIONSHIPS BETWEEN A PREDATOR AND PEST INFESTATION IN WINTER RAPE AND RELEVANCE TO INTEGRATED PEST MANAGEMENT STRATEGIES	I	94	25/08/00	16:30	CC		2	PS	2
Alleoni, B.	176	EFFICIENCY OF THE FORMULATION 50 SC OF THE PYRETHROID LAMBDA-CYALOTHRIN IN THE CONTROL OF ANTICARSIA GEMMATALIS IN THE SOYBEAN CROP	I	45	21/08/00	16:30	CC		2	PS	2
Alleoni, B.	177	EFFICIENCY OF THE FORMULATION 50 SC OF THE PYRETHROID LAMBDA-CYALOTHRIN IN THE CONTROL OF PSEUDALETIA SEQUAX (MYTHIMNA SEQUAX) IN THE WHEAT CROP	I	45	21/08/00	16:30	CC		2	PS	2
Alleoni, B.	178	EFFICIENCY OF THE FORMULATIONS 50 CS AND 250 CS OF THE PYRETHROID LAMBDA-CYALOTHRIN IN THE CONTROL OF DIABROTICA SPECIOSA IN BEAN CROP	I	46	21/08/00	16:30	CC		2	PS	2
Alleoni, B.	881	EFFECTS OF DIFFERENT DATES OF SOWING ON COMMON BEAN CULTIVATED ON TILLED AND NON-TILLED SOIL MANAGEMENT SYSTEMS ON THE SEASONAL OCCURRENCY OF PESTS IN PONTA GROSSA-PR	I	223	22/08/00	16:30	CC		6	PS	6
Alleyne, M.	1481	PHYSIOLOGICAL FACTORS DETERMINING SUITABILITY OF BRACONID ENDOPARASITOIDS (COTESIA FLAVIPES COMPLEX) FOR DEVELOPMENT IN NOVEL-ASSOCIATION LEPIDOPTERAN STEMBORERS (DIATRAEA SPECIES AND OSTRINIA NUBILALIS)	I	374	21/08/00	16:30	CC		8	PS	8
Allison, J. D.	677	HINOTERMES MARGINALIS OLFACTORY RESPONSES BY MONOCHAMUS CLAMATOR, MONOCHAMUS SCUTELLATUS AND MONOCHAMUS OBTUSUS (COLEOPTERA: CERAMBYCIDAE) TO BARK BEETLE PHEROMONES	I	171	23/08/00	16:30	CC		4	PS	4
Alloali*i, I.	2014	PATHOGENS OF TARO BEETLES AND THEIR POTENTIAL USE IN PEST MANAGEMENT IN THE SW PACIFIC	I	508	23/08/00	14:00	HM	P	11	5	11
Allwood, A. J.	3929	THE TECHNOLOGY AND ECONOMICS OF FRUIT FLY ERADICATION IN PACIFIC ISLAND COUNTRIES	II	992	26/08/00	11:00	HB	H	22	8	22
Allwood, A. J.	230	ANNIHILATION OF FOUR FRUIT FLY PEST SPECIES ON THE PACIFIC ISLAND OF NAURU USING FIPRONIL IN PASSIVE BAITING SYSTEMS	I	59	22/08/00	16:30	CC		2	PS	2
Almaraz, L. B.	921	BIOECOLOGICAL STUDIES OF RUSSIAN WHEAT APHID IN ARGENTINA AND CHILE	I	233	21/08/00	16:30	CC		6	PS	6
Almeida Filho, W. V.	2985	IXODID TICKS COLLECTED FROM ARMADILLO EUPHRACTUS SEXCINCTUS AND ANTEATER MYMERCOPHAGA TRIDACTYLA AT EMAS NATIONAL PARK, STATE OF GOIÁS, BRAZIL	II	753	22/08/00	16:30	CC		15	PS	15
Almeida, A. C. L.	3233	THE TRANSMISSION SPECIFICITY AND EFFICIENCY OF BRAZILIAN TOSPOVIRUSES OCCURRING ON TOMATO BY FOUR THRIPS SPECIES	II	816	23/08/00	16:30	CC		17	PS	17
Almeida, A. P. G.	2959	ANOPHELES GAMBIAE MIDGUT MICROVILLI: EFFECTS OF INDUCED IMMUNITY ON LONGEVITY, FERTILITY AND TRANSMISSION OF MALARIA	II	747	21/08/00	16:30	CC		15	PS	15
Almeida, C. S. de	2138	ENTOMOPHTHORALEAN PATHOGENIC FUNGI (ZYGOMYCOTINA – ZYGOMYCETES) IN THE NATURAL CONTROL OF INSECTS – PROSPECTS IN THE SOUTH OF BAHIA, BRAZIL	I	539	24/08/00	16:30	CC		11	PS	11
Almeida, E.	236	POPULATIONAL COMPOSITION AND SOIL MOBILITY OF SCAPTOCORIS CASTANEA (HETEROPTERA:CYDNIDAE) IN GOIÁS, BRAZIL	I	60	22/08/00	16:30	CC		2	PS	2
Almeida, E. A. B.	3712	REVISION OF THE BRAZILIAN SPECIES OF PSEUDAUGOCHLORA (HYMENOPTERA: HALICTIDAE	II	937	21/08/00	16:30	CC		21	PS	21
Almeida, E. A. B.	3844	REVISION AND PHYLOGENY OF THE SPECIES OF EXOMALOPSIS (PHANOMALOPSIS) (HYMENOPTERA: APIDAE)	II	970	25/08/00	16:30	CC		21	PS	21
Almeida, F. J.	1292	EFFECT OF THE MICROENCAPSULATED FORMULATION OF LAMBDA-CYHALOTHRIN FOR THE CONTROL OF THE BLACK CUTWORM, AGROTIS IPSILON (LEPIDOPTERA: NOCTUIDAE), IN CORN	I	326	21/08/00	16:30	CC		7	PS	7
Almeida, F. J.	1377	EFFECT OF A SPECIAL THERMONEBULIZATION FORMICIDE FORMULATION FOR THE CONTROL OF THE LEAF-CUTTING ANT, ATTA CAPIGUARA (HYMENOPTERA:FORMICIDAE)	I	347	24/08/00	16:30	CC		7	PS	7
Almeida, G. R. de	1641	POS-INTRODUCTION OF THE NATURAL ENEMY AGENIAPIS CITRICOLA IN CITRUS GROVES IN JAGUARIÚNA AND AGUAÍ REGIONS, SÃO PAULO STATE, BRAZIL: PRELIMINARY RESULTS	I	414	24/08/00	16:30	CC		8	PS	8
Almeida, J. C.	497	COMPOSITION AND RELATIVE ABUNDANCE OF DIPTERAN FAMILIES (EXCLUDING NEMATOCERA AND ACALYPTRATAE) COLLECTED BY MALAISE TRAPS, WITHIN AND OUTSIDE FOREST FRAGMENTS IN TWO DIFFERENT AREAS	I	126	22/08/00	16:30	CC		3	PS	3
Almeida, J. E. M.	2148	EPIZOOTY OF NOMURAEA RILEYI IN SPODOPTERA FRUGIPERDA LARVAE IN THE CORN CROP, ZEA MAYS	I	542	25/08/00	16:30	CC		11	PS	11
Almeida, J. E. M.	2028	SETTING UP AN ENTOMOPATHOGENIC MICROORGANISMS COLLECTION AT THE CENTRO EXPERIMENTAL DO INSTITUTO BIOLOGICO/LABORATORIO DE CONTROLE BIOLOGICO, BRAZIL	I	512	21/08/00	16:30	CC		11	PS	11
Almeida, J. E. M.	2629	EFFECT OF PHYSIOLOGICAL PRODUCTS ON ADULTS OF ANTICARSIA GEMMATALIS	II	664	22/08/00	16:30	CC		14	PS	14
Almeida, J. E. M.	2004	MICROBIAL CONTROL OF TERMITES IN BRAZIL	I	506	22/08/00	14:05	HM	P	11	4	11
Almeida, J. E. M.	3318	EFFECT OF THE TEMPERATURE AND LIGHT REGIME ON THE PRODUCTION AND STORAGE OF SPOROTHRIX INSECTORUM	II	838	23/08/00	16:30	CC		18	PS	18
Almeida, J. E. M.	1296	EFFECT OF THIAMETHOXAM (ACTARA® 250 WG) ON ENTOMOPATHOGENIC MICROORGANISMS	I	327	21/08/00	16:30	CC		7	PS	7
Almeida, J. R.	536	GEOGRAPHIC DISTRIBUTION AND PHENOLOGY OF FIELD PLANTS AS PARAMETERS OF TROPHIC RESOURCES IN NEOTROPICAL ENTOMOTAXOCENOSES	I	136	22/08/00	16:30	CC		3	PS	3
Almeida, J. R.	1097	MODELLING THE POPULATION DYNAMICS OF ATHERIGONA ORIENTALIS (DIPTERA, MUSCIDAE)	I	277	25/08/00	16:30	CC		6	PS	6
Almeida, J. R.	2416	POST-EMBRYONIC DEVELOPMENT OF CALYPTRATE FLIES IN ARTIFICIAL DIETS I. CHRYSOMYA MEGACEPHALA (DIPTERA: CALLIPHORIDAE)	II	610	21/08/00	16:30	CC		13	PS	13
Almeida, L. M.	2976	REARING TECHNIQUES OF ALPHITOBIUS DIAPERINUS (COLEOPTERA: TENEBRIONIDAE) USING DIFFERENT TEMPERATURES, DIETS AND HUMIDITIES	II	751	22/08/00	16:30	CC		15	PS	15
Almeida, L. M.	3183	MORPHOLOGICAL STUDY OF THE ADULT OF MEIBOMEUS CYANIPENNIS (COLEOPTERA:BRUCHIDAE)	II	803	25/08/00	16:30	CC		16	PS	16
Almeida, L. M.	3807	A REVISION OF THE GENUS TIPHYSA MULSANT AND TRANSFERENCE TO BRACHIACANTHADINI (COLEOPTERA, COCCINELLIDAE).	II	961	24/08/00	16:30	CC		21	PS	21
Almeida, L. M. de	3796	FIRST RECORD OF A BUPRESTIDAE (COLEOPTERA) SPECIES IN ASSOCIATION WITH ANNONA MURICATA (ANONACEAE) IN BRAZIL	II	958	24/08/00	16:30	CC		21	PS	21

Sub-titles: (HB=Hotel Bourbon) - (HM=Hotel Mabu) - (CC=Convention Center) - (Bol=Foz Boulevard) - (PS=Poster Session) - (PL=Plenary Lecturer)

AUTHOR	N°	TITLE	Book	Page	Date	Time	Local	Room	Session	Symp	New Session
Almeida, L. M. de	1047	THE LYPE TABLE PARAMETERS FOR ZAGLOBA BEAUMONTI (COLEOPTERA: COCCINELLIDAE) AS A PREDATOR OF DIASPIS ECHINOCACTI (HEMIPTERA: DIASPIDIDAE)	I	264	23/08/00	16:30	CC		6	PS	6
Almeida, M. A. P. de	1482	INFLUENCE OF HOST DENSITY ON ATTACK RATES OF TACHINAEPHAGUS ZEALANDICUS ASHMEAD (HYMENOPTERA: ENCYRTIDAE) ON MUSCA DOMESTICA (DIPTERA: MUSCIDAE) AND CHRYSOMYA PUTORIA (DIPTERA: CALLIPHORIDAE	I	374	21/08/00	16:30	CC		8	PS	8
Almeida, M. C. de	882	BIOCOENOTICS OF WILD BEES (HYMENOPTERA, APOIDEA) OF RESTRICTED AREAS OF "CERRADO" IN JAGUARIAÍVA, PARANÁ (SOUTHERN BRAZIL)	I	223	21/08/00	16:30	CC		6	PS	6
Almeida, M. C. de	1775	ADDITIONAL OBSERVATIONS ON NESTING BIOLOGY OF PTILOTHRIX PLUMATA (APOIDEA, ANTHOPHORIDAE)	I	447	23/08/00	16:30	CC		9	PS	9
Almeida, M. L.	2757	IPM PROGRAMMES FOR PROTECTED VEGETABLE CROPS (IN OESTE REGION OF PORTUGAL)	II	696	23/08/00	16:30	CC		14	PS	14
Almeida, R.	3448	UTILIZATION OF DIFFERENT CULTURE MEDIA FOR BEE SEMEN STORAGE (APIS MELLIFERA; HYMENOPTERA: APOIDEA)	II	870	21/08/00	16:30	CC		19	PS	19
Almeida, R. J.	4063	INTERATION BETWEEN CROPPING FACTORS AND ACTION OF INSECTS AND MOLDS IN THE DEPRECIATION OF THE NUTRITIONAL QUALITIES OF THE CORN BR 2121-QPM DURING THE STORAGE	II	1026	21/08/00	16:30	CC		23	PS	23
Almeida, R. J.	4064	EFFECTS OF THE NUTRITIONAL QUALITY OF THE CORN GRAINS ON THE INFESTATION STORED GRAIN INSECTS AND MOLDS DURING THE STORAGE	II	1026	21/08/00	16:30	CC		23	PS	23
Almeida, S. L.	222	THE USE OF ABOVE GROUND HEXAFLUMURON BAITS IN THE ELIMINATION OF A COPTOTERMES HAVILANDI COLONY LOCATED IN RIO CLARO, SP, BRAZIL (ISOPTERA, RHINOTERMITIDAE)	I	57	22/08/00	16:30	CC		2	PS	2
Almeida, S. L. de	3506	FORAGING POPULATION AND TERRITORY OF THE SUBTERRANEAN TERMITE COPTOTERMES HAVILANDI (ISOPTERA : RHINOTERMITIDAE) BY THE TRIPLE MARKED RECAPTURE METHOD IN AN URBAN AREA	II	885	23/08/00	16:30	CC		19	PS	19
Almeida, S. L. de	3507	FORAGING POPULATION AND TERRITORY OF THE SUBTERRANEAN TERMITE HETEROTERMES TENUIS (ISOPTERA : RHINOTERMITIDAE) BY THE TRIPLE MARKED RECAPTURE METHOD IN AN URBAN AREA	II	885	23/08/00	16:30	CC		19	PS	19
Almeida, S. L. de	3535	USE OF ABOVE GROUND 0.5% HEXAFLUMURON BAITS (RECRUIT® AG) IN THE CONTROL OF COPTOTERMES HAVILANDI (ISOPTERA: RHINOTERMITIDAE) IN CONSTRUCTIONS LOCATED IN SÃO PAULO, SP, BRAZIL	II	892	24/08/00	16:30	CC		19	PS	19
Almeida, S. L. de	3449	FIELD EVALUATION OF A 0,5% HEXAFLUMURON BAIT (RECRUIT® II) FOR COLONY ELIMINATION OF THE SUBTERRANEAN TERMITE COPTOTERMES HAVILANDI (ISOPTERA : RHINOTERMITIDAE)	II	871	21/08/00	16:30	CC		19	PS	19
Almeida, S.L. de	4165	FIELD EVALUATION OF A 0,5% HEXAFLUMURON BAIT (RECRUIT® II) FOR COLONY ELIMINATION OF SUBTERRANEAN TERMITE HETEROTERMES TENUIS (ISOPTERA : RHINOTERMITIDAE).	II	1052	21/08/00	16:30	CC		Erratum	PS	19
Almirón, W.	565	ESTIMATING INSECT DIVERSITY IN CENTRAL ARGENTINA: A COMPARISON AMONG TAXA AND HABITATS	I	143	25/08/00	16:30	CC		3	PS	3
Almirón, W. R.	1328	INSECTICIDE AND REPELLENT EFFECTS OF MELIA AZEDARACH EXTRACTS AGAINST AEDES AEGYPTI (DIPTERA: CULICIDAE)	I	335	22/08/00	16:30	CC		7	PS	7
Alomar, O.	2558	BIOLOGICAL CONTROL WITH PREDATORS AND PARASITOIDS	II	646	22/08/00	11:05	HB	B	14	3	14
Aloni, R.	831	GALLING APHIDS AS PHYSICAL ECOSYSTEM ENGINEERS : THE VASCULAR SYSTEM IN APHID GALLS AS A MASS-FEEDING APPARATUS	I	210	23/08/00	11:05	HB	D	6	5	6
Alonso, A.	968	A STUDY OF MACROINVERTEBRATES IN RIVES ECOSYSTEMS (NW IBERIAN PENINSULA), AFFECTED BY SMALL HYDROELECTRIC DAMS	I	244	22/08/00	16:30	CC		6	PS	6
Alonso, A. I.	1901	ARTHROPODS DIVERSITY IN SEABIRDS COLONIES: APPLIED TO PHALACROCORAX ARISTOTELIS L. OF ISLANDS CÍES AND ONS (NW PENÍNSULA IBÉRICA)	I	479	22/08/00	16:30	CC		10	PS	10
Alonso, R.	698	MASS TRAPPING EXPERIENCE OF CERATITIS CAPITATA(DIPTERA: TEPHRITIDAE) WITH SYNTHETIC FEMALE FOOD ATTRACTANTS IN A CITRUS ORCHARD (MALLORCA, SPAIN)	I	176	24/08/00	16:30	CC		4	PS	4
Alonso, R.	880	SPACE-SEASONAL DISTRIBUTION OF CERATITIS CAPITATA (DIPTERA: TEPHRITIDAE) IN A MASS TRAPPING EXPERIENCE IN A CITRUS ORCHARD IN MALLORCA (SPAIN)	I	222	21/08/00	16:30	CC		6	PS	6
Alonzo, & G.	653	CONTACT CHEMICAL CUES RELEASED BY ADULTS OF NEZARA VIRIDULA HAVE A KAIROMONAL EFFECT ON THE EGG PARASITOID TRISSOLCUS BASALIS: A CHROMATOGRAPHIC INVESTIGATION	I	165	22/08/00	16:30	CC		4	PS	4
Alphey, L. S.	3995	INSECT POPULATION CONTROL USING A DOMINANT, REPRESSIBLE, LETHAL GENETIC SYSTEM	II	1008	25/08/00	16:30	CC		22	PS	22
Alpizar, D.	612	PHEROMONE-BASED MASS TRAPPING OF THE BANANA WEEVIL, COSMOPOLITES SORDIDUS & THE WEST INDIAN SUGARCANE WEEVIL, METAMASIUS HEMIPTERUS IN BANANA & PLANTAIN	I	155	24/08/00	11:05	Bol	S	4	6	4
Alv, T. D.	429	HOST-SPECIFICITY IN MACULINEA ALCON: A LARGE BLUE BUTTERFLY CONSERVATION ISSUE IN EUROPE	I	109	24/08/00	14:05	HB	C	3	6	3
Alter, D.	687	THE EFFECTS OF HOST PLANT ODOURS ON THE CALLING BEHAVIOUR, EGG MATURATION AND MATING SUCCESS OF THE COTTON BOLLWORM, HELICOVERPA ARMIGERA (HÜBNER) (LEPIDOPTERA: NOCTUIDAE)	I	174	23/08/00	16:30	CC		4	PS	4
Altieri, M. A.	2578	ECOSYSTEMS ECOLOGY AND IPM	II	651	23/08/00	15:30	HB	B	14	5	14
Aluja, M.	1615	HYMENOPTERAN PARASITOIDS ON FRUIT – INFESTING TEPHRITIDAE (DIPTERA) IN LATIN AMERICA AND THE SOUTHERN UNITED STATES: DIVERSITY, DISTRIBUTION, TAXONOMIC STATUS AND THEIR USE IN FRUIT FLY BIOLOGICAL CONTROL	I	407	24/08/00	16:30	CC		8	PS	8
Aluja, M.	1661	FRUIT FLY BIOLOGICAL CONTROL IN LATIN AMERICA: MINIMIZING THE RISKS POSED BY TEPHRITIDAE IN MEXICO AND CENTRAL AMERICA	I	419	25/08/00	16:30	CC		8	PS	8
Alvarenga, F.G.	3986	DATA BASE OF QUARANTINE PESTS TO BRAZIL	II	1006	24/08/00	16:30	CC		22	PS	22
Alvarenga, M. A. R.	179	PERFORMANCE OF THE INSECTICIDES BUPROFEZIN 250; PYRIPROXIFEN 100 AND BUPROFEZIN 250 + ACEPHATE, IN CONTROL OF "WHITE FLY", BEMISIA ARGENTIFOLII, IN CABBAGE CROP	I	46	21/08/00	16:30	CC		2	PS	2
Alvarenga, M. A. R.	1397	CONTROL OF "WHITE FLY", BEMISIA ARGENTIFOLII WITE THE INSECTICIDES THIACLOPRID 480 SC; IMIDACLOPRID 700 GRDA AND IMIDACLOPRID 200 SC, IN CUCUMBER PLANTATION	I	352	25/08/00	16:30	CC		7	PS	7
Alvarez, B. M.	2962	TRIATOMINES INVOLVED IN DOMESTIC AND WILD TRYPANOSOMA CRUZI TRANSMISSION IN CONCEPCIÓN, CORRIENTES, ARGENTINA	II	747	21/08/00	16:30	CC		15	PS	15
Alvarez, C. M.	2068	USE OF ENTOMOPATHOGENIC FUNGI FOR THE CONTROL OF CALIROA CERASI	I	522	22/08/00	16:30	CC		11	PS	11
Alvarez, G.	245	INCIDENCE OF THE DAMAGE OF PLATYPUS SULCATUS CHAPUIS (COLEOPTERA, PLATYPODIDAE) IN THE QUALITY OF POPULUS DELTOIDES WOODS	I	62	23/08/00	16:30	CC		2	PS	2
Álvarez, J.	3713	NEW INFORMATION ABOUT HETEROPTERA IN THE NORTHWEST OF THE IBERIAN PENINSULA PONDS.	II	937	24/08/00	16:30	CC		21	PS	21
Alvarez-Zagoya, R.	574	BIONOMICS OF PEPPERTREE PSYLLID CALOPHYA RUBRA (HOMOPTERA: PSYLLIDAE) IN MEXICO	I	145	21/08/00	16:30	CC		3	PS	3
Alves, A. de A.	3543	CONTROL OF UNDERGROUND TERMITES AMITERMES SP. (ISOPTERA: TERMITIDAE, TERMITINAE) ON PINEAPPLE CROP IN SEMIARID ZONE OF NORTHEAST BRAZIL	II	894	25/08/00	16:30	CC		19	PS	19
Alves, E. B.	14	BASES FOR AN ACARICIDE RESISTANCE MANAGEMENT PROGRAM OF BREVIPALPUS PHOENICIS (ACARI: TENUIPALPIDAE) TO THE ACARICIDE DICOFOL IN BRAZILIAN CITRUS	I	4	21/08/00	16:30	CC		1	PS	7
Alves, H. E.	979	BEETLE ASSEMBLAGES (COLEOPTERA) IN THE PARQUE ESTADUAL XIXOVÁ-JAPUÍ, SÃO VICENTE-PRAIA GRANDE, SÃO PAULO	I	247	24/08/00	16:30	CC		6	PS	6

Sub-titles: (HB=Hotel Bourbon) - (HM=Hotel Mabu) - (CC=Convention Center) - (Bol=Foz Boulevard) - (PS=Poster Session) - (PL=Plenary Lecturer)

AUTHOR	N°	TITLE	Book	Page	Date	Time	Local	Room	Session	Symp	New Session
Alves, L. F. A.	15	DAMAGE CHARACTERIZATION OF OLIGONYCHUS YOTHERSI (ACARI: TETRANICHIDAE) TO ERVA-MATE (ILEX PARAGUARIENSIS) (AQUIFOLIACEAE)	I	4	21/08/00	16:30	CC		1	PS	7
Alves, L. F. A.	2036	TRANSMISSION OF NUCLEOPOLYHEDROVIRUS IN BOMBYX MORI (LEPIDOPTERA: BOMBYCIDAE)	I	514	22/08/00	16:30	CC		11	PS	11
Alves, L. F. A.	2118	VIRULENCE OF BEAUVERIA BASSIANA ISOLATES TO OLIGONYCHUS YOTHERSI (ACARI: TETRANICHIDAE)	I	534	24/08/00	16:30	CC		11	PS	11
Alves, R. T.	2029	VOLATILITY COMPARISONS OF DIFFERENT FORMULATIONS USED TO APPLY MYCOINSECTICIDES	I	512	21/08/00	16:30	CC		11	PS	11
Alves, R. T.	2030	EVALUATION OF APPLICATION TECHNIQUES OF AN EMULSIFIABLE ADJUVANT OIL FUNGAL FORMULATION	I	512	21/08/00	16:30	CC		11	PS	11
Alves, R. T.	2016	DEVELOPMENT OF MYCOPESTICIDES FORMULATIONS AND APPLICATION TECHNIQUES	I	509	23/08/00	15:50	HM	P	11	6	11
Alves, S. B.	2113	GROOMING CAPACITY INHIBITION IN CORNITERMES CUMULANS INOCULATED WITH ENTOMOPATHOGENIC FUNGI WHEN TREATED WITH IMIDACLOPRID	I	533	23/08/00	16:30	CC		11	PS	11
Alves, S. B.	2114	DEVELOPMENTAL CYCLES OF THE ENTOMOPATHOGENIC FUNGI BEAUVERIA BASSIANA AND METARHIZIUM ANISOPLIAE ON THE TERMITE CORNITERMES CUMULANS AS DETERMINED FROM SCANNING ELECTRON MICROSCOPE (SEM) STUDY	I	533	23/08/00	16:30	CC		11	PS	11
Alves, S. B.	2155	SELECTION OF ENTOMOPATOGENIC FUNGI IN THE CONTROL OF LEPTOPHARSA HEVEAE	I	543	25/08/00	16:30	CC		11	PS	11
Alves, S. B.	2004	MICROBIAL CONTROL OF TERMITES IN BRAZIL	I	506	22/08/00	14:05	HM	P	11	4	11
Alves, S. B.	270	OCCURENCE OF THRIPS ON NIAGARA TABLE GRAPE AND ITS CONTROL WITH THE INSECTICIDES THIACLOPRID AND METHIOCARB ASSOCIATED WITH METARHIZIUM ANISOPLIAE	I	69	23/08/00	16:30	CC		2	PS	2
Alves, S. B.	917	FORAGING ACTIVITY OF HETEROTERMES TENUIS (ISOPTERA: RHINOTERMITIDAE) IN SUGARCANE AREA ACCORDING TO YEAR SEASONS	I	232	21/08/00	16:30	CC		6	PS	6
Alves, S. B.	3472	ATTRACTION/REPELLENCE OF SUBTERRANEAN TERMITES WITH PLANT EXTRACTS	II	876	22/08/00	16:30	CC		19	PS	19
Alves, S. B.	3473	EFFECTS OF PLANT EXTRACTS AND ENTOMOPATHOGENIC FUNGI ON SUBTERRANEAN TERMITES	II	877	22/08/00	16:30	CC		19	PS	19
Alves, S. N.	1293	EFFECTS OF IVERMECTIN ON THE FAT BODY MORPHOLOGY OF CULEX QUINQUEFASCIATUS LARVAE	I	326	21/08/00	16:30	CC		7	PS	7
Alves-dos-Santos, I.	3450	NESTING BIOLOGY OF TETRAPEDIA DIVERSIPES KLUG (TETRAPEDIINI, APOIDEA).	II	871	21/08/00	16:30	CC		19	PS	19
Alves-dos-Santos, I.	3451	VISITING BEES OF EICHHORNIA AZUREA FLOWERS (PONTEDERIACEAE) IN SOUTHEASTERN BRAZIL.	II	871	21/08/00	16:30	CC		19	PS	19
Alviña, A.	975	INTERACTIONS BETWEEN FEMALES OF MANUELIA POSTICA (SPINOLA) AND COMPARISONS OF ITS NESTS WITH THE NESTS OF MANUELIA GAYI (SPINOLA) (HYMENOPTERA: ANTHOPHORIDAE)	I	246	21/08/00	16:30	CC		6	PS	6
Al-Wahaibi, A. K.	883	OVIPOSITION OF HOMALODISCA SPP. (HEMIPTERA: CICADELLIDAE: CICADELLINAE) AND ASSOCIATED EGG PARASITISM ON CITRUS: SPATIAL DISTRIBUTION	I	223	21/08/00	16:30	CC		6	PS	6
Alzogaray, R.	668	NITROGENOUS COMPOUNDS AS ATTRACTANTS OF TRIATOMA INFESTANS	I	169	22/08/00	16:30	CC		4	PS	4
Alzogaray, R.	667	COPULATION PHEROMONE OF THE VECTOR OF CHAGAS DISEASE, TRIATOMA infestans: IDENTIFICATION AND BIOASSAY	I	169	22/08/00	16:30	CC		4	PS	4
Alzogaray, R. A.	2392	BEHAVIORAL RESPONSE OF STOMOXYS CALCITRANS (DIPTERA: MUSCIDAE) TO ITS OWN FECES	II	604	21/08/00	16:30	CC		13	PS	13
Alzugaray, R.	85	IPM OF SCARAB PESTS IN SOUTH AMERICA	I	22	21/08/00	11:35	HB	A	2	1	2
Amano, H.	3376	AN EVIDENCE OF MATERNALLY CONTROLLED SEX DETERMINATION IN PHYTOSEIULUS PERSIMILIS	II	852	25/08/00	16:30	CC		18	PS	18
Amaral Filho, B. F.	1509	INFLUENCE OF PREY SIZE ON PREDATION SUCCESS BY ZELUS LONGIPES (HETEROPTERA: REDUVIIDAE)	I	381	21/08/00	16:30	CC		8	PS	8
Amaral Filho, B. F.	4013	EVALUATION OF GAMMA RADIATION (COBALT 60) ABOUT THE ARCELIN PROTEIN AND ITS INFLUENCE ON RESISTANCE TO BEAN WEEVIL	II	1013	21/08/00	15:30	HB	J	23	2	23
Amaral Filho, B. F.	3744	INMATURE STAGES OF ZELUS LONGIPES (HETEROPTERA, REDUVIIDAE)	II	945	22/08/00	16:30	CC		21	PS	21
Amaral-Filho, B. F.	352	POPULATIONAL STUDIES OF LEPTOGLOSSUS. ZONATUS (HETEROPTERA: COREIDAE) ON CORN (ZEA MAYS) IN BRAZIL	I	89	25/08/00	16:30	CC		2	PS	2
Amaral-Filho, B. F.	1168	EFFECT OF NYMPHAL DENSITY ON DEVELOPMENT AND PERFORMANCE OF LEPTOGLOSSUS ZONATUS, THE LEAF-FOOTED BUG (HETEROPTERA:COREIDAE) ON CORN (ZEA MAYS)	I	294	21/08/00	16:30	CC		6	PS	6
Amaral-Filho, B. F.	730	PHEROMONES SYSTEM OF LEPTOGLOSSUS ZONATUS (HETEROPTERA:COREIDAE)	I	184	24/08/00	16:30	CC		4	PS	4
Amaro, F.	2757	IPM PROGRAMMES FOR PROTECTED VEGETABLE CROPS (IN OESTE REGION OF PORTUGAL)	II	696	23/08/00	16:30	CC		14	PS	14
Amaro, F.	333	BUMBLEBEE FORAGING ACTIVITY AT GREENHOUSE TOMATO CROP WITH DIFFERENT POLLINATOR DENSITY	I	84	25/08/00	16:30	CC		2	PS	2
Amaro, F.	2696	CONSTRAINTS FACED BY THE GREENHOUSE VEGETABLES GROWERS USING BUMBLEBEES TO POLLINATION	II	681	22/08/00	16:30	CC		14	PS	14
Amaro, W.	3714	GENERA OF ANOMALONINAE (HYMENOPTERA: ICHNEUMONIDAE) FROM VENEZUELA	II	938	23/	16:30	CC		21	PS	21
Ambrosano, G. M. B.	2740	RESISTANCE OF STRAWBERRIES TO TETRANYCHUS URTICAE (ACARI: TETRANYCHIDAE)	II	692	23/08/00	16:30	CC		14	PS	14
Ambrosi, P.	1010	DISTRIBUTION OF THE HORSE-CHESTNUT LEAFMINER, CAMERARIA OHRIDELLA (LEPIDOPTERA, GRACILLARIIDAE) IN THE REGION SOUTH-TYROL – TRENTINO (NORTH EASTERN ITALY)	I	255	22/08/00	16:30	CC		6	PS	6
Ameen, M.	4062	LABORATORY AND FIELD STUDIES ON LARVAL CONTROL OF CULEX QUINQUEFASCIATUS MOSQUITOES INHABITING URBAN AND SUBURBAN DHAKA, BANGLADESH	II	1026	22/08/00	16:30	CC		23	PS	23
Amendt, J.	2953	PARASITOIDS IN FORENSIC ENTOMOLOGY	II	745	26/08/00	14:45	Bol	R	15	11	15
Amin, A. A. H.	884	AN ANALYSIS OF THERSHOLD TEMPERATURES FOR THE DEVELOPMENT OF CEREAL APHIDS, SCHIZAPHIS GRAMIMUM IN MIDDLE EGYPT	I	223	21/08/00	16:30	CC		6	PS	6
Amin, A. H.	885	LIFE HISTORY AND LIFE TABLES OF CITRUS LEAF MINERPHYLLOCNISTIS CITRELLA (LEPIDOPTERA:GRACILLARIIDAE)	I	224	21/08/00	16:30	CC		6	PS	6
Amorim, D. S.	3868	"COECUS GROUP", A PHYLOGENETIC ANALYSIS TO REVIEW THE STACH'S STATEMENTS. (COLLEMBOLA : ARRHOPALITIDAE)	II	976	25/08/00	16:30	CC		21	PS	21
Amorim, D. S.	2194	LAZY EVOLUTION: CRETACEOUS/TERTIARY BIOGEOGRAPHY IN THE NEOTROPICAL REGION	I	554	23/08/00	11:05	HB	L	12	5	12
Amorim, D. S.	3657	BASAL DIPTERA PHYLOGENY	II	923	24/08/00	9:35	HB	E	21	6	21
Amorim, D. S.	3715	A NEW PHYLOGENY AND PHYLOGENETIC CLASSIFICATION FOR THE CANTHYLOSCELIDAE (DIPTERA: PSYCHODOMORPHA)	II	938	21/08/00	16:30	CC		21	PS	21
Amorim, D. S.	3740	CLADISTIC ANALYSIS OF THE GENUS BRACHYPREMNA OSTEN SACKEN 1886 (DIPTERA, TIPULIDAE)	II	944	22/08/00	16:30	CC		21	PS	21
Amorim, D. S.	3854	PHYLOGENETIC ANALYSIS FROM SUPERTRIBE LASIOPTERIDI (DIPTERA: CECIDOMYIIDAE), WITH FOCUS IN THE POSITION OF TROTTERIA	II	973	25/08/00	16:30	CC		21	PS	21
Amorim, L. C. S.	1616	INTRODUCTION OF THE PARASITOID AGENIASPIS CITRICOLA FOR THE BIOLOGICAL CONTROL OF CITRUS LEAFMINER PHYLLOCNISTIS CITRELLA IN BRAZIL	I	407	24/08/00	16:30	CC		8	PS	8

Sub-titles: (HB=Hotel Bourbon) - (HM=Hotel Mabu) - (CC=Convention Center) - (Bol=Foz Boulevard) - (PS=Poster Session) - (PL=Plenary Lecturer)

AUTHOR	N°	TITLE	Book	Page	Date	Time	Local	Room	Session	Symp	New Session
Amorim, L. C. S.	249	EFFICIENCY OF THE INSECTICIDE ACTARA (THIAMETOXAN) ON CONTROL OF SHARPSHOOTER VECTORS OF XYLELLA FASTIDIOSA ON CITRUS	I	63	22/08/00	16:30	CC		2	PS	2
Amrein, H.	577	THE MOLECULAR BIOLOGY OF DROSOPHILA ODORANT RECEPTORS	I	146	21/08/00	10:45	Bol	S	4	1	4
An, Y.	3528	A NOVEL FUNCTION OF THE PARALYTIC PEPTIDE OF THE WILD SILKMOTH ANTHERAEA YAMAMAI (ANY-PARP) FOR DIAPAUSE INDUCTION OF THE SILKWORM BOMBYX MORI	II	890	24/08/00	16:30	CC		19	PS	19
Anagnou-Veroniki, M.	2613	THE EFFECTS OF CITRUS LEAF MINER INFESTATIONS IN CITRUS GROVES	II	660	21/08/00	16:30	CC		14	PS	14
Anciso, J.	1530	BIOLOGICAL CONTROL OF FLORIDA RED SCALE IN TEXAS CITRUS	I	386	22/08/00	16:30	CC		8	PS	8
Andaloro, J. T.	1270	INDOXACARB: ATTRIBUTES THAT IMPACT FIELD PERFORMANCE AND CONTRIBUTE TO CONSERVATION OF BENEFICIALS	I	321	25/08/00	10:20	HM	N	7	9	7
Andan, H. F.	1254	CURENT DEVELOPMENTS WITH ETHNOBOTANICAL INSECTICIDES FROM GHANA: REVIVING AND MODERNISING AGE-OLD PRACTICE	I	317	24/08/00	10:20	HM	N	7	7	7
Andersen, A.	462	BIODIVERSITY OF AGROMYZIDAE IN CEREAL AND GRASS FIELDS AND THEIR BOUNDARIES	I	117	21/08/00	16:30	CC		3	PS	3
Andersen, A. N.	463	SIMPLIFYING ANT MONITORING: A CASE STUDY FROM THE AUSTRALIAN SEMI-ARID TROPICS	I	117	21/08/00	16:30	CC		3	PS	3
Andersen, N. M.	3569	ECOLOGICAL PHYLOGENETICS AS APPLIED TO SEMIAQUATIC BUGS (HEMIPTERA, GERROMORPHA)	II	901	23/08/00	9:35	Bol	U	20	1	20
Andersen, N. M.	3627	PHYLOGENY OF TEMPERATE WATER STRIDERS (GERRIDAE: LIMNOPORUS, AQUARIUS & GERRIS) BASED ON COMBINED ANALYSES OF MOLECULAR AND MORPHOLOGICAL DATA	II	916	22/08/00	9:35	HB	E	21	3	21
Andersen, N. M.	4174	PHYLOGENY AND PHYLOGEOGRAPHY OF THE MARINE WATER STRIDER HALOBATES (HETEROPTERA, GERRIDAE)	II	1054	23/08/00	10:05	Bol	U	Erratum	1	20
Andersen, P. C.	3205	PHYSIOLOGICAL ADAPTATIONS OF LEAFHOPPERS THAT FEED ON XYLEM FLUID: EXPLORING NUTRIENT LIMITATIONS AS A COMPONENT OF INTEGRATED CROP MANAGEMENT	II	809	21/08/00	14:35	Bol	U	17	1	17
Andersen, P. C.	3219	NUTRITION AND DEVELOPMENT OF THE GLASSY-WINGED SHARPSHOOTER EXAMINED BY TRADITIONAL AND NOVEL NUTRITIONAL INDICES	II	813	21/08/00	16:30	CC		17	PS	17
Anderson Jr., J.R.	3900	THE EFFECT OF TECHNOLOGY CHANGES ON IPM	II	984	23/08/00	15:35	HB	H	22	5	22
Anderson, G. S.	2940	ESTABLISHING A COUNTRYWIDE DATABASE OF INSECT SUCCESSION ON CARRION IN CANADA.	II	742	26/08/00	9:50	Bol	R	15	11	15
Anderson, J. R.	764	FARMSOURCE.COM, TRAINING CONSULTANTS ONLINE	I	193	23/08/00	11:35	Bol	T	5	4	5
Anderson, K. L.	3937	NORTHERN AUSTRALIA QUARANTINE STRATEGY, AUSTRALIA'S FRONTLINE OF DEFENCE	II	994	21/08/00	16:30	CC		22	PS	22
Anderson, M.	2908	THE ROLE OF HOUSEFLIES IN THE SPREAD OF HUMAN DISEASE - CONTROL IMPLICATIONS	II	734	24/08/00	9:35	Bol	R	15	7	15
Anderson, M. A.	2051	DESIGNING PROTEINASE INHIBITORS FOR THE CONTROL OF HELICOVERPA SPECIES	I	517	21/08/00	16:30	CC		11	PS	11
Anderson, P.	741	ANTENNAL AND BEHAVIORAL RESPONSES TO NONHOST ANGIOSPERM LEAF AND BARK VOLATILES BY CONIFER INSECT	I	187	25/08/00	16:30	CC		4	PS	4
Anderson, P. K.	103	INTERNATIONAL AND NATIONAL RESEARCH PROGRAMS FOR THE DEVELOPMENT OF BEMISIA IPM SYSTEMS	I	27	22/08/00	15:00	HB	A	2	4	2
Anderson, R. S.	3617	BIODIVERSITY AND BIOGEOGRAPHY OF NEOTROPICAL LEAF LITTER WEEVILS (CURCULIONIDAE)	II	913	21/08/00	13:35	HB	E	21	2	21
Anderson, R. S.	3716	INTERNATIONAL TAXONOMIC COLLABORATIONS: DEVELOPING AND MAINTAINING NORTH SOUTH LINKAGES WITHIN THE AMERICAS	II	938	21/08/00	16:30	CC		21	PS	21
Andrade, A. P. P.	2675	ANALYSIS OF RESIDUES OF SULFLURAMIDA IN GRASS AND SOIL AS WELL AS EFFICIENCY OF THE PRODUCT "MIREX-S MAX•" IN THE CONTROL OF ATTA CAPIGUARA (HYMENOPTERA: FORMICIDAE)	II	676	22/08/00	16:30	CC		14	PS	14
Andrade, A. P. P.	3452	BROOD-DEVELOPMENT OF THE THREE ACROMYRMEX SUBTERRANEUS (HYMENOPTERA, FORMICIDAE) SUBSPECIES	II	871	21/08/00	16:30	CC		19	PS	19
Andrade, A. P. P.	3453	NEST-ARCHITECTURE OF TWO ACROMYRMEX SUBTERRANEUS (HYMENOPTERA, FORMICIDAE) SUBSPECIES	II	872	21/08/00	16:30	CC		19	PS	19
Andrade, C. F. S.	2235	POLYTENE CHROMOSOMES OF CULEX QUINQUEFASCIATUS (DIPTERA: CULICIDAE)	I	564	21/08/00	16:30	CC		12	PS	12
Andrade, G. G.	2614	EFFECT OF NITROGEN FERTILIZATION ON THE RESISTANCE OF CORN PLANTS TO THE ATTACK OF FALL ARMYWORM (LEPIDOPTERA: NOCTUIDAE)	II	660	21/08/00	16:30	CC		14	PS	14
Andrade, G. S.	3717	CLADISTIC ANALYSIS OF THE CERESINI GENERA: A REAPPRAISAL (HEMIPTERA, AUCHENORRHYNCHA, MEMBRACIDAE)	II	938	21/08/00	16:30	CC		21	PS	21
Andrade, J. C. R.	2984	BRAZILIAN SPOTTED FEVER TRANSMITED BY AMBLYOMMA AUREOLATUM (ACARI) IN MOGI DAS CRUZES, BRAZIL: REPORT OF FOUR HUMAN CASES AND ENVIRONMENTAL CONTROL MEASURES	II	753	22/08/00	16:30	CC		15	PS	15
Andrade, J. L. B.	1533	SURVEY OF PARASITOIDS OF THE FALL ARMYWORM, SPODOPTERA FRUGIPERDA (LEPIDOPTERA: NOCTUIDAE), IN FERNANDÓPOLIS REGION, SÃO PAULO STATE, BRAZIL	I	387	22/08/00	16:30	CC		8	PS	8
Andrade, L. O.	3455	PRELIMINARY SURVEY AND SPECIES COMPOSITION OF TERMITES IN SOME SITES OF THE CAMPUS OF THE "UNIVERSIDADE FEDERAL RURAL DO RIO DE JANEIRO", IN SEROPEDICA (RJ), BRAZIL	II	872	21/08/00	16:30	CC		19	PS	19
Andrade, L. O.	1946	EFFICIENCY OF GRANULATED SYSTEMIC INSECTICIDES TO ELIMINATE THE COPTOTERMES HAVILANDI COLONIES ATTACKING ROOTS OF TREES	I	490	23/08/00	16:30	CC		10	PS	10
Andrade, L. O.	4113	CONTROL OF NASUTITERMES SP. IN A HISTORICAL PATRIMONY IN THE CONTRYSIDE OF RIO DE JANEIRO	II	1038	24/08/00	16:30	CC		23	PS	23
Andrade, L. O.	4114	CONTROL OF NASUTITERMES SP. ATTACKING A STORE OF FABRICS IN THE COUNTRYSIDE OF RIO DE JANEIRO STATE	II	1039	25/08/00	16:30	CC		23	PS	23
Andrade, R. C. de	16	EFFECT OF NUTRIENTS ON THE FLAT MITE, BREVIPALPUS PHOENICIS (ACARI:TENUIPALPIDAE) AND ON COFFEE RING SPOT VIRUS TRANSMISSION IN THE COFFEE (COFFEA ARABICA) CULTURE	I	4	21/08/00	16:30	CC		1	PS	1
Andress, E.	3959	REVIEWING A MULTI-AGENCY BIOLOGICAL CONTROL PROGRAM FOR BEMISIA ARGENTIFOLII IN THE SOUTHWEST UNITED STATES: ESTABLISHING, CONSERVING & AUGMENTING NEW PARASITOIDS & EVALUATING THEIR IMPACT	II	999	22/08/00	16:30	CC		22	PS	22
Andrews, J. R. H.	17	HOUSE DUST MITE (DERMATOPHAGOIDES PTERONYSSINUS) MORTALITY IN OCCUPIED BEDS AND HEATED AND UNHEATED CARPET	I	5	21/08/00	16:30	CC		1	PS	1
Andújar, A.	3718	PHYLOGENETIC RELATIONSHIPS OF THE GENUS ZABRUS (COLEOPTERA, CARABIDAE) BASED ON MORPHOLOGICAL, KARYOTYPIC, AND MOLECULAR DATA	II	939	21/08/00	16:30	CC		21	PS	21
Angeli, L. F. A.	67	POLIPHAGOTARSONEMUS LATUS (ACARI: TARSONEMIDAE) DAMAGES IN "ERVA-MATE" SEEDLINGS	I	17	25/08/00	16:30	CC		1	PS	1
Angeli, S.	625	CHEMOSENSORY PROTEINS IN SCHISTOCERCA GREGARIA	I	158	21/08/00	16:30	CC		4	PS	4
Angelis, S. De	1785	DISTRIBUTION OF SCAPTOCORIS CASTANEA POPULATION IN THE SOIL PROFILE	I	450	25/08/00	16:30	CC		9	PS	9
Angharad M. R. Gatehouse	V	Transgenic plants; an environmentally-friendly method of pest control?	I	XVII I	22/08/00	8:00	HB			PL	
Angioy, A. M.	2417	NEURONAL CONTROL OF HEART REVERSAL IN THE HAWKMOTH MANDUCA SEXTA	II	611	21/08/00	16:30	CC		13	PS	13
Angle Jr., G. W.	1268	BIFENAZATE (D2341), A NOVEL AGENT TO CONTROL SPIDER MITES	I	320	25/08/00	9:35	HM	N	7	9	7
Angst, M.	1279	PRO-ACTIVE RESISTANCE MANAGEMENT OF THIAMETHOXAM	I	323	25/08/00	14:50	HM	N	7	10	7

Sub-titles: (HB=Hotel Bourbon) - (HM=Hotel Mabu) - (CC=Convention Center) - (Bol=Foz Boulevard) - (PS=Poster Session) - (PL=Plenary Lecturer)

AUTHOR	Nº	TITLE	Book	Page	Date	Time	Local	Room	Session	Symp	New Session
Anjos, E. D.	2984	BRAZILIAN SPOTTED FEVER TRANSMITED BY AMBLYOMMA AUREOLATUM (ACARI) IN MOGI DAS CRUZES, BRAZIL: REPORT OF FOUR HUMAN CASES AND ENVIRONMENTAL CONTROL MEASURES	II	753	22/08/00	16:30	CC		15	PS	15
Anjos, N.	1945	IMPACT OF DEFOLIATION BY COSTALIMAITA FERRUGINEA (COLEOPTERA: CHRYSOMELIDAE) IN EUCALYPTUS GRANDIS HILL EX MAIDEN	I	490	23/08/00	16:30	CC		10	PS	10
Añober, G. M.	3650	ECOLOGY OF TWO SPECIES OF STREPSIPTERA PARASITIC ON MANGO LEAFHOPPERS IN THE PHILIPPINES	II	922	23/08/00	14:50	HB	E	21	5	21
Anstead, J. A.	464	BIOTYPIC AND GENOTYPIC DIVERSITY OF GREENBUGS: HOST ADAPTED OR CULTIVAR SELECTED	I	118	21/08/00	16:30	CC		3	PS	3
Anthomelidis, A. G.	2111	EFFICACY OF SPINOSAD NATURALYTE INSECT CONTROL AGAINST LOBESIA BOTRANA (LEPIDOPTERA: TORTRICIDAE) ON GREEK VINEYARDS	I	532	23/08/00	16:30	CC		11	PS	11
Antognozzi, E.	886	IMPROVEMENT OF HONEY-BEE POLLINATION IN ACTINIDIA DELICIOSA	I	224	21/08/00	16:30	CC		6	PS	6
Anton, S.	675	JUVENILE HORMONE – ITS EFFECT ON AGGREGATION BEHAVIOUR AND CENTRAL NERVOUS PROCESSING OF AGGREGATION PHEROMONES IN THE DESERT LOCUST	I	171	23/08/00	16:30	CC		4	PS	4
Antonialli Junior, W. F.	3493	DIVISION OF LABOR IN ECTATOMMA EDENTATUM (HYMENOPTERA, FORMICIDAE)	II	882	23/08/00	16:30	CC		19	PS	19
Antonini, Y.	1973	UTILIZATION OF FLORAL RESOURCES BY MELIPONINEOS (APIDAE:MELIPONINI) IN A FOREST FRAGMENT, BELO HORIZONTE, MG, BRAZIL	I	497	25/08/00	16:30	CC		10	PS	10
Antonini, Y.	3454	INFLUENCE OF THE PRESENCE OF CARIOCAR BRASILIENSIS (CARIOCARACEAE) ON THE DENSITY OF STINGLESS BEE NESTS (APIDAE: MELIPONINI) IN A SMALL FARM, JANUÁRIA, MG, BRAZIL	II	872	21/08/00	16:30	CC		19	PS	19
Antonini, Y.	3593	USE OF STACHYTARPHETA GLABRA (VERBENACEAE) BY HERBIVOROUS AND NECTARIVOROUS INSECTS IN A METALIFEROUS ALTITUDINAL REGION, MINAS GERAIS, BRAZIL	II	907	21/08/00	16:30	CC		20	PS	20
Antonio, M. B.	1634	FIRST RECORD OF CHRYSOPERLA EXTERNA PREYING THE CITRUS LEAF MINER PHYLLOCNISTIS CITRELLA	I	412	25/08/00	16:30	CC		8	PS	8
Antunes, E. C.	180	SUBLETHAL EFFECTS OF ABAMECTIN SUPPRESSING COLONIES OF THE LEAF-CUTTING ANT ACROMYRMEX SUBTERRANEUS SUBTERRANEUS	I	46	21/08/00	16:30	CC		2	PS	2
Antunes, W. C.	1232	RESISTANCE AND SYNERGISM TO ORGANOSPHOSPHATE INSECTICIDES IN POPULATIONS OF LEUCOPTERA COFFEELLA (LEPIDOPTERA: LYONETIIDAE)	I	311	21/08/00	16:05	HM	N	7	2	7
Aoki, V. L.	3018	ANTIBODY AND BLOOD LEUKOCYTE RESPONSE IN RHIPICEPHALUS SANGUINEUS TICK INFESTED DOGS AND GUINEA PIGS	II	761	25/08/00	16:30	CC		15	PS	15
Appel, A. G.	2377	PHYSIOLOGICAL AND BEHAVIORAL STRATEGIES USED BY COCKROACHES TO REDUCE WATER LOSS: AN OVERVIEW	II	601	25/08/00	9:35	HB	I	13	8	13
Aquadro, C. F.	3300	CONTROL OF DROSOPHILA REPRODUCTION BY MALE-DERIVED PROTEINS IN THE SEMINAL FLUID	II	833	25/08/00	13:35	HB	K	18	7	18
Aquino, B. T.	2801	INTEGRATED BIOLOGICAL CONTROL OF WHITE FLIES (BEMISIA TABACI) IN OAXACA, MEXICO	II	707	24/08/00	16:30	CC		14	PS	14
Arab, A.	3104	ULTRAMORPHOLOGY OF THE MIDGUT OF SOLENOPSIS SAEVISSIMA (FORMICIDAE: MYRMICINAE)	II	783	21/08/00	16:30	CC		16	PS	16
Arai, T.	3312	MOLECULAR BIOLOGY OF INSECT CLOCKS FOR PHOTOPERIODISM	II	836	25/08/00	14:00	HB	K	18	8	18
Arakawa, T.	3523	MASS-PRODUCTION OF PORCINE INTERLEUKIN-2 IN BOMBYX MORI	II	889	24/08/00	16:30	CC		19	PS	19
Araki, A. S.	3021	MONITORING OF HEMATOPHAGOUS VECTORS IN THE AREA OF INFLUENCE OF THE YACYRETA DAM	II	762	22/08/00	16:30	CC		15	PS	15
Aramaki, P. H.	192	EFFECT OF DIFFERENT SEED TREATMENTS ON APHID APHIS GOSSYPII CONTROL VEGETATIVE DEVELOPMENT AND YIELD OF COTTON CROP	I	49	22/08/00	16:30	CC		2	PS	2
Aramaki, P. H.	193	EFFECT OF DIFFERENT SEED TREATMENTS ON THRIPS FRANKLINIELLA SCHULTZEI CONTROL VEGETATIVE DEVELOPMENT AND YIELD OF COTTON CROP	I	49	22/08/00	16:30	CC		2	PS	2
Arancibia, C.	1551	HYDROTAEA AENESCENS, A LARVAL PREDATOR OF THE HOUSE FLY: A SUMMARY OF RECENT RESERCH	I	391	22/08/00	16:30	CC		8	PS	8
Araújo, E. C. de	2396	CELLULAR IMMUNE RESPONSE OF THE MOSQUITO CULEX QUINQUEFASCIATUS (DIPTERA-CULICIDAE) TO CANDIDA ALBICANS INFECTION.	II	605	21/08/00	16:30	CC		13	PS	13
Araujo, E. L.	181	FRUIT FLIES OF THE GENUS ANASTREPHA IN THE FRUIT PRODUCING REGION OF MOSSORO/ASSU, RIO GRANDE DO NORTE, BRAZIL	I	46	21/08/00	16:30	CC		2	PS	2
Araújo, E. L.	906	SURVEY OF FRUIT FLIES (DIPTERA: TEPHRITIDAE) IN FOUR CITIES IN PARAÍBA	I	229	21/08/00	16:30	CC		6	PS	6
Araújo, G. T.	3455	PRELIMINARY SURVEY AND SPECIES COMPOSITION OF TERMITES IN SOME SITES OF THE CAMPUS OF THE "UNIVERSIDADE FEDERAL RURAL DO RIO DE JANEIRO", IN SEROPEDICA (RJ), BRAZIL	II	872	21/08/00	16:30	CC		19	PS	19
Araújo, G. T.	3533	INFESTATION OF TERMITES IN EUCALYPTUS SP. AT THE "UNIVERSIDADE FEDERAL RURAL DO RIO DE JANEIRO"	II	891	25/08/00	16:30	CC		19	PS	19
Araújo, G. T.	1946	EFFICIENCY OF GRANULATED SYSTEMIC INSECTICIDES TO ELIMINATE THE COPTOTERMES HAVILANDI COLONIES ATTACKING ROOTS OF TREES	I	490	23/08/00	16:30	CC		10	PS	10
Araújo, G. T.	3465	ERADICATION OF THE COPTOTERMES HAVILANDI COLONIES BY CURATIVE AND PREVENTIVE TREATMENT OF INFESTED RESIDENTIAL BUILDINGS IN URBAN AREAS IN THE CITIES OF NITEROI AND RIO DE JANEIRO (RJ), BRAZIL	II	875	22/08/00	16:30	CC		19	PS	19
Araújo, M.	381	MODELLING DISTRIBUTIONS AND MAKING COMPARISONS: CAN WE PREDICT RELATIVE GAPS IN OUR KNOWLEDGE OF INSECT BIODIVERSITY MORE ACCURATELY?	I	97	21/08/00	11:50	HB	C	3	1	3
Araújo, M. C.	2044	THE SPECIFICITY OF BEAUVERIA BASSIANA FOR THE CONTROL OF MITE PESTS OF PAPAYA	I	516	21/08/00	16:30	CC		11	PS	11
Araújo, N.	250	EFFICIENCY OF THE INSECTICIDE TEMIK 150 (ALDICARB) ON CONTROL OF SHARPSHOOTER VECTORS OF XYLELLA FASTIDIOSA ON CITRUS	I	64	22/08/00	16:30	CC		2	PS	2
Araújo, N.	672	ATTRACTIVITY OF PROTEIN HIDROLISATE AND SUGARCANE MOLASSES ON ADULT FRUIT FLIES ANASTREPHA SP. AND CERATITIS CAPITATA (DIPTERA:TEPHRITIDAE) ON CITRUS ORCHARD	I	170	23/08/00	16:30	CC		4	PS	4
Araújo, R. A.	1926	PATTERNS OF SPECIES RICHNESS AND ABUNDANCE OF DEFOLIATOR LEPIDOPTERA ASSOCIATED WITH EUCALYPTUS GRANDIS IN BRAZIL AND HOW THEY RELATE TO PLANT AGE	I	485	22/08/00	16:30	CC		10	PS	10
Araujo, R. P. C.	2056	CONIDIAL VIABILITY OF TWO ENTOMOPATHOGENOUS FUNGI KEPT ON AQUEOUS SUSPENSION UNDER DIFFERENTS STORAGE CONDITIONS AND PERIOD	I	519	22/08/00	16:30	CC		11	PS	11
Araujo, R. P. C.	2057	EFFICIENCY OF THE ENTOMOPATHOGENOUS FUNGUS BEAUVERIA BASSIANA (BBBR057/CPATC) STRAIN ON BLACK COCONUT BUNCH WEEVIL HOMALINOTUS CORIACEUS (COLEOPTERA: CURCULIONIDAE)	I	519	22/08/00	16:30	CC		11	PS	11
Araujo, R. P. C.	2058	EFFICIENCY OF THE ENTOMOPATHOGENOUS FUNGUS BEAUVERIA BASSIANA (BbBr057/CPATC) STRAIN ON THE AMERICAN PALM WEEVIL RHYNCHOPHORUS PALMARUM (COLEOPTERA:CURCULIONIDAE)	I	519	22/08/00	16:30	CC		11	PS	11
Araujo, R. P. C.	665	EFFICIENCY OF DIFFERENTS LURES AND THEIR PROBABLE INTERACTION IMPROVING RHYNCHOPHORUS PALMARUM ADULTS ATTRACTION TO THE TRAPS	I	168	22/08/00	16:30	CC		4	PS	4
Araujo, R. P. C.	666	EVALUATION OF THE "PET" TRAP EFFICIENCY ON THE CAPTURE OF ADULTS OF RHYNCHOPHORUS PALMARUM AND THE COST/BENEFIT ANALISYS	I	168	22/08/00	16:30	CC		4	PS	4
Araújo, S.	188	CONTROL OF ORTHEZIA PRAELONGA IN WEST INDIAN CHERRY, MALPIGHIA GLABRA USING FORMULATIONS AND THREE APPLICATION METHODS OF THIAMETHOXAM	I	48	21/08/00	16:30	CC		2	PS	2
Araya, J. E.	3938	INSECTS DAMAGING RESISTANT PLANT CROPS	II	994	21/08/00	16:30	CC		22	PS	22
Araya, K.	3719	PHYLOGENY AND SEXUAL DIMORPHISM OF STAG BEETLES (COLEOPTERA, LUCANIDAE)	II	939	21/08/00	16:30	CC		21	PS	21

Sub-titles: (HB=Hotel Bourbon) - (HM=Hotel Mabu) - (CC=Convention Center) - (Boi=Foz Boulevard) - (PS=Poster Session) - (PL=Plenary Lecturer)

AUTHOR	Nº	TITLE	Book	Page	Date	Time	Local	Room	Session	Symp	New Session
Araya, K.	1770	RELATIONSHIP BETWEEN MICROHABITAT AND BODY SHAPE IN ADULT PASSALID BEETLES (COLEOPTERA, PASSALIDAE)	I	446	22/08/00	16:30	CC		9	PS	9
Arbab, A.	887	DETERMINATION OF SPATIAL DISTRIBUTION PATTERN OF EGG AND LARVAL INSTARS OF ELM-LEAF BEETLE XANTHOGALEAROCELLA LUTEOLA (COL.; CHRYSOMELLIDAE)	I	224	21/08/00	16:30	CC		6	PS	6
Arbab, A.	2715	THE EFFICACY OF CERTAIN AQUEOUS PLANT EXTRACTS FROM GUILAN PROVINCE AGAINST ELM LEAF BEETLE XANTHOGALEAROCELLA LUTEOLA (COL; CHRYSOMELLIDAE)	II	686	23/08/00	16:30	CC		14	PS	14
Arber, A.	3398	THE INTRODUCED SUBTERRANEAN TERMITE, RETICULITERMES LUCIFUGAS IN URUGUAY	II	858	21/08/00	14:30	HM	Q	19	1	19
Arbino, M. O.	3512	PRELIMINARY INVENTORY OF ISOPTERA FROM NATURAL PROTECTED AREAS OF NORTHEAST ARGENTINA	II	886	23/08/00	16:30	CC		19	PS	19
Arbogast, R. T.	4016	ENHANCING THE BIOCONTROL OF BRUCHIDS INFESTING STORED LEGUMES THROUGH THE COMBINED APPLICATION OF A PREDATORY BUG AND LARVAL PARASITOIDS	II	1014	22/08/00	10:00	HB	J	23	3	23
Arcaya, E.	888	SOME BIOLOGICAL AND ECOLOGICAL ASPECTS OF PSEUDODOROS CLAVATUS (DIPTERA:SYRPHIDAE)	I	224	21/08/00	16:30	CC		6	PS	6
Archangelsky, M.	3293	EVOLUTIONARY TRENDS IN MORPHOLOGICAL ADAPTATIONS OF IMMATURE STAGES OF HYDROPHILOIDEA (COLEOPTERA	II	832	24/08/00	11:05	HB	K	18	6	18
Ardila, J. M.	626	DIVERSITY OF DUNG BEETLES (COLEOPTERA: SCARABAEIDAE) IN BORDER-INNER TRANSECTS IN A FOREST OF THE COLOMBIAN ANDES	I	158	21/08/00	16:30	CC		4	PS	4
Ares, M. I.	1483	ECONOMICALLY IMPORTANT PESTS OF THE COSAVE REGION AND THE AVAILABLE TECHNOLOGIES FOR THEIR BIOLOGICAL CONTROL	I	374	21/08/00	16:30	CC		8	PS	8
Arhex, V. F.	1935	MAIN INSECT FOREST PESTS AFFECTING PINES IN THE PATAGONIA ARGENTINA	I	488	23/08/00	16:30	CC		10	PS	10
Arias A, R. de	2987	TRIATOMINES AND OTHER ARTHROPODS IN BIRD NESTS IN NATIVE AND MENNONITE COMMUNITIES OF THE PARAGUAYAN CHACO	II	754	22/08/00	16:30	CC		15	PS	15
Arias, E. T.	4155	PHYLOGENY OF THE TRIBE POMACHILIINI CANDÈZE	II	1049	21/08/00	16:30	CC		Erratum	PS	21
Arias, M. C.	2249	PHYLOGENETIC RELATIONSHIP AMONG STINGLESS BEE SPECIES INFERRED BY MITOCHONDRIAL DNA RESTRICTION FRAGMENT LENGTH POLYMORPHISM	I	568	21/08/00	16:30	CC		12	PS	12
Arias, M. C.	2179	CONTRIBUTIONS OF MITOCHONDRIAL DNA ANALYSES TO MELIPONINI BIOLOGY AND EVOLUTION	I	550	22/08/00	10:35	HB	L	12	3	12
Arias, Q. A.	3738	THE SPILOMELINI OF VENEZUELA (LEPIDOPTERA:CRAMBIDAE: PYRAUSTINAE)	II	944	21/08/00	16:30	CC		21	PS	21
Arif, B. M.	1838	AN OVERVIEW OF BIOTECHNOLOGICAL APPROACHES TO BIOLOGICAL AND BIORATIONAL CONTROL OF FOREST INSECT PESTS	I	463	23/08/00	9:35	HB	M	10	4	10
Arif, B. M.	2382	HORMONAL REGULATION OF CUTICLE FORMATION AND CHITIN SYNTHESIS	II	602	25/08/00	13:35	HB	I	13	9	13
Arif, B. M.	1845	BIOLOGICAL CONTROL OF FOREST PESTS USING INSECT SPECIFIC VIRUSES	I	465	23/08/00	14:35	HB	M	10	4	10
Arif, M. I.	1291	INSECTICIDE RESISTANCE IN HELICOVERPA ARMIGERA AND STRATEGIES FOR ITS MANAGEMENT IN PAKISTAN	I	326	21/08/00	16:30	CC		7	PS	7
Arif, R.	293	YIELD LOSS ASSESSMENT OF UPLAND RICE DUE TO INSECT PESTS IN CENTRAL KALIMANTAN, BORNEO, INDONESIA IN WET SEASON 1997/98	I	74	24/08/00	16:30	CC		2	PS	2
Arijs, Y.	1434	PRODUCTION OF PREDATORY BUGS ON ARTIFICIAL AND FACTITIOUS FOODS AND THEIR USE IN GREENHOUSE PEST MANAGEMENT	I	362	21/08/00	15:35	HM	O	8	2	8
Arimura, K.	2615	GROWTH STAGE-DEPENDENT RESISTANCE OF RICE PLANT TO THE WHITEBACKED PLANTHOPPER	II	661	21/08/00	16:30	CC		14	PS	14
Arlian, L. G.	3	HOST IMMUNE RESPONSE TO SARCOPTES SCABIEI AND INDUCED IMMUNITY	I	1	24/08/00	14:35	HB	F	1	1	1
Armendano, A.	1331	INFLUENCE OF INSECTICIDES ON THE SPIDERS COMMUNITY IN A SOY CULTIVATION (BUENOS AIRES, ARGENTINA)	I	336	22/08/00	16:30	CC		7	PS	7
Armer, C.	2035	THE BENEFICIAL NEMATODE, HETERORHABDITIS MARELATUS : ITS PROMISE IN BIOCONTROL OF PESTS IN NURSERY AND FIELD CROPS	I	513	21/08/00	16:30	CC		11	PS	11
Armstrong, A.	2483	THE DESIGN AND APPLICATION OF AN ACTIGRAPH TO STUDY THE CIRCADIAN RHYTHM OF THE DUMP FLY, HYDROTAEA AENESCENS	II	627	24/08/00	16:30	CC		13	PS	13
Armstrong, J. W.	3918	HISTORICAL OVERVIEW OF QUARANTINE TREATMENTS IN INTERNATIONAL TRADE	II	989	25/08/00	15:20	HB	H	22	8	22
Arnason, J. T.	1857	THE BIOCHEMICAL MECHANISM FOR THE RESISTANCE OF RED MAPLE TREES TO FOREST TENT CATERPILLAR FEEDING	I	468	24/08/00	11:50	HB	M	10	5	10
Arnason, J. T.	3963	INSECTICIDAL EFFECTS OF THUJA OCCIDENTALIS (CUPRESSACEAE) ESSENTIAL OIL ON CALLOSOBRUCHUS MACULATUS [COLEOPTERA: BRUCHIDAE]	II	1000	22/08/00	16:30	CC		22	PS	22
Arnault, A. C.	3002	INFLUENCE OF A DIET BASE OF FISH MEAT IN DIFFERENT PUTRAFATION STAGES ON THE POST-EMBRYONIC DEVELOPMENT OF LUCILIA CUPRINA (DIPTERA:CALLIPHORIDAE) UNDER LABORATORY CONDITIONS	II	757	24/08/00	16:30	CC		15	PS	15
Arnaut, A. C.	2470	INFLUENCE OF DIFFERENT AGES OF FISH PUTREFATION ON THE POST EMBRIONIC DEVELOPMENT OF LUCÍLIA CUPRINA (DIPTERA:CALLIPHORIDAE) UNDER LABORATORY CONDITIONS	II	624	23/08/00	16:30	CC		13	PS	13
Arneodo, J. D.	563	PRESENCE OF DIURAPHIS NOXIA (HOMOPTERA: APHIDIDAE) COLONIZING BARLEY CROPS IN THE CENTRAL AREA OF THE PROVINCE OF CÓRDOBA (ARGENTINA)	I	142	25/08/00	16:30	CC		3	PS	3
Arnold, M.	4094	ARTIFICIAL FEEDING OF MOSQUITOS VIA A MEMBRANELESS SYTSTEM	II	1034	24/08/00	16:30	CC		23	PS	23
Arrigoni, E. de B.	1470	EFFECT OF DENSITY OF DIATRAEA SACCHARALIS EGGS IN THE PARASITISM OF TRICHOGRAMMA GALLOI IN SUGARCANE	I	371	26/08/00	10:05	HM	O	8	8	8
Arruda, I. C.	711	ROLE OF NEZARA VIRIDULA (HEMIPTERA-PENTATOMIDAE) ON INDUCING THE PRODUCTION OF FLAVONOID IN SOYBEAN GENOTYPES	I	180	21/08/00	16:30	CC		4	PS	4
Arruda, I. C.	1114	BIOLOGICAL AND NUTRITIONAL ASPECTS OF NEZARA VIRIDULA (HEMIPTERA:PENTATOMIDAE) ON SOYBEAN GENOTYPES	I	281	22/08/00	16:30	CC		6	PS	6
Arruda, P. A.	2271	THE COMPLETE MITOCHONDRIAL GENOME OF THE PRIMARY SCREWWORM FLY COCHLIOMYIA HOMINIVORAX (DIPTERA: CALLIPHORIDAE)	I	573	22/08/00	16:30	CC		12	PS	12
Artayasa, I. P.	3992	DAILY ACTIVITY OF THE FRUIT FLIES (BACTROCERA DORSALIS COMPLEX) AND ITS PARASITOID (BIOSTERES VANDENBOSCHI) IN CARAMBOLA TREE, WEST JAVA INDONESIA	II	1007	25/08/00	16:30	CC		22	PS	22
Arthur, V.	4013	EVALUATION OF GAMMA RADIATION (COBALT 60) ABOUT THE ARCELIN PROTEIN AND ITS INFLUENCE ON RESISTANCE TO BEAN WEEVIL	II	1013	21/08/00	15:30	HB	J	23	2	23
Arthur, F. H.	117	EFFICACY OF PARTICLE FILMS TO CONTROL TRIBOLIUM SPP. IN MILLS AND FOOD STORAGE FACILITIES.	I	30	23/08/00	14:55	HB	A	2	6	2
Arthur, V.	183	USE OF GAMMA RADIATION TO CONTROL SITOPHILUS LINEARIS (COLEOPTERA: CURCULIONIDAE) ATTACKING TAMARINDUS INDICUS (LEGUMINOSAE: FABOIDEAE)	I	47	21/08/00	16:30	CC		2	PS	2
Arthur, V.	3987	USE OF GAMMA RADIATION AS QUARENTENARY TREATMENT TO CONTROL THE MOTH OPOGONA SACCHARI (BOJER, 1856) (LEPIDOPTERA : TINEIDAE) IN BANANA (MUSA SP.) AND DRACAENA FRAGANS	II	1006	24/08/00	16:30	CC		22	PS	22
Arzone, A.	4065	THE HISTORY OF THE INSECTICIDE FENOXYCARB IN ITALY	II	1026	21/08/00	16:30	CC		23	PS	23
Arzua, M.	4066	SMALL WILD MAMMALS SIPHONAPTERA FROM ITAPEVI COUNTY, STATE OF SÃO PAULO, BRAZIL	II	1027	21/08/00	16:30	CC		23	PS	23
Asano, T.	2393	TRANSPORT OF PRO-PHENOLOXIDASE FROM HEMOLYMPH TO CUTICLE	II	605	21/08/00	16:30	CC		13	PS	13
Asanov, K. A.	1443	UNIFICATION OF INDUSTRIAL LINES OPERATING TIME ENTOMOPHAGES	I	364	22/08/00	14:20	HM	O	8	4	8
Asayama, T.	1021	MAJOR PESTS OF SOURSOP (ANNONA MURICATA) IN BRAZILIAN CERRADOS REGION AND THEIR NATURAL ENEMIES	I	258	23/08/00	16:30	CC		6	PS	6
Asbach, R.	62	LABORATORY STUDIES ON THE LIFE HISTORY, POST-EMBRYONIC SURVIVAL AND OVIPOSITION OF THE PREDACEOUS MITE CYDNODROMUS SP. [ACARINA: PHYTOSEIIDAE] ON DIFFERENT KINDS OF FOOD SUBSTANCES	I	16	24/08/00	16:30	CC		1	PS	1

Sub-titles: (HB=Hotel Bourbon) - (HM=Hotel Mabu) - (CC=Convention Center) - (Bol=Foz Boulevard) - (PS=Poster Session) - (PL=Plenary Lecturer)

AUTHOR	Nº	TITLE	Book	Page	Date	Time	Local	Room	Session	Symp	New Session
Asche, M.	3611	THE ENIGMATIC NEOTROPICAL DELPHACIDAE (INSECTA, HEMIPTERA, FULGOROMORPHA) – A STATUS REPORT OF OUR KNOWLEDGE ABOUT A LONG NEGLECTED GROUP	II	912	21/08/00	10:05	HB	E	21	1	21
Ashe, J. S.	3815	AN ILLUSTRATED GUIDE TO THE STAPHYLINIDAE (COLEOPTERA) OF MEXICO	II	963	24/08/00	16:30	CC		21	PS	21
Ashida, M.	2361	PROPHENOLOXIDASE CASCADE OF THE SILKWORM, BOMBYX MORI	II	596	23/08/00	15:50	HB	I	13	5	13
Ashida, M.	2393	TRANSPORT OF PRO-PHENOLOXIDASE FROM HEMOLYMPH TO CUTICLE	II	605	21/08/00	16:30	CC		13	PS	13
Ashida, M.	2478	A NEW COMPONENT OF THE PROPHENOLOXIDASE CASCADE, ß-1,3-GLUCAN RECOGNITION PROTEIN II FROM THE SILKWORM, Bombyx mori	II	626	23/08/00	16:30	CC		13	PS	13
Ashida, M.	2409	PROCESSING OF DROSOPHILA SPÄTZLE PROTEIN BY A SERINE PROTEASE IN THE PROPHENOLOXIDASE CASCADE OF THE SILKWORM PLASMA	II	609	21/08/00	16:30	CC		13	PS	13
Askoy, S.	2899	BACTERIAL SYMBIONTS AND THE CONTROL OF AFRICAN TRYPANOSOMES	II	732	23/08/00	10:35	Bol	R	15	5	15
Aslam, A. F. M.	4062	LABORATORY AND FIELD STUDIES ON LARVAL CONTROL OF CULEX QUINQUEFASCIATUS MOSQUITOES INHABITING URBAN AND SUBURBAN DHAKA, BANGLADESH	II	1026	22/08/00	16:30	CC		23	PS	23
Aspöck, H.	1466	THE BIOLOGY OF RAPHIDIOPTERA: A REVIEW OF PRESENT KNOWLEDGE WITH A CRITICAL VALUATION OF THE POSSIBLE USE OF SNAKE-FLIES IN INTEGRATED PEST CONTROL	I	370	24/08/00	14:35	HM	O	8	7	8
Aspöck, U.	3685	PHYLOGENY OF THE NEUROPTERIDA	II	930	25/08/00	15:05	HB	E	21	8	21
Asquith, A.	83	ERADICATION OF A SCARAB PEST FROM A NATIONAL WILDLIFE REFUGE	I	22	21/08/00	10:50	HB	A	2	1	2
Assi, M. E. B.	2616	EVALUATING SWEET POTATO FOR RESISTANCE TO THE WEST INDIAN SWEET POTATO WEEVIL	II	661	21/08/00	16:30	CC		14	PS	14
Astete, H.	2903	SPATIAL AND TEMPORAL HETEROGENEITY IN DENGUE VIRUS TRANSMISSION AND AEDES AEGYPTI POPULATION DENSITIES IN IQUITOS, PERU	II	733	23/08/00	14:35	Bol	R	15	6	15
Astorza, B. De	2301	MOLECULAR PHYLOGENY, CHROMOSOMES, AND HOST PLANT AFFILIATION IN CHRYSOLINA AND OREINA (COLEOPTERA, CHRYSOMELIDAE)	I	581	24/08/00	16:30	CC		12	PS	12
Atarassi, R. K.	296	EFFICACY EVALUATION OF KARATE ZEON 50 CS FOR THE CONTROL OF Diaphorocera costalimai, INSECT VECTOR OF CVC IN CITRUS	I	75	24/08/00	16:30	CC		2	PS	2
Atella, G. C.	2507	HEME GENERATION AND PROCESSING IN THE MIDGUT LUMEN AND ITS STORAGE IN THE EPITHELIAL CELLS OF THE RHODNIUS PROLIXUS (HEMIPTERA: REDUVIIDAE)	II	633	24/08/00	16:30	CC		13	PS	13
Athanasakis, P.	2265	CLONING OF THE ACIDIC RIBOSOMAL P-PROTEINS IN THE SILKMOTH BOMBYX MORI	I	572	22/08/00	16:30	CC		12	PS	12
Atkinson, P. W.	2217	HAT MEDIATED TRANSFORMATION OF INSECTS	I	560	25/08/00	13:35	HB	L	12	10	12
Atkinson, P. W.	2334	WEAK EXPRESSION OF EGFP IN TRANSGENIC AEDES AEGYPTI AND STOMOXYS CALCITRANS DESPITE THE PRESENCE OF MULTIPLE COPIES OF THE TRANSGENE	I	589	25/08/00	16:30	CC		12	PS	12
Attardo, G.	2917	ENGINEERING BLOOD MEAL-ACTIVATED SYSTEMIC IMMUNITY USING FAT BODY-SPECIFIC GENES IN THE MOSQUITO VECTOR	II	736	24/08/00	15:05	Bol	R	15	8	15
Attia, A. A.	2665	WHEAT CROP PROTECTION BASED ON PLANT RESISTANCE AND BIOLOGICAL CONTROL IN EGYPT	II	673	22/08/00	16:30	CC		14	PS	14
Atui, M. B.	4067	ENZYME LINKED IMMUNOASSAY TESTS FOR INSECT MYOSIN IN WHEAT: EFFECTS OF MYOSIN DEGRADATION	II	1027	21/08/00	16:30	CC		23	PS	23
Atui, M. B.	4068	ENZYME LINKED IMMUNOASSAY TESTS FOR INSECT MYOSIN IN WHEAT: EFFECTS OF MYOSIN DEGRADATION	II	1027	21/08/00	16:30	CC		23	PS	23
Auad, A. M.	184	FUNCTIONAL RESPONSE OF CHRYSOPERLA EXTERNA (HAGEN) (NEUROPTERA: CHRYSOPIDAE) FED NYMPHS OF UROLEUCON AMBROSIAE (THOMAS) (HEMIPTERA: APHIDIDAE) APHID FROM LETTUCE	I	47	21/08/00	16:30	CC		2	PS	2
Auad, A. M.	1484	BIOLOGICAL ASPECTS OF CHRYSOPERLA EXTERNA AND CERAEOCHRYSA CINCTA IMMATURE STAGES FED EGGS AND NYMPHS OF BIOTYPE "B" BEMISIA TABACI	I	374	22/08/00	16:30	CC		8	PS	8
Auad, A. M.	4150	EFFECT OF DIFFERENT TEMPERATURES ON THE BIOLOGY OF TAKECALLIS TAIWANUS (HOMOPTERA: APHIDIDAE) AND THERMAL REQUIREMENTS	II	1048	21/058/00	16:30	CC		Erratum	PS	18
Augusti, J. C.	1948	EFFICIENCY OF DIFFERENT INSECTICIDES IN CONTROL OF NURSERY FLY SCYTHROPOCHROA SP. (DIPTERA: SCIARIDAE) IN EUCALYPTUS SEEDLINGS	I	491	23/08/00	16:30	CC		10	PS	10
Augusti, J. C.	1980	EVALUATION OF TWO TRAP CARDS TO MONITORING OF SCYTHROPOCHROA SP. (DIPTERA: SCIARIDAE) IN EUCALYPTUS SEEDLINGS NURSERY	I	499	25/08/00	16:30	CC		10	PS	10
Augustinos	787	MICROSATELLITE MARKERS OF TWO AGRICULTURAL PESTS, THE MEDFLY, CERATITIS CAPITATA AND THE OLIVE FLY, BACTROCERA OLEAE	I	199	22/08/00	16:30	CC		5	PS	5
Augustinos, A.	3976	A CENTROMERE-SPECIFIC CLONE IN THE MEDFLY, CERATITIS CAPITATA	II	1003	24/08/00	16:30	CC		22	PS	22
Ausher, R.	1277	PROGRESSIVE INSECTICIDE RESISTANCE MANAGEMENT PROGRAMS IN THE ISRAELI AGRICULTURAL ECOSYSTEM	I	322	25/08/00	14:20	HM	N	7	10	7
Ausher, R.	105	IMPLEMENTATION AND ADOPTION OF IPM SYSTEMS	I	27	22/08/00	16:00	HB	A	2	4	2
Avalos, D. S.	185	BIOLOGICAL ASPECTS AND VITAL STATISTICS OF EDESSA MEDITABUNDA (HEMIPTERA, PENTATOMIDAE) UNDER CONTROLLED CONDITIONS	I	47	21/08/00	16:30	CC		2	PS	2
Avalos, G.	2962	TRIATOMINES INVOLVED IN DOMESTIC AND WILD TRYPANOSOMA CRUZI TRANSMISSION IN CONCEPCIÓN, CORRIENTES, ARGENTINA	II	747	21/08/00	16:30	CC		15	PS	15
Avanci, M. R. F.	1527	EGG PARASITOIDS OF ANTICARSIA GEMMATALIS (LEPIDOPTERA: NOCTUIDAE) ON SOYBEANS IN BRAZIL.	I	385	22/08/00	16:30	CC		8	PS	8
Avancini, R.	3039	REGULATION OF OVARIAN MORPHOGENESIS IN DROSOPHILA	II	767	21/08/00	14:00	HB	G	16	1	16
Avancini, R. M. P.	2300	SEX CHROMOSOME VARIATION AMONG MUSCOIDEA FLIES	I	580	24/08/00	16:30	CC		12	PS	12
Avancini, R. M. P.	3375	SECRETION OF SEXUAL ACCESSORY GLANDS OF FEMALE FLIES: SOME BIOCHEMICAL CHARACTERISTICS AND ANTIBACTERIAL ACTIVITY (DIPTERA, CALLIPHORIDAE, MUSCIDAE)	II	852	25/08/00	16:30	CC		18	PS	18
Avelar, C.	1111	FEEDING BEHAVIOR OF THE SPITTLEBUG DEOIS FLAVOPICTA (HOMOPTERA: CERCOPIDAE) ON WILD AND CULTIVATED HOST PLANT	I	280	24/08/00	16:30	CC		6	PS	6
Avila, A.	3236	DELPHACID PLANTHOPPERS AND THE "MAL DE RIO CUARTO" IN MAIZE IN THE NORTH OF ARGENTINA (INSECTA - FULGOROMORPHA)	II	817	23/08/00	16:30	CC		17	PS	17
Ávila, A. C. de	3233	THE TRANSMISSION SPECIFICITY AND EFFICIENCY OF BRAZILIAN TOSPOVIRUSES OCCURRING ON TOMATO BY FOUR THRIPS SPECIES	II	816	23/08/00	16:30	CC		17	PS	17
Ávila, C. J.	889	INFLUENCE OF AGE OF BEAN PLANTS ON THE FECUNDITY AND LEAF CONSUMPTION OF DIABROTICA SPECIOSA (COLEOPTERA: CHRYSOMELIDAE)	I	225	21/08/00	16:30	CC		6	PS	6
Ávila, C. J.	890	INFLUENCE OF THE HOST PLANT ON THE LEAF CONSUMPTION BY ADULTS OF DIABROTICA SPECIOSA (COLEOPTERA: CHRYSOMELIDAE)	I	225	21/08/00	16:30	CC		6	PS	6
Ávila, C. J.	1588	ARTIFICIAL DIET FOR DIABROTICA SPECIOSA (COLEOPTERA; CHRYSOMELIDAE) REARING	I	400	24/08/00	16:30	CC		8	PS	8
Avilés, R.	1256	USE AND PERSPECTIVES OF BOTANICAL PESTICIDES IN CUBA	I	317	24/08/00	11:05	HM	N	7	7	7
Avilla, J.	2544	STATUS OF CODLING MOTH MANAGEMENT AND CURRENT CONTROL PROGRAMS: NORTHERN HEMISPHERE	II	643	21/08/00	13:35	HB	B	14	2	14
Avilla, J.	1394	MECHANISMS OF AZINPHOS-METHYL RESISTANCE IN A STRAIN OF CYDIA POMONELLA FROM SOUTHERN EUROPE	I	352	21/08/00	16:30	CC		7	PS	7
Awadallah, K. T.	1699	RATES OF PARASITISM BY METEORUS RUBENS AND M. GYRATOR ON THEIR INSECT HOSTS	I	428	25/08/00	16:30	CC		8	PS	8
Awmack, C. S.	1485	FIELD SCALE RESPONSES OF APHIDS AND THEIR NATURAL ENEMIES TO ELEVATED CO2 AND O3	I	375	21/08/00	16:30	CC		8	PS	8
Axel, R.	577	THE MOLECULAR BIOLOGY OF DROSOPHILA ODORANT RECEPTORS	I	146	21/08/00	10:45	Bol	S	4	1	4
Ayasse, M.	627	IDENTIFICATION OF FEMALE AND MALE SEX PHEROMONES IN THE SOLITARY BEE OSMIA RUFA (HYMENOPTERA: MEGACHILIDAE)	I	159	21/08/00	16:30	CC		4	PS	4

Sub-titles: (HB=Hotel Bourbon) - (HM=Hotel Mabu) - (CC=Convention Center) - (Bol=Foz Boulevard) - (PS=Poster Session) - (PL=Plenary Lecturer)

AUTHOR	Nº	TITLE	Book	Page	Date	Time	Local	Room	Session	Symp	New Session
Ayer, S.	3301	ECDYSTEROID-TRIGGERED REGULATORY HIERARCHIES IN INSECT REPRODUCTION	II	834	25/08/00	14:05	HB	K	18	7	18
Ayres, C. F. J.	2227	RAPD MARKERS FOR GENETIC POPULATIONS STUDIES IN AEDES	I	562	21/08/00	16:30	CC		12	PS	12
Ayres, M. P.	1930	INTERACTIONS BETWEEN BEETLE ATTACK RATE AND PINE TREE DEFENSES PRODUCE POSITIVE DENSITY DEPENDENCE IN DENDROCTONUS FRONTALIS	I	486	22/08/00	16:30	CC		10	PS	10
Ayres, P. G.	850	INTERACTIONS BETWEEN ABOVE- AND BELOW-GROUND FUNGAL ENDOPHYTES: EFFECTS ON A LEPIDOPTERAN HERBIVORE	I	215	24/08/00	11:05	HB	D	6	6	6
Azad, A. F.	2960	MOLECULAR MECHANISMS AND COMPETITION BETWEEN PATHOGENIC AND NONPATHOGENIC RICKETTSIAE IN ARTHROPODS	II	747	21/08/00	16:30	CC		15	PS	15
Azam, K. M.	2617	EFFICACY OF PLANT EXTRACTS AGAINST NYMPHS OF WHITEFLY, BEMISIA TABACI GENNADIUS	II	661	21/08/00	16:30	CC		14	PS	14
Azeredo, E. H. de	2618	EFFICACY OF THIAMETHOXAM AND ALDICARB IN THE CONTROL OF DIABROTICA SPECIOSA GERM, 1824 (COLEOPTERA – CHRYSOMELIDAE – GALERUCINAE) ON POTATO CROP (SOLANUM TUBEROSUM) IN PINHEIRAL CITY, RJ -BRAZIL	II	661	21/08/00	16:30	CC		14	PS	14
Azeredo, E. H. de	2619	FIELD EVALUATION OF EFFICACY OF THIAMETHOXAN 250WG AND ALDICARB 150G IN THE CONTROL OF CEROTOMA ARCUATA (COLEOPTERA: CHRYSOMELIDAE) IN BEAN (PHASEOLUS VULGARIS) IN PINHEIRAL CITY , RJ, BRAZIL	II	662	21/08/00	16:30	CC		14	PS	14
Azeredo-Espin, A. M. L.	2204	CONTRIBUTION OF MOLECULAR MARKERS IN BLOWFLIES	I	556	24/08/00	11:05	HB	L	12	7	12
Azeredo-Espin, A. M. L.	2242	CHARACTERIZATION OF MOLECULAR MARKERS ON CHRYSOMYA ALBICEPS BY PCR-RFLP OF MITOCHONDRIAL DNA	I	566	21/08/00	16:30	CC		12	PS	12
Azeredo-Espin, A. M. L.	2261	RECOVERY OF MITOCHONDRIAL DNA SEQUENCES FROM MUSEUM SPECIMENS: METHODS AND EVOLUTIONARY PERSPECTIVES	I	571	22/08/00	16:30	CC		12	PS	12
Azeredo-Espin, A. M. L.	2270	CHRYSOMYA (CALLIPHORIDAE) MITOCHONDRIAL DNA CONTROL REGION: CHARACTERIZATION OF C. MEGACEPHALA tRNA REPEAT	I	573	22/08/00	16:30	CC		12	PS	12
Azeredo-Espin, A. M. L.	2271	THE COMPLETE MITOCHONDRIAL GENOME OF THE PRIMARY SCREWWORM FLY COCHLIOMYIA HOMINIVORAX (DIPTERA: CALLIPHORIDAE)	I	573	22/08/00	16:30	CC		12	PS	12
Azevedo, G. G.	3456	THE CELL PROVISIONING AND OVIPOSITION PROCESS (POP) IN SOME SPECIES OF PARTAMONA (HYMENOPTERA, APIDAE, MELIPONINAE)	II	872	21/08/00	16:30	CC		19	PS	19
Azevedo, M. A. P.	1591	DIVERSITY AND COMMUNITY STRUCTURE OF PARASITOIDS ASSOCIATED WITH ENTOMOGENOUS GALLS IN BRAZIL	I	401	23/08/00	16:30	CC		8	PS	8
Azevedo, O. R. F.	1659	PARASITOIDS OF PHYLLOCNISTIS CITRELLA IN RIO DE JANEIRO STATE, BRASIL	I	418	25/08/00	16:30	CC		8	PS	8
Azevedo, O. R. F.	2620	USE OF THIAMETHOXIAM IN THE OF CONTROL PINNASPIS ASPIDISTRAE (HOMOPTERA:STERNORHYNCHA) AND ITS ON THE POPULATION OF NATIVE PARASITOIDES IN CITRUS SPP., IN ARARUAMA CITY, RJ, BRAZIL	II	662	21/08/00	16:30	CC		14	PS	14
Azevedo, O. R. F.	2621	OCCURRENCE OF THE ENTOMOPATHOGENIC FUNGUS ASCHERSONIA SP. INFESTING SELENASPIDUS ARTICULATUS (HOMOPTERA: DIASPIDIDAE), IN THE STATE OF RIO DE JANEIRO, BRAZIL	II	662	21/08/00	16:30	CC		14	PS	14
Azevedo, O. R. F.	1158	DAMAGE CAUSED BY SNOUT BEETLES OF THE GENERA PANTOMORUS AND NAUPACTUS IN THE "TAHITI" TRUE LIME IN ARARUAMA CITY, RJ - BRAZIL	I	292	25/08/00	16:30	CC		6	PS	6
Azevedo, O. R. F.	2646	USE OF THIAMETHOXAM IN THE CONTROL DE SELENASPIDUS ARTICULATUS (HOMOPTERA:DIASPIDIDAE) AND EFFECT ON THE POPULATION OF THEIR NATIVE PREDATORS IN CITRUS IN SÃO VICENTE DE PAULO (ARARUAMA, RJ), BRAZIL	II	668	21/08/00	16:30	CC		14	PS	14
Azevedo, O. R. F.	2799	EFFECT OF NITROGENOUS AND POTASSIC FERTILIZATION ON THE POPULATION OF ALEUROTHRIXUS FLOCCOSUS (HOMOPTERA; ALEYRODIDAE), IN SWEET ORANGE (CITRUS SINENSIS), CULTIVAR "FOLHA MURCHA"	II	707	24/08/00	16:30	CC		14	PS	14
Azevedo, O. R. F.	2824	EFFECT OF THIAMETHOXAM ON THE POPULATION OF COCCUS VIRIDIS (HOMOPTERA:COCCIDAE) IN CITURS PLANTS IN ARARUAMA CITY, RJ, BRAZIL	II	713	25/08/00	16:30	CC		14	PS	14
Azevedo, O. R. F.	2645	CONTROL OF PHYLLOCNISTIS CITRELLA (LEPIDOPTERA, GRACILLARIIDAE) BY THIAMETHOXAM IN CITRUS IN ARARUAMA CITY–RJ	II	668	21/08/00	16:30	CC		14	PS	14
Azevedo, O. R. F.	1137	IDENTIFICATION OF THE SPATIAL DISTRIBUTION PATTERNS OF INSECT SPECIES BELONGING TO THE HOMNOPETRA-STERNORHYNCA COMPELX IN CITRUS PLANTS (CITRUS SPP.) IN THE STATE OF RIO DE JANEIRO THROUGH THE USE OF VARIOUS STATISTICAL AND MATHEMATICAL MODELS	I	287	24/08/00	16:30	CC		6	PS	6
Azevedo, O. R. F.	1138	MONITORING AND POPULATION DYNAMICS OF THE ENTOMO-WILDLIFE ASSOCIATED TO THE CULTIVATION OF COCONUT PALM (COCOS NUCIFERA) BY MEANS OF TRAPS MODEL C-47 L – MUNICIPALITY OF ITAGUAÍ, STATE OF RIO DE JANEIRO, BRAZIL	I	287	24/08/00	16:30	CC		6	PS	6
Azevedo, O. R. F.	2800	EFFECT OF DIFFERENT LEVELS OF NITROGENOUS AND POTASSIC FERTILIZATION ON THE POPULATION OF COCCUS VIRIDIS (HOMOPTERA; COCCIDAE) IN SWEET ORANGE (CITRUS SINENSIS), CULTIVAR "FOLHA MURCHA"	II	707	24/08/00	16:30	CC		14	PS	14
Azevedo, O. R. F.	1140	THE OCCURENCE AND BIOLOGICAL ASPECTS OF THE JUMPING PLANT LICE (HOMOPTERA:PSYLIDAE) ON GUAVA PLANTS (PSIDIUM GUAYAVA) AND 'SOMBREIRO' TREES (VICTORIA FAIRCHILDIANA) IN THE STATE OF RIO DE JANEIRO, BRAZIL	I	287	23/08/00	16:30	CC		6	PS	6
Azevedo, R. de	2702	STRATEGY OF SEED TREATMENT FOR RATIONALIZATION OF CHEMICAL CONTROL OF ORYZOPHAGUS ORYZAE ON FLOODED RICE	II	682	22/08/00	16:30	CC		14	PS	14
Azevedo, R. de	2703	INFLUENCE OF LIBERTY LINK IRRIGATED RICE TECHNOLOGY ON ORYZOPHAGUS ORYZAE (COLEOPTERA: CURCULIONIDAE)	II	683	22/08/00	16:30	CC		14	PS	14
Azhar, I.	3939	THE COCOA BLACK ANT (CBA) AS AN INDICATOR OF THE COCOA AND COCONUT AGROECOSYSTEM HEALTH MEASURED INDIRECTLY THROUGH THE LEVEL OF COCOA POD BORER (CPB) INFESTATION	II	994	21/08/00	16:30	CC		22	PS	22
Azizyan, A. A.	2228	ABOUT GENETICAL VARIABILITY OF CODLING MOTH POPULATIONS INHABITING IN DIFFERENT CONDITION	I	562	21/08/00	16:30	CC		12	PS	12
Aznar, C.	2961	TRIATOMINES SPECIES (HEMIPTERA, REDUVIIDAE, TRIATOMINAE) AND TRYPANOSOMA CRUZI IN FRENCH GUYANA	II	747	21/08/00	16:30	CC		15	PS	15
Azzieli, A.	4049	APPLICATION OF GASTIGHT STORAGE IN THE TROPICS	II	1022	24/08/00	11:15	HB	J	23	8	23
Ba, M.	2662	DEVELOPPING IPM COMPONENTS FOR THE CONTROL OF SORGHUM MAIN PESTS IN BURKINA FASO	II	672	21/08/00	16:30	CC		14	PS	14
Babjan, B.	3824	BIOCONTROL AGENTS ASSOCIATED WITH PROUTISTA MOESTA, A VECTOR OF PHYTOPLASMA DISEASES OF PALMS, WITH PARTICULAR REFERENCE TO HALICTOPHAGUS PALMI	II	965	25/08/00	16:30	CC		21	PS	21
Bacci jr., M.	728	POLYSACCHARIDASES IN NESTS OF THE LEAF-CUTTING ANT ATTA SEXDENS	I	184	25/08/00	16:30	CC		4	PS	4
Bacci Jr, M.	2278	USING PRIMERS DESIGNED FOR AMPLIFICATION OF FLIES'S MITOCHONDRIAL DNA TO AMPLIFY MITOCHONDRIAL DNA FROM TERMITES, WITH PHYLOGENETIC PURPOSE	I	575	23/08/00	16:30	CC		12	PS	12
Bacci Jr., M.	2122	PIPERONYL DERIVATES BASED ON SESAMIN AND THEIR INHIBITION OF THE SYMBIOTIC FUNGUS OF LEAF-CUTTING ANTS	I	535	24/08/00	16:30	CC		11	PS	11
Bacci, L.	1398	PATTERNS OF ANSWER OF THE ENTOMOFAUNA OF THE CANOPY OF THE BEAN PLANT TO THE IMIDACLOPRID APPLICATION	I	353	25/08/00	16:30	CC		7	PS	7
Bacci, M.	2149	ENZYME PRODUCTION BY THE FUNGUS SYMBIOTIC WITH THE ANT MYCETAROTES PARALLELUS	I	542	25/08/00	16:30	CC		11	PS	11
Bacci, M.	3433	GROWTH INHIBITION OF THE SYMBIOTIC FUNGUS OF ATTA SEXDENS, BY NATURAL PRODUCTS AND SYNTHETIC COMPOUNDS	II	867	23/08/00	11:35	HM	Q	19	4	19
Bach de Roca, C.	3832	MULTIVARIATE STATISTICAL ANALYSIS AIDS TO THE CHARACTERIZATION OF THE GENUS RETICULITERMES IN SPAIN (ISOPTERA: RHINOTERMITIDAE)	II	967	24/08/00	16:30	CC		21	PS	21
Bach, C.	3394	TERMITE DAMAGE TO BUILDINGS IN THE PROVINCE OF CORDOBA	II	857	21/08/00	11:50	HM	Q	19	1	19

Sub-titles: (HB=Hotel Bourbon) - (HM=Hotel Mabu) - (CC=Convention Center) - (Bol=Foz Boulevard) - (PS=Poster Session) - (PL=Plenary Lecturer)

AUTHOR	Nº	TITLE	Book	Page	Date	Time	Local	Room	Session	Symp	New Session
Backeljau, T.	908	GENETIC AND SOIL NUTRIENT EFFECTS ON RESISTANCE OF COMMON REED TO A GALL-FORMER	I	229	21/08/00	16:30	CC		6	PS	6
Backus, E. A.	3332	INGESTION AND DIGESTION OF GREEN FLUORESCENT PROTEIN BY THE WESTERN TARNISHED PLANT BUG, LYGUS HESPERUS	II	841	22/08/00	16:30	CC		18	PS	18
Badii, M. H.	18	LIFE HISTORY PARAMETERS AND FUNCTIONAL RESPONSE PHYTOSEIULUS PERSIMILIS ON TETRANYCHUS URTICAE	I	5	21/08/00	16:30	CC		1	PS	1
Badii, M. H.	19	FUNCTIONAL RESPONSE OF PHYTOSEIULUS PERSIMILIS ON TETRANYCHUS URTICAE ON THREE DIFFERENT ROSE VARIETIES	I	5	21/08/00	16:30	CC		1	PS	1
Badii, M. H.	20	FUNCTIONAL RESPONSE OF THE PREDACEOUS, EUSEIUS HIBISCI ON IMMATURE STAGES OF TWO-SPOTTED SPIDER MITE, TETRANYCHUS URTICAE	I	5	21/08/00	16:30	CC		1	PS	1
Badii, M.H.	1526	SUBLETHAL EFFECTS OF BACILLUS THURINGIENSIS VAR. ISRAELENSIS (VECTOBAC G & AS) ON LIFE PARAMETERS OF AEDES AEGYPTI	I	385	22/08/00	16:30	CC		8	PS	8
Badmin, J. S.	2031	HURRICANE FORCE STORM DAMAGE IN UK TEMPERATE WOODLAND BENEFITS INVASIVE LEAFHOPPER	I	512	21/08/00	16:30	CC		11	PS	11
Bado, S. G.	186	MORPHOLOGICAL, BIOLOGICAL ASPECTS AND DAMAGE OF TENTHECORIS BICOLOR DISTINTUS (HETEROPTERA: MIRIDAE): AN AMARILLIDACEAE AND ORQUIDACEAE PEST	I	48	21/08/00	16:30	CC		2	PS	2
Bado, S. G.	2622	INSECT DEVELOPMENT DELAY PRODUCED BY WITHANOLIDES FROM SOLANACEAE	II	662	22/08/00	16:30	CC		14	PS	14
Baetselier, P. De	2362	EVIDENCE FOR PHENOLOXIDASE ACTIVITY IN EARTHWORMS	II	597	23/08/00	13:50	HB	I	13	5	13
Baggerman, G.	3258	NEUROPEPTIDES IN LOCUSTS: PROGRESS IN THE SEARCH FOR FUNCTIONS	II	823	21/08/00	15:00	HB	K	18	1	18
Baggerman, G.	3249	MALE-FEMALE DIFFERENCES IN NEUROPEPTIDE PROFILES IN LOCUSTS	II	821	21/08/00	9:35	HB	K	18	1	18
Bagneres, A. G.	599	ENDOCRINE REGULATION AND MECHANISM OF HYDROCARBON PHEROMONE PRODUCTION IN THE HOUSEFLY, MUSCA DOMESTICA	I	152	23/08/00	10:35	Bol	S	4	4	4
Bahia Filho, O.	1409	DELTAMETHRIN RESIDUES ON/IN CORN AND POPCORN GRAINS AND IN SOME OF THEIR PROCESSED PRODUCTS DETERMINED BY GAS CHROMATOGRAPHY	I	355	25/08/00	16:30	CC		7	PS	7
Bahia Filho, O.	2841	DELTAMETHRIN RESIDUES ON/IN WHEAT GRAIN AND IN SOME OF THEIR PROCESSED PRODUCTS DETERMINED BY GAS CHROMATOGRAPHY	II	717	25/08/00	16:30	CC		14	PS	14
Bailey, P. T.	130	TOWARDS INSECTICIDE-FREE VITICULTURE IN AUSTRALIA AND NEW ZEALAND	I	34	24/08/00	13:30	HB	A	2	8	2
Bailey, W. J.	1732	SINGING OUT OF TURN: SATELLITE BEHAVIOUR IN AUSTRALIAN PHANEROPTERINE BUSHCRICKETS	I	436	22/08/00	15:45	HB	F	9	3	9
Bailez, O.	187	BIOLOGY OF THE GUAJAVA WEEVIL, CONOTRACHELUS PSIDII (COLEOPTERA: CURCULIONIDAE), REARED UNDER LABORATORY CONDITIONS	I	48	21/08/00	16:30	CC		2	PS	2
Bajwa, W. I.	761	AN INTERACTIVE INFORMATION RETRIEVAL AND REFERRAL SYSTEM FOR WORLDWIDE ELECTRONIC IPM INFORMATION	I	192	23/08/00	10:05	Bol	T	5	4	5
Bajwa, W. I.	2032	SYNERGISM OF ENTOMOPATHOGENS AND CHEMICAL INSECTICIDES: THEORY AND APPLICATION	I	513	21/08/00	16:30	CC		11	PS	11
Bajwa, W. I.	2623	ONLINE DECISION SUPPORT SYSTEM FOR INTEGRATED CODLING MOTH MANAGEMENT	II	663	22/08/00	16:30	CC		14	PS	14
Bajwa, W. I.	2657	ONLINE APPLICATION SERVER FOR PHENOLOGY MODELS AND MAPS	II	671	21/08/00	16:30	CC		14	PS	14
Bakanova, E. I.	21	ASSESSMENT OF PUBLIC HYGIENE INSECTO ACARICIDES IN RUSSIA	I	6	21/08/00	16:30	CC		1	PS	1
Bakanova, N. Yu.	21	ASSESSMENT OF PUBLIC HYGIENE INSECTO ACARICIDES IN RUSSIA	I	6	21/08/00	16:30	CC		1	PS	1
Baker, B.	891	HERBIVORES ASSOCIATED WITH THE REPRODUCTIVE PARTS OF OURATEA HEXASPERMA IN CENTRAL BRAZIL	I	225	21/08/00	16:30	CC		6	PS	6
Baker, C.	3140	THE EXTERNAL MICROMORPHOLOGY OF THE EAR MITE OTODECTES CYNOTIS (ACARI : PSOROPTIDAE) AS REVEALED BY SCANNING ELECTRON MICROSCOPY	II	792	22/08/00	16:30	CC		16	PS	16
Baker, E. N.	580	PHEROMONE BINDING PROTEINS: STRUCTURAL, FUNCTIONAL AND GENETIC IMPERATIVES IN TORTRICID MOTHS	I	147	21/08/00	15:00	Bol	S	4	1	4
Baker, G. H.	2624	INTEGRATED CONTROL OF MEDITERRANEAN SNAILS IN SOUTHERN AUSTRALIA, INCLUDING THE USE OF PARASITIC SARCOPHAGID FLIES	II	663	21/08/00	16:30	CC		14	PS	14
Baker, G. T.	1190	BIONOMICS OF THE CITRUS YELLOW MITE, EOTETRANYCHUS CENDANAI (TETRANYCHIDAE)	I	300	25/08/00	16:30	CC		6	PS	6
Baker, G. T.	1679	BIONOMICS OF AMBLYSEIUS LONGISPINOSUS (PHYTOSEIDAE) AND ITS EFFICACY AS A BIOLOGICAL CONTROL AGENT OF EOTETRANYCHUS CENDANAI (TETRANYCHIDAE)	I	423	24/08/00	16:30	CC		8	PS	8
Baker, G.L.	936	INTERACTIONS BETWEEN CLIMATE, PASTURE GROWTH AND PARASITES IN DEVELOPMENT OF OUTBREAKS OF AN ACRIDID, PHAULACRIDIUM VITTATUM IN SOUTH-EAST AUSTRALIA	I	236	21/08/00	16:30	CC		6	PS	6
Baker, H. M.	580	PHEROMONE BINDING PROTEINS: STRUCTURAL, FUNCTIONAL AND GENETIC IMPERATIVES IN TORTRICID MOTHS	I	147	21/08/00	15:00	Bol	S	4	1	4
Baker, J. E.	4020	NEAR-INFRARED SPECTROSCOPY APPLIED TO DETECTING PARASITOIDS AND HIDDEN INSECT LARVAE, IDENTIFYING COLEOPTERA, AND CHRONOLOGICAL AGE-GRADING	II	1015	22/08/00	11:00	HB	J	23	3	23
Baker, M. D.	3684	PHYLOGENY OF THE BEETLE SUBORDER ADEPHAGA AND FAMILY CARABIDAE, AS INFERRED USING RIBOSOMAL DNA AND THE WINGLESS GENE	II	930	25/08/00	14:50	HB	E	21	8	21
Baker, P. S.	329	SPATIAL DISTRIBUTION OF THE COFFEE BERRY BORER HYPOTHENEMUS HAMPEI ON COFFEE TREES, ANS ITS IMPLICATIONS FOR SAMPLING	I	83	24/08/00	16:30	CC		2	PS	2
Baker, R. H.	3642	THE PHYLOGENETIC UTILITY OF DIFFERENT CLASSES OF MOLECULAR SEQUENCE DATA AND ITS IMPLICATION FOR WEIGHTED ANALYSES	II	920	22/08/00	15:40	HB	E	21	4	21
Baker, T. C.	617	WIDELY SPACED, HIGH-EMISSION-RATE PHEROMONE SOURCES FOR MATING DISRUPTION OF LEPIDOPTEROUS PESTS	I	156	24/08/00	15:30	Bol	S	4	6	4
Baker, T. C.	3874	MATING DISRUPTION OF CAROB MOTH IN DATES.	II	978	21/08/00	14:00	HB	H	22	1	22
Bakker, D. De	1813	GROUND BEETLE DIVERSITY AND ASSEMBLAGES FROM FORESTS IN FLANDERS: A BASELINE STUDY	I	457	22/08/00	16:30	CC		10	PS	3
Bakker, D. De	1813	GROUND BEETLE DIVERSITY AND ASSEMBLAGES FROM FORESTS IN FLANDERS: A BASELINE STUDY	I	457	22/08/00	16:30	CC		10	PS	3
Bakker, D. De	1912	BEETLES, SPIDERS AND FLIES AS BIO-INDICATORS IN FORESTS: A LARGE SCALE RESEARCH PROJECT IN FLANDERS (BELGIUM)	I	482	21/08/00	16:30	CC		10	PS	10
Bakker, D. De	567	BEETLE DIVERSITY AND FOREST CHARACTERISTICS IN FLANDERS (BELGIUM)	I	143	25/08/00	16:30	CC		3	PS	3
Bakker, D. De	1903	FOREST SOIL CLASSIFICATION BASED ON COLLEMBOLA FAUNA	I	480	22/08/00	16:30	CC		10	PS	10
Balakrishnan, R.	1726	MATE SAMPLING STRATEGIES AND MATE CHOICE IN THE ORTHOPTERA: IMPLICATIONS OF NEUROETHOLOGICAL STUDIES	I	435	22/08/00	14:15	HB	F	9	3	9
Balança, G.	892	RAINFALL AND RECENT OUTBREAKS OF THE AFRICAN MIGRATORY LOCUST IN THE LAKE CHAD BASIN	I	225	21/08/00	16:30	CC		6	PS	6
Balbi, G.	1939	APPLICATION OF A GEOGRAPHICAL INFORMATION SYSTEM TO THE STUDY OF SIREX NOCTILIO (HYMENOPTERA-SIRICIDAE) IN CALAMUCHITA VALLEY, CÓRDOBA, ARGENTINA	I	489	23/08/00	16:30	CC		10	PS	10
Balcázar-Lara, M.	459	RICHNESS HOTSPOTS AND RARITY HOTSPOTS OF MEXICAN SATURNIIDAE (INSECTA: LEPIDOPTERA)	I	116	26/08/00	15:20	HB	C	3	10	3
Balcázar-Lara, M.	3828	BUTTERFLIES OF FOUR LOCALITIES IN "TIERRA CALIENTE" MICHOACAN, MEXICO	II	966	24/08/00	16:30	CC		21	PS	21
Baldacchino, F.	1486	PREDATION OF DOCIOSTAURUS MAROCCANUS BY ZOOPHAGOUS DIPTERA AND COLEOPTERA (SOUTHERN ITALY)	I	375	21/08/00	16:30	CC		8	PS	8
Balderrama, N.	3457	ALARM PHEROMONE COMPONENTS AND OPIOID SYSTEM ACTIVATION IN HONEYBEES	II	873	21/08/00	16:30	CC		19	PS	19

Sub-titles: (HB=Hotel Bourbon) - (HM=Hotel Mabu) - (CC=Convention Center) - (Bol=Foz Boulevard) - (PS=Poster Session) - (PL=Plenary Lecturer)

AUTHOR	N°	TITLE	Book	Page	Date	Time	Local	Room	Session	Symp	New Session
Balderrama, N.	3531	BEHAVIOURAL RESPONSES OF THE HONEY BEE TO ALARM-SCENTS AT THE FOOD SOURCE	II	891	24/08/00	16:30	CC		19	PS	19
Baldin, E. L. L.	628	EFFECTS OF SQUASH GENOTYPES ON BIOLOGY AND FEEDING PREFERENCE OF LEPTOGLOSSUS GONAGRA	I	159	21/08/00	16:30	CC		4	PS	4
Baldin, E. L. L.	629	RESISTANCE OF FRUITS OF PASSION FRUIT GENOTYPES TO ANISOSCELES FOLIACEA MARGINELLA	I	159	21/08/00	16:30	CC		4	PS	4
Baldin, E. L. L.	630	ATTRACTIVITY OF PASSION FRUIT GENOTYPES TO Holhymenia histrio AND FEEDING PREFERENCE	I	159	21/08/00	16:30	CC		4	PS	4
Baldin, E. L. L.	2840	OVIPOSITION PREFERENCE OF SILVERLEAF WHITEFLY (HEMIPTERA: ALEYRODIDAE) FOR SQUASH GENOTYPES	II	717	22/08/00	16:30	CC		14	PS	14
Baldin, E. L. L.	631	RESISTANCE OF BEAN GENOTYPES TO THE BEAN WEEVIL ACANTHOSCELIDES OBTECTUS	I	160	22/08/00	16:30	CC		4	PS	4
Baldin, E. L. L.	632	FEEDING PREFERENCE OF DIABROTICA SPECIOSA FOR SQUASH GENOTYPES	I	160	22/08/00	16:30	CC		4	PS	4
Baldin, E. L. L.	633	EVALUATION OF FEEDING PREFERENCE OF EPICAUTA ATOMARIA FOR PASSION FRUIT GENOTYPES	I	160	22/08/00	16:30	CC		4	PS	4
Baldock, C.	580	PHEROMONE BINDING PROTEINS: STRUCTURAL, FUNCTIONAL AND GENETIC IMPERATIVES IN TORTRICID MOTHS	I	147	21/08/00	15:00	Bol	S	4	1	4
Baldwin, J. A.	2635	DEVELOPMENT OF A METHOD OF RISK ASSESSMENT TO FACILITATE INTEGRATED MANAGEMENT OF SPOTTED WILT DISEASE OF PEANUT IN GEORGIA	II	666	22/08/00	16:30	CC		14	PS	14
Baldwin, J. A.	2566	SUCCESSES WITH PEANUT IPM IN THE SOUTHEASTERN UNITED STATES THROUGH INTERDISCIPLINARY APPROACHES	II	648	22/08/00	14:50	HB	B	14	4	14
Ball, B. V.	3441	HONEY BEE DISEASES AND VARROA INFESTATIONS IN BRAZIL	II	869	24/08/00	11:05	HM	Q	19	5	19
Ballard, J.	2020	THE ROLE OF FORMULATION ADDITIVES IN INCREASING THE POTENCY OF CYDIA POMONELLA GRANULOVIRUS FOR CODLING MOTH LARVAE	I	510	24/08/00	11:05	HM	P	11	7	11
Ballerio, A.	3315	A SURVEY OF THE SEXUALLY DIMORPHIC CHARACTERS IN THE CERATOCANTHINAE (COLEOPTERA: SCARABAEOIDEA: CERATOCANTHIDAE)	II	837	21/08/00	16:30	CC		18	PS	21
Balles, S.	3092	TESTIS DIFFERENTIATION - ROLE OF APICAL COMPLEX	II	780	26/08/00	10:00	HB	G	16	9	16
Balseiro, E. G.	877	DECAY OF LEAF LITTER BY AQUATIC INSECTS IN ANDEAN LOW ORDER STREAMS	I	222	21/08/00	16:30	CC		6	PS	6
Banaszak, J.	96	THE STATUS OF POLLINATORS IN EUROPE	I	25	22/08/00	11:15	HB	A	2	3	2
Banchio, E.	657	ANTIFEEDANT EFFECTS OF ARGENTINE MELIA AZEDARACH FRUIT EXTRACT AND ITS ACTIVE COMPOUND MELIARTENIN	I	166	22/08/00	16:30	CC		4	PS	4
Bandeira, A. G.	3477	DAMAGES CAUSED BY THE NASUTITERMES SPP. (ISOPTERA : TERMITIDAE) IN ERIOTHECA CRENULATICALYX (BOMBACACEAE) AT THE UNIVERSIDADE FEDERAL DA PARAÍBA, JOÃO PESSOA (PB), BRAZIL	II	878	22/08/00	16:30	CC		19	PS	19
Bandeira, C. T.	2633	STRATATEGIC MANAGEMENT FOR THE CONTROL OF SOURSOP PESTS IN NORTHEAST BRAZIL	II	665	22/08/00	16:30	CC		14	PS	14
Bandla, M. D.	3243	HOW AND WHY DO THRIPS TRANSMIT TOSPOVIRUSES, A CELLULAR APPROACH TO UNDERSTANDING	II	819	25/08/00	16:30	CC		17	PS	17
Banks, G. K.	3720	MOLECULAR PHYLOGENY OF BEMISIA TABACI (HOMOPTERA; ALEYRODIDAE) USING A MITOCHONDRIAL MARKER, THE 16S RIBOSOMAL SUBUNIT GENE	II	939	21/08/00	16:30	CC		21	PS	21
Banks, J. E.	2625	SELECTIVE PESTICIDES AND WEEDY MARGINS: SYNERGISTIC EFFECTS OF INTEGRATED PEST MANAGEMENT	II	663	21/08/00	16:30	CC		14	PS	14
Banks, J. E.	1234	DIFFERENTIAL SUSCEPTIBILITY AMONG LIFE STAGES TO TOXICANTS: IMPLICATIONS FOR EFFECTS ON NON-TARGET INVERTEBRATES	I	312	22/08/00	10:05	HM	N	7	3	7
Báo, S. N.	3100	CYTOCHEMICAL LOCALIZATION OF ENZYMES DURING SPERMIOGENESIS IN INSECT	II	782	26/08/00	14:45	HB	G	16	9	16
Báo, S. N.	2508	MORPHOLOGICAL CHARACTERIZATION OF LARVAL HAEMOCYTES FROM ANTICARSIA GEMMATALIS	II	633	24/08/00	16:30	CC		13	PS	13
Báo, S.N.	3131	DETECTION OF CALCIUM AND CALMODULIN DURING SPERMIOGENESIS IN PHYTOPHAGOUS BUGS (HEMIPTERA: PENTATOMIDAE)	II	790	22/08/00	16:30	CC		16	PS	16
Baptista, A. R.	3721	PRELIMINARY CLADISTIC ANALYSIS OF THE FAMILY AULACIGASTRIDAE SENSU LATO (DIPTERA, CYCLORRHAPHA)	II	939	21/08/00	16:30	CC		21	PS	21
Baptista, G. C. de	1409	DELTAMETHRIN RESIDUES ON/IN CORN AND POPCORN GRAINS AND IN SOME OF THEIR PROCESSED PRODUCTS DETERMINED BY GAS CHROMATOGRAPHY	I	355	25/08/00	16:30	CC		7	PS	7
Baptista, G. C. de	2841	DELTAMETHRIN RESIDUES ON/IN WHEAT GRAIN AND IN SOME OF THEIR PROCESSED PRODUCTS DETERMINED BY GAS CHROMATOGRAPHY	II	717	25/08/00	16:30	CC		14	PS	14
Bar, M. E.	2962	TRIATOMINES INVOLVED IN DOMESTIC AND WILD TRYPANOSOMA CRUZI TRANSMISSION IN CONCEPCIÓN, CORRIENTES, ARGENTINA	II	747	21/08/00	16:30	CC		15	PS	15
Barata, J. M. S.	4069	BEHAVIOUR'S ESTIMATION OF PANSTRONGYLUES MEGISTUS (HEMIPTERA-REDUVIIDAE) UNDER THE ACTION OF LIME (CAOH)	II	1027	21/08/00	16:30	CC		23	PS	23
Barbadilla, A.	2197	NATURAL SELECTION EFFECTS ON INVERSION SIZE IN DIPTERA	I	555	23/08/00	14:05	HB	L	12	6	12
Barbadilla, A.	2213	TRANSPOSONS ARE IMPLICATED IN THE GENERATION OF NATURAL CHROMOSOMAL REARRANGEMENTS IN INSECTS	I	559	24/08/00	16:15	HB	L	12	8	12
Barbagallo, S.	1487	STATUS OF BIOLOGICAL CONTROL OF THE CITRUS LEAFMINER (PHYLLOCNISTIS CITRELLA) IN ITALY	I	375	21/08/00	16:30	CC		8	PS	8
Barbagallo, S.	3722	AN APPROACH TO EVOLUTIVE TAXONOMY OF THE APHID GENUS ANURAPHIS (RHYNCHOTA APHIDIDAE)	II	940	21/08/00	16:30	CC		21	PS	21
Barbercheck, M	157	SOUTHERN CORN ROOTWORMS	I	40	26/08/00	13:15	HB	A	2	11	2
Barberena, M. F.	893	DISTURBANCE EFFECTS ON INSECT COMMUNITIES ALONG A SUCCESSIONAL GRADIENT	I	226	21/08/00	16:30	CC		6	PS	6
Barbieri, A. A.	2637	EFFECTS OF SEED TREATMENT WITH INSECTICIDE ON THE GERMINATION, NUTRIENTS, NODULATION, YIELD AND PEST CONTROL IN BEAN (PHASEOLUS VULGARIS) CULTURE	II	666	21/08/00	16:30	CC		14	PS	14
Barbolini, E.	1299	RELATIONSHIP BETWEEN EXPRESSION, AMPLIFICATION AND METHYLATION OF FE4 GENE IN MYZUS PERSICAE (HOMOPTERA, APHIDIDAE)	I	328	21/08/00	16:30	CC		7	PS	7
Barbosa, L.R.	184	FUNCTIONAL RESPONSE OF CHRYSOPERLA EXTERNA (HAGEN) (NEUROPTERA: CHRYSOPIDAE) FED NYMPHS OF UROLEUCON AMBROSIAE (THOMAS) (HEMIPTERA: APHIDIDAE) APHID FROM LETTUCE	I	47	21/08/00	16:30	CC		2	PS	2
Barbosa, A.	938	LIFE HISTORIES OF EPHEMEROPTERA IN COMECHINGONES MOUNTAIN STREAMS	I	237	21/08/00	16:30	CC		6	PS	6
Barbosa, C. J.	3244	EXPERIMENTAL TRANSMISSION OF "STICKY DISEASE" OF PAPAYA BY BEMISIA ARGENTIFOLLI	II	819	25/08/00	16:30	CC		17	PS	17
Barbosa, C. J.	3232	OCCURRENCE OF SHARPSHOTER IN CITRUS ORCHARDS AFFECTED BY CVC IN NORTH COAST OF BAHIA AND SOUTH OF SERGIPE STATE, BRAZIL	II	816	23/08/00	16:30	CC		17	PS	17
Barbosa, E. S.	1121	BIOLOGY OF BEMISIA ARGENTIFOLII ON DRY BEAN (PHASEOLUS VULGARIS)	I	283	24/08/00	16:30	CC		6	PS	6
Barbosa, F. R.	1294	EFFECT OF CHEMICAL CONTROL OF BEMISIA ARGENTIFOLII (HEMIPTERA: ALEYRODIDAE) ON THE INCIDENCE OF BEAN GOLDEN MOSAIC VIRUS IN COMMON BEANS AND ITS YIELD	I	327	21/08/00	16:30	CC		7	PS	7
Barbosa, F. R.	2626	INTEGRATED MANAGEMENT OF THE APHID, APHIS GOSSYPII, IN INDIAN CHERRY TREE, IN IRRIGATED AREAS OF THE SÃO FRANCISCO VALLEY	II	663	22/08/00	16:30	CC		14	PS	14
Barbosa, G. L.	199	EFFICIENCY OF PYRETHROID INSECTICIDES IN THE CONTROL OF ALABAMA ARGILLACEA IN COTTON CROP	I	51	21/08/00	16:30	CC		2	PS	2
Barbosa, G. V. de S.	1047	THE LYFE TABLE PARAMETERS FOR ZAGLOBA BEAUMONTI (COLEOPTERA: COCCINELLIDAE) AS A PREDATOR OF DIASPIS ECHINOCACTI (HEMIPTERA: DIASPIDIDAE)	I	264	23/08/00	16:30	CC		6	PS	6
Barbosa, I. R.	2845	SCREENING FORAGE GRASSES OF THE GENUS BRACHIARIA FOR RESISTANCE TO THE SPITTLEBUGS (HOMOPTERA: CERCOPIDAE)	II	718	25/08/00	16:30	CC		14	PS	14

Sub-titles: (HB=Hotel Bourbon) - (HM=Hotel Mabu) - (CC=Convention Center) - (Bol=Foz Boulevard) - (PS=Poster Session) - (PL=Plenary Lecturer)

AUTHOR	N°	TITLE	Book	Page	Date	Time	Local	Room	Session	Symp	New Session
Barbosa, J. C.	280	SPATIAL DISTRIBUTION OF ACROGONIA SP., DILOBOPTERUS COSTALIMAI AND ONCOMETOPIA FACIALIS IN BRAZILIAN CITRUS	I	71	23/08/00	16:30	CC		2	PS	2
Barbosa, J. C. L.	1388	EFFICACY OF GROWTH REGULATOR INSECTICIDES FOR THE CONTROL OF RACHIPLUSIA NU (LEPIDOPTERA - NOCTUIDAE) ON SOYBEAN	I	350	24/08/00	16:30	CC		7	PS	7
Barbosa, J. C. L.	1389	EVALUATION OF GROWTH REGULATOR INSECTICIDES ON THE CONTROL OF RACHIPLUSIA NU (LEPIDOPTERA - NOCTUIDAE) ON SOYBEAN	I	350	24/08/00	16:30	CC		7	PS	7
Barbosa, P.	894	COMPARISON OF THE MACROLEPIDOPTERAN ASSEMBLAGES OF SALIX NIGRA AND ACER NEGUNDO: A STORY OF CATERPILLARS, PLANTS, PARASITOIDS, AND PREDATORS	I	226	21/08/00	16:30	CC		6	PS	6
Barbosa, P.	1423	HERBIVORE AND NATURAL ENEMY ASSEMBLAGE STRUCTURE: INFLUENCE ON TRI-TROPHIC INTERACTIONS AND BIOLOGICAL CONTROL	I	359	21/08/00	11:05	HM	O	8	1	8
Barbosa, P.	1876	COMPARISON OF THE MACROLEPIDOPTERAN ASSEMBLAGES OF SALIX NIGRA AND ACER NEGUNDO: A STORY OF CATERPILLARS, PLANTS, PARASITOIDS, AND PREDATORS	I	473	25/08/00	14:35	HB	M	10	8	10
Barbosa, P.	2233	GENETIC MARKERS IN CONGENERIC HERBIVORES: FINE-SCALE POPULATION STRUCTURE	I	564	21/08/00	16:30	CC		12	PS	12
Barbosa, R. C.	1140	THE OCCURENCE AND BIOLOGICAL ASPECTS OF THE JUMPING PLANT LICE (HOMOPTERA:PSYLIDAE) ON GUAVA PLANTS (PSIDIUM GUAYAVA) AND 'SOMBREIRO' TREES (VICTORIA FAIRCHILDIANA) IN THE STATE OF RIO DE JANEIRO, BRAZIL	I	287	23/08/00	16:30	CC		6	PS	6
Barbosa, R. M. R	634	RESPONSE OF GRAVID FEMALE CULEX QUINQUEFASCIATUS (DIPTERA - CULICIDAE) TO NATURAL PHEROMONE IN THE CHOICE OF AN OVIPOSITION SITE	I	160	21/08/00	16:30	CC		4	PS	4
Barbosa, R. M. R.	623	UTILIZATION OF PCR FOR DETECTION OF WUCHERERIA BANCROFTI IN BARRA DE GUABIRABA - PE, NON-EDEMIC CONSIDERED AREA	I	158	21/08/00	16:30	CC		4	PS	4
Barbosa, S.	1295	OBSOLETE INSECTICIDES IN LATIN AMERICA: WHAT TO DO WITH THEM?	I	327	21/08/00	16:30	CC		7	PS	7
Bărbulescu, A.	895	RESEARCH REGARDING POPULATIONS DYNAMICS AND MARKING EUROPEAN CORN BORER (OSTRINIA NUBILALIS)	I	226	21/08/00	16:30	CC		6	PS	6
Bărbulescu, A.	2394	SUCCESSIVE GENERATIONS OF THE EUROPEAN CORN BORER OBTAINED BY MASS REARING ON ARTIFICIAL DIET	II	605	21/08/00	16:30	CC		13	PS	13
Bărbulescu, A.	2627	PROTECTION OF WINTER WHEAT AND BARLEY CROPS AGAINST DISEASES AND PESTS BY AN INTEGRATED CONTROL SYSTEM	II	664	22/08/00	16:30	CC		14	PS	14
Bărbulescu, A.	3940	RESULTS REGARDING MAIZE RESISTANCE TO THE EUROPEAN CORN BORER IN ROMANIA	II	994	23/08/00	16:30	CC		22	PS	22
Bărbulescu, A.	2787	SUNN PEST (EURYGASTER INTEGRICEPS) MANAGEMENT IN ROMANIA	II	704	23/08/00	16:30	CC		14	PS	14
Bărbulescu, A.	2788	STUDY OF FACTORS INVOLVED IN REDUCING POPULATION LEVEL OF HAPLODIPLOSIS MARGINATA	II	704	24/08/00	16:30	CC		14	PS	14
Barcellos, A.	3763	REVISION OF TAUROCERUS AMYOT & SERVILLE, 1843 (HETEROPTERA, PENTATOMIDAE, PENTATOMINI)	II	950	22/08/00	16:30	CC		21	PS	21
Barcenas-O.,M.	1316	RESPONSE OF PLUTELLA XYLOSTELLA (LEPIDOPTERA: PLUTELLIDAE) TO THE SELECTION WITH BACILLUS THURINGIENSIS	I	332	22/08/00	16:30	CC		7	PS	7
Barchuk, A. R.	3316	JUVENILE HORMONE PROMOTES VITELLOGENIN EXPRESSION IN POST-EMBRYONIC STAGES OF APIS MELLIFERA FEMALES	II	837	21/08/00	16:30	CC		18	PS	18
Barci, L. A. G.	3317	ACARICIDE ACTION OF ROPE TOBACCO (NICOTINA TABACUM) OVER LARVAE OF BOOPHILUS MICROPLUS UNDER LABORATORY CONDITIONS	II	838	21/08/00	16:30	CC		18	PS	18
Barclay, M.	3621	A PHYLOGENY OF THE WEEVIL MAJOR GROUPS: MORPHOLOGICAL AND MOLECULAR EVIDENCE.	II	914	21/08/00	14:50	HB	E	21	2	21
Baric, B.	2628	SPECIES OF HETEROPTERA IN CROATIAN APPLE ORCHARDS	II	664	21/08/00	16:30	CC		14	PS	14
Barkawi, L. S.	602	MOLECULAR STUDIES ON THE ENDOCRINE REGULATION AND TISSUE LOCALIZATION OF DE NOVO MONOTERPENOID PHEROMONE COMPONENT BIOSYNTHESIS IN PINE BARK BEETLES	I	152	23/08/00	11:25	Bol	S	4	4	4
Barker, A. M.	798	DO HOST-PLANT INTERACTIONS AND SUSCEPTIBILITY TO SOIL CULTIVATION DETERMINE THE ABUNDANCE OF GRAMINIVOROUS SAWFLIES ON BRITISH FARMLAND?	I	202	21/08/00	9:50	HB	D	6	1	6
Barker, S. C.	1298	NUCLEOTIDE SEQUENCE & EXPRESSION OF A SECOND PUTATIVE ACETYLCHOLINESTERASE GENE FROM ORGANOPHOSPHATE (OP)-SUSCEPTIBLE AND OP-RESISTANT CATTLE TICKS	I	328	21/08/00	16:30	CC		7	PS	7
Barlow, N.	84	MANAGEMENT OF RHINOCEROS BEETLES IN MALAYSIA	I	22	21/08/00	11:05	HB	A	2	1	2
Barlow, N. D.	2010	DISEASE/HOST MODELS FOR SOIL-DWELLING PESTS	I	507	23/08/00	10:35	HM	P	11	5	11
Barotto, O.	1939	APPLICATION OF A GEOGRAPHICAL INFORMATION SYSTEM TO THE STUDY OF SIREX NOCTILIO (HYMENOPTERA-SIRICIDAE) IN CALAMUCHITA VALLEY, CÓRDOBA, ARGENTINA	I	489	23/08/00	16:30	CC		10	PS	10
Barquín, J.	209	EVALUATION OF THE EFFICACY ON AN AGGREGATION PHEROMONE AS A MEANS OF CAPTURE AND PROTECTION AGAINST COSMOPOLITES SORDIDUS GERMAR (COLEOPTERA: CURCULIONIDAE) IN THE CANARY ISLANDS	I	53	22/08/00	16:30	CC		2	PS	2
Barradas, M. M.	3238	THE USE OF LEAF DISC LOCAL LESION TEST ON THE STUDY OF PLANT VIRUS TRANSMISSION	II	817	24/08/00	16:30	CC		17	PS	17
Barratt, B. I. P.	2481	SIGNIFICANCE OF TERATOCYTES AS A SOURCE OF NUTRIENTS FOR DEVELOPING LARVAE OF 3 SPECIES OF EUPHORINE PARASITOIDS OF THE ADULT HOSTS	II	627	24/08/00	16:30	CC		13	PS	13
Barreira, R. L.	3008	ANTHROPOPHILIC BEHAVIOUR OF CULICIDAE DURING SUNSET INSIDE FOREST OF IGUAÇU REGIONAL PARK, PARANA STATE, BRAZIL	II	759	24/08/00	16:30	CC		15	PS	15
Barreto, M. R.	3941	EFFECTS OF TROPICAL BACULOVIRUS ISOLATES AGAINST SPODOPTERA FRUGIPERDA (LEPIDOPTERA: NOCTUIDAE) LARVAE	II	995	21/08/00	16:30	CC		22	PS	22
Barreto, M. R.	3967	ANALYSIS OF SUPERNATANTS FROM CULTURES OF 'B.t.' STRAINS CONTAINING VIP3A-LIKE GENES AND THEIR RELATIVE EFICIENCY IN THE CONTROL OF TROPICAL FALL ARMYWORM LARVAE	II	1001	23/08/00	16:30	CC		22	PS	22
Barreto, M. R.	3968	TEMPORAL PATTERN OF PROTEIN SECRETION AND INSECTICIDAL ACTIVITY AGAINST TROPICAL FALL ARMYWORM IN THE SUPERNATANT OF THE 'B.t.' STRAIN 'HD125'	II	1001	23/08/00	16:30	CC		22	PS	22
Barrientos-Lozano, L.	2033	COMPARISON OF THE PATHOGENICITY OF THREE ISOLATES OF METARHIZIUM FOR WINGLESS GRASSHOPPER: EFFECT OF DOSE AND TEMPERATURE	I	513	21/08/00	16:30	CC		11	PS	11
Barrigossi, J. A. F.	635	CASSAVA HORNWORM, ERINNYIS ELLO, CONSUMPTION RATES AND PERFORMANCE ON FOUR CASSAVA VARIETIES	I	161	21/08/00	16:30	CC		4	PS	4
Barrigossi, J. A. F.	661	DETERMINING THE SUSCEPTIBILITY OF LESSER CORNTALK BORER IN RICE ELASMOPALPUS LIGNOSELLUS TO INSECTICIDES	I	167	22/08/00	16:30	CC		4	PS	4
Barrigossi, J. A. F.	673	ECONOMIC INJURY LEVEL AND SEQUENCIAL SAMPLING FOR BEMISIA TABACI IN TOMATO	I	170	23/08/00	16:30	CC		4	PS	4
Barrigossi, J. A. F.	2598	RICE INTEGRATED PEST MANAGEMENT STATUS IN BRAZIL	II	656	25/08/00	11:35	HB	B	14	8	14
Barrios, I.	3235	RESOURCE AVAILABILITY AND SPATIAL DISTRIBUTION OF DELPHACODES KUSCHELI (FULGOROMORPHA: DELPHACIDAE)	II	817	23/08/00	16:30	CC		17	PS	17
Barrios, I.	3236	DELPHACID PLANTHOPPERS AND THE 'MAL DE RIO CUARTO' IN MAIZE IN THE NORTH OF ARGENTINA (INSECTA - FULGOROMORPHA)	II	817	23/08/00	16:30	CC		17	PS	17
Barrios, S.	4100	REVERSION OF PERMETHRIN RESISTANCE BY INSECTICIDE SYNERGISTS IN THE HEADLICE PEDICULUS CAPITIS (PHTHIRAPTERA, PEDICULIDAE).	II	1035	21/08/00	16:30	CC		23	PS	23
Barro, P. J. De	104	IPM OF BEMISIA TABACI IN AUSTRALASIA	I	27	22/08/00	15:30	HB	A	2	4	2
Barro, P. J. De	2575	APPLICATIONS OF MOLECULAR ECOLOGY TO IPM – WHAT IMPACT?	II	651	23/08/00	14:00	HB	B	14	5	14
Barron, A. B.	3458	WHAT MAKES AN ANARCHIST? THE DEVELOPMENT AND BEHAVIOUR OF ANARCHISTIC BEES (APIS MELLIFERA)	II	873	21/08/00	16:30	CC		19	PS	19

Sub-titles: (HB=Hotel Bourbon) - (HM=Hotel Mabu) - (CC=Convention Center) - (Bol=Foz Boulevard) - (PS=Poster Session) - (PL=Plenary Lecturer)

AUTHOR	Nº	TITLE	Book	Page	Date	Time	Local	Room	Session	Symp	New Session
Barros, R.	4085	IDENTIFICATION OF COWPEA VIGNA UNGUICULATA GENOTYPES RESISTANT TO CALLOSOBRUCHUS MACULATUS	II	1031	23/08/00	16:30	CC		23	PS	23
Barros, A. T. M.	2983	THE EFFECTS OF MANAGEMENT STRATEGIES ON RESISTANCE IN THE HORN FLY, HAEMATOBIA IRRITANS	II	753	22/08/00	16:30	CC		15	PS	15
Barros, R.	188	CONTROL OF ORTHEZIA PRAELONGA IN WEST INDIAN CHERRY, MALPIGHIA GLABRA USING FORMULATIONS AND THREE APPLICATION METHODS OF THIAMETHOXAM	I	48	21/08/00	16:30	CC		2	PS	2
Barros, R.	268	EFFICIENCY OF METHODS FOR SAMPLING THRIPS ON ONION	I	68	23/08/00	16:30	CC		2	PS	2
Barros, R.	1330	EFFECT OF VEGETAL AQUEOUS EXTRACTS ON IMMATURE STAGES AND FEMALES OF THE CASSAVA GREEN MITE MONONYCHELUS TANAJOA	I	336	22/08/00	16:30	CC		7	PS	7
Barros-Battesti, D. M.	1902	RELATIONSHIP BETWEEN TICKS AND SMALL WILD MAMMALS IN A DISTURBED ATLANTIC FOREST FRAGMENT IN ITAPEVI COUNTY, STATE OF SÃO PAULO, BRAZIL	I	479	21/08/00	16:30	CC		10	PS	10
Barros-Battesti, D. M.	3248	SEROLOGY FOR BABESIA BOVIS IN HUMAN PATIENTS WITH LYME- LYKE DISEASE SYNDROME, SYPHILIS, SEPTICEMIA AND AUTOIMMUNE DISEASES	II	820	25/08/00	16:30	CC		17	PS	17
Barros-Battesti, D. M.	4066	SMALL WILD MAMMALS SIPHONAPTERA FROM ITAPEVI COUNTY, STATE OF SÃO PAULO, BRAZIL	II	1027	21/08/00	16:30	CC		23	PS	23
Barros-Bellanda, H. C. H.	896	EFFECT OF FOOD DEPRIVATION ON IMMATURE PHASE OF ASCIA MONUSTE	I	226	21/08/00	16:30	CC		6	PS	6
Barraclough, T. G.	1205	ASSESSING THE HISTORICAL AFFINITIES OF NEOTROPICAL BEETLE FAUNAS AT A JOINT UK BELIZEAN FIELD SITE	I	304	23/08/00	16:30	CC		6	PS	6
Barret, M. R.	2158	EFFECT OF TREATMENT TIMING OF BACULOVIRUS SPODOPTERA AND BACILLUS THURINGIENSIS ON SPODOPTERA FRUGIPERDA	I	544	25/08/00	16:30	CC		11	PS	11
Barsotti, R. C.	3459	CASTE POLYMORPHISM IN LABORATORY COLONIES OF COPTOTERMES HAVILANDI (ISOPTERA, RHINOTERMITIDAE)	II	873	21/08/00	16:30	CC		19	PS	19
Barsotti, R. C.	939	GROWTH PATTERNS OF INCIPIENT COLONIES OF COPTOTERMES HAVILANDI (ISOPTERA, RHINOTHERMITIDAE) INITIATED IN THE LABORATORY FROM SWARMING ALATES	I	237	21/08/00	16:30	CC		6	PS	6
Barteli, A. C.	2162	NUCLEOPOLYHEDROVIRUS SPECIFIC TO FALL ARMYWORM SPODOPTERA FRUGIPERDA	I	545	22/08/00	16:30	CC		11	PS	11
Bartelt, , R. J.	678	CHEMICAL DEFENSE IN THE PLANT BUG LOPIDEA ROBINIAE	I	171	23/08/00	16:30	CC		4	PS	4
Bartelt, R. J.	799	ASPECTS OF THE ECOLOGY OF THE WHEAT STEM SAWFLY (HYMENOPTERA: CEPHIDAE) IN NORTH AMERICA	I	202	21/08/00	10:05	HB	D	6	1	6
Bartelt, R. J.	624	IDENTIFICATION OF CHEMICAL DEFENSE SECRETION OF A DUNG BEETLE	I	158	21/08/00	16:30	CC		4	PS	4
Bartolozzi, L.	3842	CHECKLIST OF THE BRENTIDAE (INSECTA, COLEOPTERA, CURCULIONOIDEA) OF THE WORLD	II	970	25/08/00	16:30	CC		21	PS	21
Barzman, M. S.	2048	HOST-HANDLING BEHAVIORS OF BLACK SCALE PARASITOIDS: A CASE FOR ANT MEDIATED EVOLUTION	I	517	21/08/00	16:30	CC		11	PS	11
Bascuñán, R.	931	BIOLOGY AND REPRODUCTIVE BEHAVIOR OF CENTRIS RODOPHTHALMA (HYMENOPTERA: ANTHOPHORIDAE)	I	235	21/08/00	16:30	CC		6	PS	6
Bashford, R.	2639	INTEGRATED PEST MANAGEMENT OF A LEAF BEETLE IN EUCALYPT PLANTATIONS IN TASMANIA, AUSTRALIA	II	667	21/08/00	16:30	CC		14	PS	14
Basibuyuk, H. H.	1807	HOST LOCATION AND OVIPOSITION IN THE ORUSSIDAE (HYMENOPTERA), A BASAL PARASITIC WASP FAMILY	I	455	25/08/00	16:30	CC		9	PS	9
Baskaran, R.K.M.	1598	DEVELOPING A COMMERCIALLY VIABLE SYSTEM USING TRICHOGRAMMA CHILONIS FOR CONTROL OF COTTON BOLLWORM HELIOTHIS ARMIGERA IN INDIA	I	403	23/08/00	16:30	CC		8	PS	8
Basky, Z.	189	BIOTYPIC VARIATION OF THE RUSSIAN WHEAT APHID BETWEEN SOUTH AFRICA AND HUNGARY	I	48	21/08/00	16:30	CC		2	PS	2
Bassanezi, R. C.	897	DISCRETE TIME MODEL OF POSTFEEDING LARVAL DISPERSAL IN BLOWFLIES	I	227	21/08/00	16:30	CC		6	PS	6
Basset, Y.	3576	STUDYING HOST AND MICROHABITAT USE BY ARTHROPODS IN TROPICAL RAIN FOREST CANOPIES: ISSUES & PERSPECTIVES	II	902	24/08/00	9:35	Bol	U	20	2	20
Basset, Y.	570	INSECT HERBIVORES AS PREDICTORS OF PLANT PHYLOGENY: EXAMPLES FROM NEW GUINEA FICUS	I	144	25/08/00	16:30	CC		3	PS	3
Bastos, C. S.	636	INTENSITY OF LOSSES IN MAIZE CULTIVATED UNDER MINERAL AND ORGANIC FERTILIZATION SYSTEMS.	I	161	21/08/00	16:30	CC		4	PS	4
Bastos, C. S.	732	LIFE TABLES OF THE CULTURES APPLIED TO PESTS OF MAIZE UNDER INTERCROPPED CULTIVATION	I	185	25/08/00	16:30	CC		4	PS	4
Bateman, R. P.	2016	DEVELOPMENT OF MYCOPESTICIDES FORMULATIONS AND APPLICATION TECHNIQUES	I	509	23/08/00	15:50	HM	P	11	6	11
Bateman, R. P.	2029	VOLATILITY COMPARISONS OF DIFFERENT FORMULATIONS USED TO APPLY MYCOINSECTICIDES	I	512	21/08/00	16:30	CC		11	PS	11
Bateman, R. P.	2030	EVALUATION OF APPLICATION TECHNIQUES OF AN EMULSIFIABLE ADJUVANT OIL FUNGAL FORMULATION	I	512	21/08/00	16:30	CC		11	PS	11
Batista Filho, A.	1296	EFFECT OF THIAMETHOXAM (ACTARA® 250 WG) ON ENTOMOPATHOGENIC MICROORGANISMS	I	327	21/08/00	16:30	CC		7	PS	7
Batista Filho, A.	2028	SETTING UP AN ENTOMOPATHOGENIC MICROORGANISMS COLLECTION AT THE CENTRO EXPERIMENTAL DO INSTITUTO BIOLOGICO/LABORATORIO DE CONTROLE BIOLOGICO, BRAZIL	I	512	21/08/00	16:30	CC		11	PS	11
Batista Filho, A.	2629	EFFECT OF PHYSIOLOGICAL PRODUCTS ON ADULTS OF ANTICARSIA GEMMATALIS	II	664	22/08/00	16:30	CC		14	PS	14
Batista Filho, A.	3318	EFFECT OF THE TEMPERATURE AND LIGHT REGIME ON THE PRODUCTION AND STORAGE OF SPOROTHRIX INSECTORUM	II	838	23/08/00	16:30	CC		18	PS	18
Batista, D. R.	1356	AGRONOMIC EFFICIENCY OF NEW MOLECULES FOR CONTROL OF THE FIELD BEAN WHITE FLY	I	342	23/08/00	16:30	CC		7	PS	7
Batista, D. R.	1357	AGRONOMIC EFFICIENCY OF THE INSECTICIDE THIAMETHOXAN FOR CONTROL OF THE PINEAPPLE MEALYBUG AND THE TERMITE	I	342	23/08/00	16:30	CC		7	PS	7
Batista, J. A. N.	2119	CHARACTERIZATION OF THE PROTEOLYTIC ACTIVITY OF ANTHONOMUS GRANDIS AND ISOLATION OF CDNAS ENCODING SERINE AND CYSTEINE PROTEASES	I	534	24/08/00	16:30	CC		11	PS	11
Batista, M. F.	632	FEEDING PREFERENCE OF DIABROTICA SPECIOSA FOR SQUASH GENOTYPES	I	160	22/08/00	16:30	CC		4	PS	4
Batista, M. F.	2840	OVIPOSITION PREFERENCE OF SILVERLEAF WHITEFLY (HEMIPTERA: ALEYRODIDAE) FOR SQUASH GENOTYPES	II	717	22/08/00	16:30	CC		14	PS	14
Battaglia, D.	1451	HOST SELECTION STRATEGIES BY THE APHID PARASITOID APHIDIUS ERVI	I	366	23/08/00	13:35	HM	O	8	6	8
Battán Horenstein, M.	3171	MORPHOLOGY OF THE MALE REPRODUCTIVE SYSTEM IN BUTHIDAE AND BOTHRIURIDAE SPECIES (ARACHNIDA, SCORPIONES)	II	800	24/08/00	16:30	CC		16	PS	16
Battán, M.	361	ARMADILLIDIUM VULGARE (CRUSTACEA: ISOPODA). NEW PEST TO SOYBEANS IN ARGENTINA?	I	91	25/08/00	16:30	CC		2	PS	2
Battistelli, A.	886	IMPROVEMENT OF HONEY-BEE POLLINATION IN ACTINIDIA DELICIOSA	I	224	21/08/00	16:30	CC		6	PS	6
Bauce, É.	924	HOW THE NUTRITION OF SPRUCE BUDWORM PARENTS INFLUENCES THE OFFSPRING	I	233	21/08/00	16:30	CC		6	PS	6
Bauce, É.	1861	RESISTANCE OF YOUNG AND MATURE BALSAM FIR TREES TO SPRUCE BUDWORM AS AFFECTED BY STAND THINNING : SHORT AND LONG TERM EFFECTS	I	469	24/08/00	14:50	HB	M	10	6	10
Bauer, T.	3084	SETAE ON HEAD AND MOUTHPARTS: ADAPTATIONS TO PREY CAPTURE	II	778	25/08/00	11:30	HB	G	16	7	16
Baum, K.	4177	SPATIAL AND TEMPORAL PATTERNS OF MITOCHONDRIAL DNA IN FERAL HONEY BEES: IMPACT OF AFRICANIZATION	II	1055	21/08/00	16:30	CC		Erratum	PS	12
Bauman, A.	2343	MOLECULAR PROPERTIES OF BIOGENIC AMINE RECEPTORS CLONED FROM HONEYBEE (APIS MELLIFERA) BRAIN	II	592	21/08/00	14:05	HB	I	13	2	13

Sub-titles: (HB=Hotel Bourbon) - (HM=Hotel Mabu) - (CC=Convention Center) - (Bol=Foz Boulevard) - (PS=Poster Session) - (PL=Plenary Lecturer)

AUTHOR	Nº	TITLE	Book	Page	Date	Time	Local	Room	Session	Symp	New Session
Baumgärtner, J.	783	INSECT INFORMATICS: TO MEET THE CHALLENGE OF MODERN INFORMATION DISSEMINATION	I	198	25/08/00	10:35	Bol	T	5	6	5
Baumgärtner, J.	795	THE DEVELOPMENT OF WEB-BASED INTELLIGENT INSECT MANAGEMENT INFORMATION SYSTEM FOR BETTER DECISION-MAKING SUPPORT	I	201	24/08/00	16:30	CC		5	PS	5
Baumgärtner, J.	859	BOTTOM-UP AND TOP-DOWN REGULATION OF INSECT POPULATIONS	I	217	25/08/00	11:20	HB	D	6	7	6
Baumgärtner, J.	2705	PHYSIOLOGICALLY-BASED TRITROPHIC METAPOPULATION MODELS IN IPM	II	683	22/08/00	16:30	CC		14	PS	14
Baumgärtner, J.	2860	WEB-BASED AFRICA IPM FORUM FOR BETTER INFORMATION DISSEMINATION	II	722	25/08/00	16:30	CC		14	PS	14
Baur, M. E.	1297	MIGRATION AND SELECTION AFFECTING INSECTICIDE RESISTANCE IN PSEUDOPLUSIA INCLUDENS	I	327	21/08/00	16:30	CC		7	PS	7
Baweja, V.	2034	EXPERIMENTAL EVALUATION OF ADULT STAGE OF SPODOPTERA LITURA (LEPIDOPTERA : NOCTUIDAE) AS A POTENT HOST FOR ENTOMOPATHOGENIC NEMATODES, STEINERNEMA GLASERI	I	513	21/08/00	16:30	CC		11	PS	11
Baweja, V.	1654	COMPATIBILITY OF ENTOMOPATHOGENIC NEMATODES AND F-1 STERILITY FOR MANAGING SPODOPTERA LITURA (LEPIDOPTERA, NOCTUIDAE) : PARASITOID RESPONSES AND HOST SUITABILITY	I	417	24/08/00	16:30	CC		8	PS	8
Baxendale, F. P.	2442	CHARACTERIZATION OF PROTEIN CHANGES IN BUFFALOGRASSES CHALLENGED BY CHINCH BUG FEEDING	II	617	22/08/00	16:30	CC		13	PS	13
Baxter, G. D.	1298	NUCLEOTIDE SEQUENCE & EXPRESSION OF A SECOND PUTATIVE ACETYLCHOLINESTERASE GENE FROM ORGANOPHOSPHATE (OP)-SUSCEPTIBLE AND OP-RESISTANT CATTLE TICKS	I	328	21/08/00	16:30	CC		7	PS	7
Baytan, A. R.	2503	JUVENILE HORMONE ESTERASE BINDING PROTEINS IN MANDUCA SEXTA	II	632	24/08/00	16:30	CC		13	PS	13
Bazzan Dessuy, M.	2630	THE SOYBEAN'S VARITIES INFLUENCE THE ANTICARSIA GEMMATALIS FITNESS ?	II	664	21/08/00	16:30	CC		14	PS	14
Bazzi, C.	3492	THE USE OF HONEYBEES (APIS MELLIFERA) AS INDICATORS FOR THE PRESENCE OF THE PHYTOPATHOGEN BACTERIUM ERWINIA AMYLOVORA IN THE ENVIRONMENT	II	881	22/08/00	16:30	CC		19	PS	19
Beard, C. B.	2981	PARATRANSGENESIS OF REDUVIID VECTORS OF CHAGAS DISEASE	II	752	22/08/00	16:30	CC		15	PS	15
Beard, C. B.	2895	BACTERIAL SYMBIONTS AND THE CONTROL OF CHAGAS DISEASE	II	731	23/08/00	9:35	Bol	R	15	5	15
Beasini, J. L.	2754	A DOSE RECOMENDATION AND AN EVALUATION OF THE EFFICIENCY OF THE FARM CHEMICAL FASTANE 1P (ALPHACIPERMETHRIN) TO CONTROL ATTA LAEVIGATA, ATTA SEXDENS RUBROPILOSA AND ATTA BISPHAERICA (HYMENOPTERA: FORMICIDAE)	II	695	23/08/00	16:30	CC		14	PS	14
Beasley, J. P.	2635	DEVELOPMENT OF A METHOD OF RISK ASSESSMENT TO FACILITATE INTEGRATED MANAGEMENT OF SPOTTED WILT DISEASE OF PEANUT IN GEORGIA	II	666	22/08/00	16:30	CC		14	PS	14
Beati, L.	2963	TAXONOMIC AND PHYLOGENETIC STUDIES OF PERUVIAN LUTZOMYIA SPECIES BASED ON MOLECULAR DATA	II	748	21/08/00	16:30	CC		15	PS	15
Beattie, A. J.	483	BIOTRACK: CONCEPTUAL AND INFORMATION TECHNOLOGY SOLUTIONS FOR UNDERSTANDING MORE OF BIODIVERSITY	I	122	22/08/00	16:30	CC		3	PS	3
Beattie, A. J.	3470	ANTIMICROBIAL COMPOUNDS FROM ANTS AND OTHER INSECTS AND THEIR ROLE IN THE EVOLUTION OF SOCIALITY	II	876	23/08/00	16:30	CC		19	PS	19
Beattie, G. A. C.	2588	CITRUS IPM IN AUSTRALIA AND EAST AND SOUTHEAST ASIA	II	654	24/08/00	14:35	HB	B	14	7	14
Beaty, B.	2354	THE ROLE OF INNATE IMMUNE PEPTIDES TO REDUCE PARASITE DEVELOPMENT IN AEDES AEGYPTI	II	595	23/08/00	11:05	HB	I	13	4	13
Beaty, L.	2354	THE ROLE OF INNATE IMMUNE PEPTIDES TO REDUCE PARASITE DEVELOPMENT IN AEDES AEGYPTI	II	595	23/08/00	11:05	HB	I	13	4	13
Beaver, R. A.	1835	DIFFERENTIAL COLONIZATION POTENTIAL AMONG WOOD-BORING BEETLES LEADS TO HIGH PROPORTIONS OF INBREEDING SPECIES ON TROPICAL ISLANDS	I	463	22/08/00	15:05	HB	M	10	3	10
Beaver, R. A.	2260	EVOLUTION OF LARVIFORM MALES IN THE INBREEDING BARK BEETLE OZOPEMON: FIERCE FIGHTERS OR JUST WEIRD?	I	570	22/08/00	16:30	CC		12	PS	12
Bebas, P.	3275	INVOLVEMENT OF CIRCADIAN RHYTHMS IN THE REPRODUCTIVE PHYSIOLOGY OF INSECT MALES	II	827	23/08/00	15:50	HB	K	18	3	18
Bécard, J. M.	3475	ADDITIVE PRIMER AND RELEASER EFFECTS OF BROOD AND QUEEN PHEROMONE ON ADULTS WORKERS IN THE HONEY BEE	II	877	22/08/00	16:30	CC		19	PS	19
Bechara, G. H.	3018	ANTIBODY AND BLOOD LEUKOCYTE RESPONSE IN RHIPICEPHALUS SANGUINEUS TICK INFESTED DOGS AND GUINEA PIGS	II	761	25/08/00	16:30	CC		15	PS	15
Bechara, J. N.	2985	IXODID TICKS COLLECTED FROM ARMADILLO EUPHRACTUS SEXCINCTUS AND ANTEATER MYMERCOPHAGA TRIDACTYLA AT EMAS NATIONAL PARK, STATE OF GOIÁS, BRAZIL.	II	753	22/08/00	16:30	CC		15	PS	15
Beck, D. W.	1326	EFFECTS OF TRANSGENIC HYBRID MAIZE ON ADULT WESTERN CORN ROOTWORM EMERGENCE AND ROOT RATINGS	I	335	22/08/00	16:30	CC		7	PS	7
Beckage, N. A.	3044	HORMONES/NEUROHORMONES-INVOLVEMENT IN HOST/PARASITE RELATIONSHIPS IN THE TOBACCO HORNWORM, MANDUCA SEXTA	II	768	22/08/00	9:35	HB	G	16	2	16
Bedford, I. D.	3720	MOLECULAR PHYLOGENY OF BEMISIA TABACI (HOMOPTERA; ALEYRODIDAE) USING A MITOCHONDRIAL MARKER, THE 16S RIBOSOMAL SUBUNIT GENE	II	939	21/08/00	16:30	CC		21	PS	21
Beéche C., M. A.	1824	DETECTION AND CONTROL OF THE GUM TREE WEEVIL GONIPTERUS SCUTELLATUS IN CHILE (COLEOPTERA: CURCULIONIDAE)	I	460	22/08/00	10:05	HB	M	10	2	10
Beek, T. A. van	727	CHARACTERIZATION OF TRICHOGRAMMA FEMALE VOLATILES LIKELY INVOLVED IN COURTSHIP BEHAVIOUR AND THEIR POTENTIAL USE IN TAXONOMY	I	184	25/08/00	16:30	CC		4	PS	4
Beer, Z. W. de	1987	OPHIOSTOMATOID FUNGI ASSOCIATED WITH THREE BARK BEETLES IN SOUTH AFRICA	I	501	25/08/00	16:30	CC		10	PS	10
Beerling, E. A. M.	961	CAN PLANTS USE ENTOMOPATHOGENS AS BODYGUARDS?	I	243	22/08/00	16:30	CC		6	PS	6
Beerntsen, B. T.	2916	GENETICALLY-ENGINEERED MOSQUITOES RESISTANT TO THE TRANSMISSION OF MALARIA	II	736	24/08/00	14:35	Bol	R	15	8	15
Beers, E.	2539	AREAWIDE MANAGEMENT OF LEPIDOPTEROUS PESTS IN PERENNIAL CROPPING SYSTEMS: OPPORTUNITIES AND CONSTRAINTS	II	642	21/08/00	9:35	HB	B	14	1	14
Beers, E. H.	2543	SYSTEMWIDE BIOLOGICAL CHANGES: HARVESTING THE COLLATERAL BENEFITS OF AREAWIDE APPROACHES	II	643	21/08/00	11:30	HB	B	14	1	14
Beers, E. H.	120	SELECTIVE USE OF PARTICLE FILM TECHNOLOGY IN WASHINGTON POME FRUIT PEST MANAGEMENT	I	31	23/08/00	15:50	HB	A	2	6	2
Beers, E. H.	2542	RESISTANCE MANAGEMENT ON AN AREAWIDE BASIS IN ANNUAL VERSUS PERENNIAL CROPPING SYSTEMS	II	642	21/08/00	11:05	HB	B	14	1	14
Beerwinkle, K. R.	1148	INTERPLAY OF VEGETATIONAL FEATURES AND MICROCLIMATE ON BOLL WEEVIL CAPTURE IN PHEROMONE TRAPS	I	289	24/08/00	16:30	CC		6	PS	6
Begliomini, E.	3974	ACTIVITY OF THE INSECTICIDE/MITICIDE, PYRIDABEN, IN THE CONTROL OF SILVERLEAF WHITEFLY COMPLEX (BEMISIA TABACI - BIOTYPES "A" AND "B") IN SOME MAIN BRAZILIAN CROPS	II	1003	23/08/00	16:30	CC		22	PS	22
Bego, L. R.	3460	RELATIVE ABUNDANCE AND EXPLOITATION OF AVAILABLE RESOURCES BY APID BEES (HYMENOPTERA: APOIDEA) IN AN URBANIZED AREA	II	873	21/08/00	16:30	CC		19	PS	19
Begon, M.	1141	INVASION SEQUENCE DETERMINES PREDATOR-PREY DYNAMICS IN A MULTISPECIES ASSEMBLAGE	I	288	24/08/00	16:30	CC		6	PS	6
Behura, S.	3980	MAPPING, TAGGING, MARKER-ASSISTED SELECTION AND MAP-BASED GENE CLONING OF GALL MIDGE RESISTANCE GENES IN RICE	II	1004	24/08/00	16:30	CC		22	PS	22
Bekon, K. A.	3906	PHYSICAL CONTROL MEASURES FOR POST-HARVEST DISINFESTATION OF CEREAL GRAIN AND DRY BEANS PRACTICABLE IN DEVELOPING COUNTRIES: A REVIEW	II	986	24/08/00	11:35	HB	H	22	6	22
Bélanger, A.	3963	INSECTICIDAL EFFECTS OF THUJA OCCIDENTALIS (CUPRESSACEAE) ESSENTIAL OIL ON CALLOSOBRUCHUS MACULATUS [COLEOPTERA: BRUCHIDAE]	II	1000	22/08/00	16:30	CC		22	PS	22

Sub-titles: (HB=Hotel Bourbon) - (HM=Hotel Mabu) - (CC=Convention Center) - (Bol=Foz Boulevard) - (PS=Poster Session) - (PL=Plenary Lecturer)

AUTHOR	Nº	TITLE	Book	Page	Date	Time	Local	Room	Session	Symp	New Session
Belardinelli, M.	3102	COMPARATIVE SPERMATOLOGY IN PLECOPTERA	II	783	26/08/00	15:45	HB	G	16	9	16
Belasque Júnior, J.	3942	CONTROL OF SPODOPTERA FRUGIPERDA IN CORN FIELD BY DIFFERENT METHOMYL RATES, VOLUMES AND APPLICATIONS METHODS	II	995	21/08/00	16:30	CC		22	PS	22
Belasque Júnior, J.	239	EFFECT OF RATES, VOLUMES AND APPLICATIONS METHODS ON THE CONTROL OF SPODOPTERA FRUGIPERDA IN MAIZE BY METHOMYL	I	61	23/08/00	16:30	CC		2	PS	2
Belayneh, Y. T.	3943	THE ROLE OF ENVIRONMENTAL POLICY AND PROCEDURES IN MITIGATING IMPACTS OF ACRIDID CONTROL IN SAHELIAN AFRICA	II	995	21/08/00	16:30	CC		22	PS	22
Belchenko, V.M.	1443	UNIFICATION OF INDUSTRIAL LINES OPERATING TIME ENTOMOPHAGES	I	364	22/08/00	14:20	HM	O	8	4	8
Bell, J.	4071	THE EFFICACY OF FOUR INSECT GROWTH REGULATORS AGAINST MITE PESTS IN STORED GRAIN	II	1028	21/08/00	16:30	CC		23	PS	23
Bell, R. A.	1554	DEVELOPMENT OF AN ARTIFICIAL DIET FOR REARING EDOVUM PUTTLERI, AN EGG PARASITOID OF THE COLORADO POTATO BEETLE, LEPTINOTARSA DECEMLINEATA	I	392	22/08/00	16:30	CC		8	PS	8
Bellamy, D. E.	2037	DISPERSAL CAPABILITIES OF THE WHITEFLY PARASITOID, ERETMOCERUS EREMICUS	I	514	24/08/00	11:30	HB	F	11	3	6
Bellés, X.	3302	MOLECULAR ASPECTS OF JUVENILE HORMONE ACTION UPON VITELLOGENIN PRODUCTION IN INSECTS	II	834	25/08/00	14:35	HB	K	18	7	18
Bellettini, S	465	DIFFERENT SEED TREATMENTS TO CONTROL THRIPS FRANKLINIELLA SCHULTZEI (THYSANOPTERA: THRIPIDAE), APHIDS APHIS GOSSYPII(HOMOPTERA: APHIDIDAE), VEGETATIVE DEVELOPMENT AND YIELD OF COTTON CROP	I	118	21/08/00	16:30	CC		3	PS	3
Bellettini, N. M. T.	190	DIFFERENT INSECTICIDES AND DOSES FOR EUSCHISTUS HEROS CONTROL ON SOYBEAN CROP	I	49	21/08/00	16:30	CC		2	PS	2
Bellettini, N. M. T.	191	DIFFERENT INSECTICIDES AND DOSES TO CONTROL GREEN STINKBUG NEZARA VIRIDULA ON SOYBEAN CROP	I	49	21/08/00	16:30	CC		2	PS	2
Bellettini, S.	190	DIFFERENT INSECTICIDES AND DOSES FOR EUSCHISTUS HEROS CONTROL ON SOYBEAN CROP	I	49	21/08/00	16:30	CC		2	PS	2
Bellettini, S.	191	DIFFERENT INSECTICIDES AND DOSES TO CONTROL GREEN STINKBUG NEZARA VIRIDULA ON SOYBEAN CROP	I	49	21/08/00	16:30	CC		2	PS	2
Bellettini, S.	192	EFFECT OF DIFFERENT SEED TREATMENTS ON APHID APHIS GOSSYPII CONTROL VEGETATIVE DEVELOPMENT AND YIELD OF COTTON CROP	I	49	22/08/00	16:30	CC		2	PS	2
Bellettini, S.	193	EFFECT OF DIFFERENT SEED TREATMENTS ON THRIPS FRANKLINIELLA SCHULTZEI CONTROL VEGETATIVE DEVELOPMENT AND YIELD OF COTTON CROP	I	49	22/08/00	16:30	CC		2	PS	2
Bellizzi, N. C.	3461	BIOLOGICAL PERFORMANCE OF SILKWORM (BOMBYX MORI) FED WITH LEAVES FROM THREE MULBERRY HYBRIDS (MORUS SP.) FERTILIZED WITH ORGANIC MATTER OR ORGANIC MATTER PLUS GYPSUM	II	874	21/08/00	16:30	CC		19	PS	19
Bellizzi, N. C.	3462	DEVELOPMENT AND COCOON YIELD OF SILKWORM (BOMBYX MORI) FED WITH LEAVES FROM MULBERRY (MORUS ALBA) FERTILIZED WITH LIMESTONE AND GYPSUM ASSOCIATED WITH NPK AND MICRONUTRIENTS	II	874	21/08/00	16:30	CC		19	PS	19
Bellizzi, N. C.	3463	NUTRITIONAL INDICES OF SILKWORM (BOMBYX MORI) FED WITH LEAVES FROM THREE MULBERRY HYBRIDS (MORUS SP.) FERTILIZED WITH ORGANIC MATTER OR ORGANIC MATTER PLUS GYPSUM	II	874	21/08/00	16:30	CC		19	PS	19
Bellizzi, N. C.	3526	ATTRACTION OF ARNITICUS SP (COLEOPTERA: CURCULIONIDAE) IN THREE MULBERRY CULTIVARS (MORUS ALBA) IN PIRACICABA - SP	II	890	24/08/00	16:30	CC		19	PS	19
Bellizzi, N. C.	3527	PRESENCE OF THE ARNITICUS SP (COLEOPTERA: CURCULIONIDAE) IN MULBERRY (MORUS ALBA) IN PIRACICABA-SP	II	890	24/08/00	16:30	CC		19	PS	19
Bellone, B. B.	921	BIOECOLOGICAL STUDIES OF RUSSIAN WHEAT APHID IN ARGENTINA AND CHILE	I	233	21/08/00	16:30	CC		6	PS	6
Bellotti, A. C.	78	SCARAB LARVAE – A WORLDWIDE PEST PROBLEM	I	21	21/08/00	9:35	HB	A	2	1	2
Bellotti, A. C.	100	HOST PLANT RESISTANCE TO BEMISIA TABACI AND OTHER WHITEFLY SPECIES, AND ASSOCIATED VIRUSES	I	26	22/08/00	13:35	HB	A	2	4	2
Bellows, T. S.	2586	INTEGRATED PEST MANAGEMENT OF CITRUS IN THE WESTERN US	II	653	24/08/00	14:05	HB	B	14	7	14
Bellusci, S.	3464	RHYTHMICITY STUDIES OF THE CLEANING TASK PERFORMED BY WORKERS IN SCAPTOTRIGONA AFF DEPILIS (HYMENOPTERA, APIDAE, MELIPONINAE)	II	874	21/08/00	16:30	CC		19	PS	19
Belmain, S. R.	1254	CURENT DEVELOPMENTS WITH ETHNOBOTANICAL INSECTICIDES FROM GHANA: REVIVING AND MODERNISING AGE-OLD PRACTICE	I	317	24/08/00	10:20	HM	N	7	7	7
Beltrami, M.	4061	RETICULITERMES LUCIFUGUS IN URBAN HOUSEHOLDS IN URUGUAY	II	1025	21/08/00	16:30	CC		23	PS	23
Belver, L.	938	LIFE HISTORIES OF EPHEMEROPTERA IN COMECHINGONES MOUNTAIN STREAMS	I	237	21/08/00	16:30	CC		6	PS	6
Bembenek, J.	3312	MOLECULAR BIOLOGY OF INSECT CLOCKS FOR PHOTOPERIODISM	II	836	25/08/00	14:00	HB	K	18	8	18
Bembenek, J.	3557	PHOTOPERIODIC CLOCK-ENDOCRINE SWITCH AXIS IN DIAPAUSE REGULATION IN SILKMOTH	II	897	24/08/00	16:30	CC		19	PS	19
Bendena, W. G.	2395	MOLECULAR CHARACTERIZATION OF THE ALLATOSTATIN PEPTIDE FAMILY	II	605	21/08/00	16:30	CC		13	PS	13
Bendena, W. G.	2288	ISOLATION, CLONING, AND CHARACTERIZATION OF G PROTEIN-COUPLED RECEPTOR GENES, FROM THE AFRICAN MIGRATORY LOCUST, LOCUSTA MIGRATORIA	I	577	23/08/00	16:30	CC		12	PS	12
Benecke, M.	2950	FORENSIC ENTOMOLOGY CASEWORK BEYOND DETERMINATION OF POST MORTEM INTERVAL: FAKE BLOOD SPATTER, MAGGOT SPECTERS, AND RED BACTERIA	II	744	26/08/00	14:00	Bol	R	15	11	15
Benecke, M.	2996	OVERVIEW OF FORENSIC ENTOMOLOGICAL INVESTIGATIONS AND RESEARCH IN RUSSIA	II	756	23/08/00	16:30	CC		15	PS	15
Benediktov, A.A.	1734	VIBRATIONAL COMMUNICATION IN ORTHOPTERA	I	437	22/08/00	16:15	HB	F	9	3	9
Bengoa, C. S.	602	MOLECULAR STUDIES ON THE ENDOCRINE REGULATION AND TISSUE LOCALIZATION OF DE NOVO MONOTERPENOID PHEROMONE COMPONENT BIOSYNTHESIS IN PINE BARK BEETLES	I	152	23/08/00	11:25	Bol	S	4	4	4
Bengozi, F. J.	322	DIFFERENT PESTICIDE APPLICATION METHODS IN CONTROL OF WHITEFLY AND LEAFMINER ON TOMATO PLANTS UNDER VINYL HOUSE	I	82	24/08/00	16:30	CC		2	PS	2
Bengtsson, J.	1614	THE ROLE OF LANDSCAPE STRUCTURE AND FARMING PRACTICE ON PREDATION OF APHID	I	407	24/08/00	16:30	CC		8	PS	8
Bengtsson, M.	654	SEX PHEROMONE OF THE BRAZILIAN APPLE LEAFROLLER, BONAGOTACRANAODES (LEPIDOPTERA: TORTRICIDAE): EFFECT OF GEOMETRICISOMERS ON MALE ATTRACTION TO (E,Z)-3,5-DODECADIENYL ACETATE	I	165	22/08/00	16:30	CC		4	PS	4
Beninato, S.	1631	TEN YEARS OF STUDIES ON PARASITOIDS OF THE PEAR PSYLLA, CACOPSYLLA PYRI, IN SICILY (RHYNCHOTA PSYLLOIDEA)	I	411	24/08/00	16:30	CC		8	PS	8
Ben-Ishai, F.	4093	LOUSE COMB VERSUS HAND EXAMINATION FOR THE DIAGNOSIS OF HEAD LOUSE INFESTATIONS	II	1033	25/08/00	16:30	CC		23	PS	23
Benito, N. P.	308	MACROFAUNA OF THE SOIL IN DIFFERENT TILLAGE SYSTEMS, IN OXYSOL OF PARANÁ, BRAZIL	I	78	24/08/00	16:30	CC		2	PS	2
Bennett, A.	2741	THE BLACK COTTON BEETLE, SYAGRUS RUGIFRONS BALY (CHRYSOMELIDAE: COLEOPTERA): ITS IMPACT ON COTTON PRODUCTION IN SOUTH AFRICA AND PROBLEMS PERTAINING TO INTEGRATED PEST MANAGEMENT	II	692	23/08/00	16:30	CC		14	PS	14
Bennett, A.	3944	TRANSGENIC COTTON COTTON, AN ALTERNATIVE TO CONVENTIONAL (NON-TRANSGENIC) COTTON FOR SOUTH AFRICA	II	995	21/08/00	16:30	CC		22	PS	22
Bennett, G. W	4045	IPM: A COMMON SENSE APPROACH TO CONTROL GERMAN COKROACH	II	1021	24/08/00	10:50	HB	J	23	10	23
Bennett, G. W	4045	IPM: A COMMON SENSE APPROACH TO CONTROL GERMAN COKROACH	II	1021	24/08/00	10:50	HB	J	23	10	23
Bennettova, B.	4022	JUVENOGENS - INSECT HORMONOGENIC COMPOUNDS.	II	1016	22/08/00	13:45	HB	J	23	4	23

Sub-titles: (HB=Hotel Bourbon) - (HM=Hotel Mabu) - (CC=Convention Center) - (Bol=Foz Boulevard) - (PS=Poster Session) - (PL=Plenary Lecturer)

AUTHOR	Nº	TITLE	Book	Page	Date	Time	Local	Room	Session	Symp	New Session
Ben-Shahar, Y.	2188	CHANGES IN BRAIN EXPRESSION OF cGMP-DEPENDENT PROTEIN KINASE GENE AND DIVISION OF LABOR IN COLONIES OF THE HONEY BEE APIS MELLIFERA	I	552	22/08/00	15:55	HB	L	12	4	12
Benson, W. W.	1075	EFFECTS OF A PREDATORY ANT ON FLORAL VISITORS	I	271	23/08/00	16:30	CC		6	PS	6
Benson, W. W.	946	ALLOMETRIC RELATIONSHIPS BETWEEN BIOMASS, VOLUME AND POPULATION SIZE IN COLONIES OF SOLENOPSIS INVICTA(HYMENOPTERA: FORMICIDAE)	I	239	22/08/00	16:30	CC		6	PS	6
Bento, A. A.	1488	DATA ON THE NATURAL CONTROL OF THE OLIVE MOTH, PRAYS OLEAE , BY PARASITOIDS IN TRÁS-OS-MONTES REGION (NORTHEASTERN PORTUGAL)	I	375	21/08/00	16:30	CC		8	PS	8
Bento, A. A.	2839	EVALUATION OF TRAPS FOR MONITORING BACTROCERA OLEAE ADULTS, IN INTEGRATED PEST MANAGEMENT	II	717	25/08/00	16:30	CC		14	PS	14
Bento, J. M. S.	1720	SEXUAL BEHAVIOR OF LONGHORN BEETLE MIGDOLUS FRYANUS (COLEOPTERA: CERAMBYCIDAE)	I	433	22/08/00	9:35	HB	F	9	2	9
Bento, J. M. S.	4160	SEXUAL BEHAVIOR AND DAILY ACTIVITY OF CITRUS BORER MOTH ECDYTOLOPHA AURANTIANA (LEPIDOPTERA: TORTRICIDAE)	II	1051	21/08/00	16:30	CC		Erratum	PS	4
Bento, J. M. S.	4161	GLANDULAR TRICHOMES IN PLANTS CAN ATTRACT HERBIVORE INSECTS	II	1051	21/08/00	16:30	CC		Erratum	PS	4
Bento, J. S.	2396	CELLULAR IMMUNE RESPONSE OF THE MOSQUITO CULEX QUINQUEFASCIATUS (DIPTERA-CULICIDAE) TO CANDIDA ALBICANS INFECTION.	II	605	21/08/00	16:30	CC		13	PS	13
Benvenga, S. R.	249	EFFICIENCY OF THE INSECTICIDE ACTARA (THIAMETOXAN) ON CONTROL OF SHARPSHOOTER VECTORS OF XYLELLA FASTIDIOSA ON CITRUS	I	63	22/08/00	16:30	CC		2	PS	2
Benvenga, S. R.	250	EFFICIENCY OF THE INSECTICIDE TEMIK 150 (ALDICARB) ON CONTROL OF SHARPSHOOTER VECTORS OF XYLELLA FASTIDIOSA ON CITRUS	I	64	22/08/00	16:30	CC		2	PS	2
Benvenga, S. R.	251	EFFICIENCY OF THE INSECTICIDE WINNER (IMIDACLOPRID) ON CONTROL OF SOME CITRUS PESTS AND SELECTIVITY TO NATURAL ENEMIES	I	64	22/08/00	16:30	CC		2	PS	2
Benvenga, S. R.	672	ATTRACTIVITY OF PROTEIN HIDROLISATE AND SUGARCANE MOLASSES ON ADULT FRUIT FLIES ANASTREPHA SP. AND CERATITIS CAPITATA (DIPTERA:TEPHRITIDAE) ON CITRUS ORCHARD	I	170	23/08/00	16:30	CC		4	PS	4
Berbert, P. A.	4073	MODIFIED ATMOSPHERE IN BRAZILIAN GRAIN STORAGE.	II	1028	22/08/00	16:30	CC		23	PS	23
Bérenger, J. M.	2961	TRIATOMINES SPECIES (HEMIPTERA, REDUVIIDAE, TRIATOMINAE) AND TRYPANOSOMA CRUZI IN FRENCH GUYANA	II	747	21/08/00	16:30	CC		15	PS	15
Beretta, J.	1106	FIELD BIOLOGY OF THE GLASSY-WINGED SHARPSHOOTER IN SOUTHERN CALIFORNIA	I	279	24/08/00	16:30	CC		6	PS	6
Beretta, J.	1106	FIELD BIOLOGY OF THE GLASSY-WINGED SHARPSHOOTER IN SOUTHERN CALIFORNIA	I	279	24/08/00	16:30	CC		6	PS	6
Beretta, J.	2592	MANAGEMENT STRATEGIES FOR CITRUS VARIEGATED CHLOROSIS	II	655	24/08/00	15:35	HB	B	14	7	14
Beretta, Julia	3210	MANAGEMENT STRATEGIES FOR CITRUS VARIEGATED CHLOROSIS	II	810	21/08/00	16:30	CC		17	PS	17
Berg, J. B.	1304	INVOLVEMENT OF VOLTAGE-DEPENDENT SODIUM CHANNELS IN DELTAMETHRIN RESISTANCE IN A STRAIN OF CYDIA POMONELLA	I	329	21/08/00	16:30	CC		7	PS	7
Berg, J. van den	194	STEM BORER HABITAT MANAGEMENT IN EAST AND SOUTHERN AFRICA	I	50	21/08/00	16:30	CC		2	PS	2
Bergamin Filho, A.	3209	VECTOR AND EPIDEMIOLOGICAL ASPECTS OF CITRUS VARIEGATED CHLOROSIS	II	810	21/08/00	15:50	Bol	U	17	1	17
Berghammer, A. J.	4000	UNIVERSAL TRANSFORMATION SYSTEM FOR TRANSGENIC ARTHROPODS	II	1009	25/08/00	16:30	CC		22	PS	22
Bergmann, E. C.	255	FIRST RECORD OF OCCURRENCE OF APHIS SPIRAECOLA (HEMIPTERA: APHIDIDAE) ON IXORA COCCINEA AND I. COCCINEA VAR. COMPACTA (RUBIACEAE)	I	65	23/08/00	16:30	CC		2	PS	2
Bergstrom, A.	466	INTRASPECIFIC GEOGRAPHIC VARIATION IN HOST-PLANT UTILIZATION OF BUTTERFLIES	I	118	21/08/00	16:30	CC		3	PS	3
Bergström, J.	898	A FIVE YEAR STUDY OF MATING FREQUENCIES AND SIZE VARIATIONS IN WILD POPULATIONS OF THE GREEN-VEINED WHITE BUTTERFLY PIERIS NAPI	I	227	21/08/00	16:30	CC		6	PS	6
Bergvinson, D. J.	637	SELECTION OF TROPICAL STEM BORERS FOR RESISTANCE TO CRYIAB IN MAIZE	I	161	21/08/00	16:30	CC		4	PS	4
Bergvinson, D. J.	638	BIOCHEMICAL BASIS FOR STORAGE PEST RESISTANCE IN MAIZE.	I	161	21/08/00	16:30	CC		4	PS	4
Bergvinson, D. J.	639	DEVELOPMENT AND CHARACTERIZATION OF MAIZE POPULATIONS RESISTANT TO TROPICAL STEM BORERS AND ARMYWORM	I	162	21/08/00	16:30	CC		4	PS	4
Berisford, C. W.	1908	SUPPRESSION OF SOUTHERN PINE BEETLE INFESTATIONS USING VERBENONE, AN ANTI-AGGREGATION PHEROMONE	I	481	23/08/00	16:30	CC		10	PS	10
Berkov, A. C.	899	A SEASONAL CHANGE IN HOST USE OF THE BRAZIL NUT FAMILY CORRESPONDS WITH GENETIC DIVERGENCE IN WOOD-BORING PALAME (CERAMBYCIDAE)	I	227	21/08/00	16:30	CC		6	PS	6
Berlandier, F. A.	195	APHID COLONISATION OF LUPIN CROPS; YIELD LOSSES AND CONTROL STRATEGIES	I	50	21/08/00	16:30	CC		2	PS	2
Bernardo, A. Di	135	PHYTOSEIID-POLLEN RELATIONSHIPS IN ITALIAN VINEYARDS	I	35	24/08/00	15:35	HB	A	2	8	2
Bernardo, U.	1475	BIOLOGICAL DATA ON MEGAPHRAGMA AMALPHITANUM AND MEGAPHRAGMA MYMARIPENNE (HYMENOPTERA: TRICHOGRAMMATIDAE), EGG-PARASITOIDS OF HELIOTHRIPS HAEMORRHOIDALIS (THYSANOPTERA: THRIPIDAE) IN SOUTHERN ITALY	I	372	26/08/00	11:20	HM	O	8	8	8
Berndt, L.	1424	ADDING FLORAL RESOURCES TO AGRO-ECOSYSTEMS: MANAGING THE CONSEQUENCES FOR THIRD AND FOURTH TROPHIC LEVELS	I	359	21/08/00	11:20	HM	O	8	1	8
Bernt, J.	2397	EFFECT OF PHLOXIN "B" INGESTION IN IMMATURE STAGES OF THE MEDFLY, CERATITIS CAPITATA	II	606	21/08/00	16:30	CC		13	PS	13
Bernier, U. R.	2868	MASS SPECTROMETRIC ANALYSIS OF HUMAN SKIN EMANATIONS TO IDENTIFY COMPOUNDS THAT INFLUENCE THE HOST-SEEKING BEHAVIOR OF MOSQUITOES	II	724	21/08/00	9:50	Bol	R	15	1	15
Borón, C.	2045	A NEW FUNGAL ISOLATE FOR THE CONTROL OF DIABROTICA SPECIOSA	I	516	21/08/00	16:30	CC		11	PS	11
Berry, R. E.	2035	THE BENEFICIAL NEMATODE, HETERORHABDITIS MARELATUS : ITS PROMISE IN BIOCONTROL OF PESTS IN NURSERY AND FIELD CROPS	I	513	21/08/00	16:30	CC		11	PS	11
Berryman, A. A.	2410	DEFENCE MECHANISMS OF NORWAY SPRUCE AGAINST BARK BEETLE-FUNGUS ATTACKS	II	609	21/08/00	16:30	CC		13	PS	13
Berrymana, A. A.	860	TOP-DOWN REGULATION OF SPRUCE NEEDLEMINER AND OTHER FOREST LEPIDOPTERA	I	217	25/08/00	11:35	HB	D	6	7	6
Berthier, S.	2229	OPTICAL PROPERTIES OF MORPHO TYPE SCALES. MULTILAYER AND GRATING MODEL	I	563	21/08/00	16:30	CC		12	PS	12
Berthier, S.	3105	BUTTERFLIES STRUCTURES AND OPTICAL TECHNOLOGY	II	783	22/08/00	16:30	CC		16	PS	16
Berthier, S.	3106	SPECTRAL SELECTIVITY PROPERTIES OF ARCHAEOPREPONA DEMOPHON	II	784	22/08/00	16:30	CC		16	PS	16
Berti Filho, E.	1491	DEVELOPMENT OF IMMATURE STAGES OF PALMISTICHUS ELAEISIS (HYM.: EULOPHIDAE) ON LEPIDOPTERA PUPAE	I	376	21/08/00	16:30	CC		8	PS	8
Berti Filho, E.	1492	BIOLOGICAL CYCLE, REPRODUCTION AND LONGEVITY OF PALMISTICHUS ELAEISIS (HYM.: EULOPHIDAE) IN LABORATORY	I	376	21/08/00	16:30	CC		8	PS	8
Berti Filho, E.	1634	FIRST RECORD OF CHRYSOPERLA EXTERNA PREYING THE CITRUS LEAF MINER PHYLLOCNISTIS CITRELLA	I	412	25/08/00	16:30	CC		8	PS	8
Berti Filho, E.	2104	ANOTHER CASE OF INSECT AND TARSONEMID MITE (ACARI: TARSONEMIDAE) ASSOCIATION.	I	531	23/08/00	16:30	CC		11	PS	11
Berti Filho, E.	1814	ENTOMOFAUNA AS A BIOINDICATOR OF THE IMPACTS OF SILVICULTURAL OPERATIONS	I	457	21/08/00	11:20	HB	M	10	1	10
Berti-Filho, E.	183	USE OF GAMMA RADIATION TO CONTROL SITOPHILUS LINEARIS (COLEOPTERA: CURCULIONIDAE) ATTACKING TAMARINDUS INDICUS (LEGUMINOSAE: FABOIDEAE)	I	47	21/08/00	16:30	CC		2	PS	2
Berti-Filho, E.	202	CERCONOTA ANONELLA (LEP., OECOPHORIDAE) IN SOURSOP (ANNONA MURICATA) IN ALAGOAS STATE, BRAZIL: OCCURRENCE AND CONTROL	I	52	21/08/00	16:30	CC		2	PS	2
Berti-Filho, E.	1592	OCCURRENCE OF BACULOVIRUS AND HEXAMERMIS SP. (NEMATODA, MERMITHIDAE) IN LONOMIA OBLIQUA (LEPIDOPTERA, SATURNIIDAE)	I	401	23/08/00	16:30	CC		8	PS	8

Sub-titles: (HB=Hotel Bourbon) - (HM=Hotel Mabu) - (CC=Convention Center) - (Bol=Foz Boulevard) - (PS=Poster Session) - (PL=Plenary Lecturer)

AUTHOR	Nº	TITLE	Book	Page	Date	Time	Local	Room	Session	Symp	New Session
Berti-Filho, E.	1932	TERMITES (INSECTA: ISOPTERA) IN EUCALYPTUS SPP. PLANTATIONS OF THE FOREST EXPERIMENTAL STATION, UNIVERSITY OF SÃO PAULO, IN ANHEMBI, STATE OF SÃO PAULO, BRAZIL	I	487	22/08/00	16:30	CC		10	PS	10
Berti-Filho, E.	4072	SURVEY AND IDENTIFICATION OF TERMITES (INSECTA: ISOPTERA) IN AN URBAN AREA OF PIRACICABA, STATE OF SÃO PAULO, BRAZIL	II	1028	22/08/00	16:30	CC		23	PS	23
Berti-Filho, E.	1622	BIOLOGICAL DATA OF SOME NATURAL ENEMIES OF THE SOURSOP BORER CERCONOTA ANONELLA (LEPIDOPTERA: OECOPHORIDAE) IN PLANALTINA, FEDERAL DISCTRICT, BRAZIL	I	409	24/08/00	16:30	CC		8	PS	8
Bertoldo, N. G.	196	DILOBODERUS ABDERUS (COL. SCARABAEIDAE) CONTROL THROUGH SEED WITH GAUCHO 600 FS IN WHEAT AND BARLEY ON RS	I	50	21/08/00	16:30	CC		2	PS	2
Bertoldo, N. G.	197	EFFICIENCY OF INSECTICIDE CRUISER IN THE CONTROL OF DILOBODERUS ABDERUS (COL. SCARABAEIDAE) BY SEED TREATMENT IN THE WHEAT, OAT, AND BARLEY	I	50	21/08/00	16:30	CC		2	PS	2
Bertoldo, N. G.	206	EFFECT DIFFERENT DOSES OF THE INSECTICIDE CRUIZER FOR CONTROL OF THE "LARVA-PIN" DIABROTICA SPECIOSA (COL.; CHRYSOMELIDAE) IN MAIZE CULTIVATION	I	53	21/08/00	16:30	CC		2	PS	2
Bertoloci, J.	1017	A POSSIBLE CASE OF MIMICRY BETWEEN AN INSECT AND A TADPOLE	I	257	23/08/00	16:30	CC		6	PS	6
Bérubé, R.	1861	RESISTANCE OF YOUNG AND MATURE BALSAM FIR TREES TO SPRUCE BUDWORM AS AFFECTED BY STAND THINNING : SHORT AND LONG TERM EFFECTS	I	469	24/08/00	14:50	HB	M	10	6	10
Beschin, A.	2362	EVIDENCE FOR PHENOLOXIDASE ACTIVITY IN EARTHWORMS	II	597	23/08/00	13:50	HB	I	13	5	13
Beserra, E. B.	1489	BEHAVIOR OF TRICHOGRAMMA PRETIOSUM (HYMENOPTERA: TRICHOGRAMMATIDAE) IN SPODOPTERA FRUGIPERDA (LEPIDOPTERA: NOCTUIDAE) EGG-MASSES	I	376	21/08/00	16:30	CC		8	PS	8
Beserra, P.	900	ON THE BIOLOGY OF THREE NEW POLLINATING SPECIES (COLEOPTERA: CURCULIONIDAE: DERELOMINI) OF CAIAUÉ ELAEIS OLEIFERA CORTÉS AND OF THE F1 HYBRID (E. GUINEENSIS X E. OLEIFERA) IN THE STATE OF AMAZONAS, BRAZIL	I	227	21/08/00	16:30	CC		6	PS	6
Beserra, P.	901	THREE NEW SPECIES OF COLEOPTERA (CURCULIONIDAE: DERELOMINI) POLLINATORS OF CAIAUÉ Elaeis oleifera (KUNTH) CORTÉS AND OF THE F1 HYBRID (E. guineensis X E. oleifera) IN THE STATE OF AMAZONAS	I	228	21/08/00	16:30	CC		6	PS	6
Beslay, D.	640	NO PLEIOTROPIC EFFECT OF INSECTIDE RESISTANCE ON SEXUAL COMMUNICATION IN CYDIA POMOMELLA	I	162	21/08/00	16:30	CC		4	PS	4
Beslay, D.	1394	MECHANISMS OF AZINPHOS-METHYL RESISTANCE IN A STRAIN OF CYDIA POMONELLA FROM SOUTHERN EUROPE	I	352	21/08/00	16:30	CC		7	PS	7
Bespalov, I. N.	1442	THE ENTOMOLOGICAL INDUSTRY IN THE UKRAINE: CONDITIONS AND PROSPECTS FOR DEVELOPMENT	I	364	22/08/00	14:05	HM	O	8	4	8
Betancur, J.	1981	PRELIMINAR OBSERVATIONS OF CULICIDS (DIPTERA:CULICIDAE) ASSOCIATED TO PHYTOTELMATA IN A VERY HYMUD TROPICAL FOREST (Umh-T) IN CHOCO-COLOMBIA	I	499	21/08/00	16:30	CC		10	PS	10
Betz, O.	3083	FUNCTIONAL MORPHOLOGY AND ECOLOGICAL IMPLICATIONS OF THE ADHESION-CAPTURE APPARATUS OF STENUS SPECIES (COLEOPTERA, STAPHYLINIDAE)	II	778	25/08/00	11:15	HB	G	16	7	16
Beuk, P. L. Th.	467	CICADA BIOGEOGRAPHY AND WALLACE'S LINE, DO CICADAS SING A DIFFERENT SONG?	I	118	21/08/00	16:30	CC		3	PS	3
Beuk, P. L. Th.	3723	THE AFFINITIES OF NEW GUINEAN SPECIES OF EMPIS (DIPTERA: EMPIDIDAE)	II	940	22/08/00	16:30	CC		21	PS	21
Beveridge, N.	1840	THE ROLE OF BACILLUS THURINGIENSIS IN FOREST PEST MANAGEMENT: ITS CURRENT STATUS AND FUTURE PROSPECTS	I	464	23/08/00	10:35	HB	M	10	4	10
Beveridge, N.	2639	INTEGRATED PEST MANAGEMENT OF A LEAF BEETLE IN EUCALYPT PLANTATIONS IN TASMANIA, AUSTRALIA	II	667	21/08/00	16:30	CC		14	PS	14
Beyenbach, K. W.	2378	ROLE OF ATP IN REGULATING AND INTEGRATING TRANSPORT ACROSS PRINCIPAL CELLS OF MALPIGHIAN TUBULES?	II	601	25/08/00	10:05	HB	I	13	8	13
Beyenbach, K. W.	2398	TWO ELECTRODE VOLTAGE CLAMP METHODS IN SINGLE PRINCIPAL CELLS OF MALPIGHIAN TUBULES OF AEDES AEGYPTI: VALIDATION OF THE METHOD	II	606	21/08/00	16:30	CC		13	PS	13
Beyenbach, K. W.	2465	CENTRAL ROLE OF METABOLISM IN ELECTROGENESIS AND EPITHELIAL TRANSPORT IN MALPIGHIAN TUBULES OF THE YELLOW FEVER MOSQUITO AEDES AEGYPTI	II	623	23/08/00	16:30	CC		13	PS	13
Beyenbach, K. W.	2466	VOLTAGE POLARIZATION OF THE BASOLATERAL MEMBRANE OF PRINCIPAL CELLS IN MALPIGHIAN TUBULES OF THE YELLOW FEVER MOSQUITO AEDES AEGYPTI: ROLE OF THE VACUOLAR H+-ATPASE AT THE APICAL MEMBRANE	II	623	23/08/00	16:30	CC		13	PS	13
Beyenbach, K. W.	2479	TWO FAMILIES OF CHLORIDE CHANNELS IN APICAL MEMBRANE PATCHES OF STELLATE CELLS OF MALPIGHIAN TUBULES OF THE YELLOW FEVER MOSQUITO AEDES AEGYPTI	II	626	23/08/00	16:30	CC		13	PS	13
Beyenbach, K. W.	2535	LEUCOKININ INCREASES SHUNT CONDUCTANCE AND ANION SELECTIVITY IN MALPIGHIAN TUBULES OF THE YELLOW FEVER MOSQUITO AEDES AEGYPTI	II	640	25/08/00	16:30	CC		13	PS	13
Beyenbach, K. W.	2536	THE MECHANISM OF ACTION OF LEUCOKININ IN MALPIGHIAN TUBULES OF THE YELLOW FEVER MOSQUITO AEDES AEGYPTI: REQUIREMENT OF INTRA- AND EXTRACELLULAR CALCIUM	II	641	25/08/00	16:30	CC		13	PS	13
Bezerra Jr., N. S.	1979	EVALUATION OF THIAMETHOXAM ON COSTALIMAITA FERRUGINEA (COLEOPTERA: CHRYSOMELIDAE) CONTROL IN EUCALYPTUS PLANTATIONS	I	499	25/08/00	16:30	CC		10	PS	10
Bezerra, M. A. S.	364	WHITEFLY IMPACT ON IRRIGATED AGRICULTURE IN SEMI-ARID REGION OF BRAZIL: THE FARMER'S PERSPECTIVE	I	92	25/08/00	16:30	CC		2	PS	2
Bezerra, M. A. S.	2847	WEEDS AS HOSTS FOR BEMISIA TABACI STRAIN B (= B. ARGENTIFOLII) (HEMIPTERA: ALEYRODIDAE) IN THE SEMI-ARID REGION OF BRAZIL	II	719	22/08/00	16:30	CC		14	PS	14
Bhandari, R.	4005	EFFECT OF PHOTOPERIOD AND TEMPERATURE CHANGES ON THE REPRODUCTIVE BEHAVIOR OF MALE BLATTELLA GERMANICA LINN. (BLATTOIDEA : BLATTELLIDAE)	II	1011	21/08/00	11:00	HB	J	23	1	23
Bharti, M.	1161	FURTHER OBSERVATIONS ON THE NOCTURNAL OVIPOSITION BEHAVIOR OF BLOW FLIES (DIPTERA: CALLIPHORIDAE)	I	293	25/08/00	16:30	CC		6	PS	6
Bhaskaran, G.	3290	IS JUVENILE HORMONE THE METAMORPHIC HORMONE OF INSECTS?	II	831	23/08/00	16:05	HB	K	18	5	18
Bhuiya, B. A.	468	BIODIVERSITY OF THE PARASITIC HYMENOPTERA IN A COASTAL MANGROVE FOREST OF BANGLADESH	I	119	21/08/00	16:30	CC		3	PS	3
Biache, G.	2025	VERTICAL TRANSMISSION OF CpGV AND IMPROVEMENTS FOR CONTROL OF CYDIA POMONELLA L., POSSIBLE EXTENSION TO CYDIA SPLENDANA (HÜBNER) IN APPLES, PEARS, WALNUTS AND CHESNUT CROPS	I	511	24/08/00	15:00	HM	P	11	7	11
Biaggi, L. L.	190	DIFFERENT INSECTICIDES AND DOSES FOR EUSCHISTUS HEROS CONTROL ON SOYBEAN CROP	I	49	21/08/00	16:30	CC		2	PS	2
Biaggi, L. L.	191	DIFFERENT INSECTICIDES AND DOSES TO CONTROL GREEN STINKBUG NEZARA VIRIDULA ON SOYBEAN CROP	I	49	21/08/00	16:30	CC		2	PS	2
Biaggi, L.S. de	192	EFFECT OF DIFFERENT SEED TREATMENTS ON APHID APHIS GOSSYPII CONTROL VEGETATIVE DEVELOPMENT AND YIELD OF COTTON CROP	I	49	22/08/00	16:30	CC		2	PS	2
Biaggi, L.S. de	193	EFFECT OF DIFFERENT SEED TREATMENTS ON THRIPS FRANKLINIELLA SCHULTZEI CONTROL VEGETATIVE DEVELOPMENT AND YIELD OF COTTON CROP	I	49	22/08/00	16:30	CC		2	PS	2
Bianchi, A. G. de	2927	STRUCTURE AND EXPRESSION OF THE LARVAL AND ADULT HEXAMERIN GENES, MDH1.1 AND MDH2.1, IN MUSCA DOMESTICA	II	739	25/08/00	11:20	Bol	R	15	9	15
Bianchi, M.	3724	THE MORPHOLOGY OF THE IMMATURE STAGE OF PHORACANTHA RECURVA (COLEOPTERA: CERAMBYCIDAE) AND A KEY TO LARVAE OF THE SPECIES OF PHORACANTHA IN URUGUAY	II	940	21/08/00	16:30	CC		21	PS	21

Sub-titles: (HB=Hotel Bourbon) - (HM=Hotel Mabu) - (CC=Convention Center) - (Bol=Foz Boulevard) - (PS=Poster Session) - (PL=Plenary Lecturer)

AUTHOR	Nº	TITLE	Book	Page	Date	Time	Local	Room	Session	Symp	New Session
Bianchi, M.	226	BIO-CONTROL FOR NEW PESTS INVASIONS IN CALIFORNIA VINEYARDS: OBSCURE MEALYBUG AS A CASE EXAMPLE	I	58	22/08/00	16:30	CC		2	PS	2
Bianchi, M.	2661	BIO-CONTROL FOR NEW PESTS INVASIONS IN CALIFORNIA VINEYARDS: OBSCURE MEALYBUG AS A CASE EXAMPLE	II	672	22/08/00	16:30	CC		14	PS	14
Bianchi, M.	1826	BIOLOGICAL AND CONTROL ASPECTS OF PHORACANTHA RECURVA, AND PHORACANTHA SEMIPUNCTATA (COLEOPTERA: CERAMBYCIDAE) IN URUGUAY	I	460	22/08/00	10:35	HB	M	10	2	10
Bianchi, U.	2276	THE PRESENCE OF THE TRANSPOSABLE ELEMENTS R1 AND R2 IS ASSOCIATED TO MITOTIC CROSSING OVER IN SEVERAL APHID SPECIES	I	574	23/08/00	16:30	CC		12	PS	12
Bianchi, U.	1299	RELATIONSHIP BETWEEN EXPRESSION, AMPLIFICATION AND METHYLATION OF PEA GENE IN MYZUS PERSICAE (HOMOPTERA, APHIDIDAE)	I	328	21/08/00	16:30	CC		7	PS	7
Bianchini, G.F.	3185	CHARACTERIZATION OF SPODOPTERA SPECIES (LEPIDOPTERA: NOCTUIDAE) OF SOUTHERN BRAZIL	II	803	22/08/00	16:30	CC		16	PS	16
Bianco, R.	198	CONTROL OF THE DICHELOPS SPP. BY TREATING THE CORN SEEDS OF DIFFERENT SIZES WITH A MIXTURE OF THIAMETHOXAM AND THIODICARB	I	51	21/08/00	16:30	CC		2	PS	2
Bianconcini, J. F.	3107	MORPHOLOGY AND BIOLOGY OF THE IMMATURE STAGES OF CITHERONIA (CITHERONIA) BRISSOTII BRISSOTII (LEPIDOPTERA, SATURNIIDADE, CERATOCAMPINAE)	II	784	21/08/00	16:30	CC		16	PS	16
Bicalho, A. C.	3465	ERADICATION OF THE COPTOTERMES HAVILANDI COLONIES BY CURATIVE AND PREVENTIVE TREATMENT OF INFESTED RESIDENTIAL BUILDINGS IN URBAN AREAS IN THE CITIES OF NITEROI AND RIO DE JANEIRO (RJ), BRAZIL	II	875	22/08/00	16:30	CC		19	PS	19
Bicalho, A. C.	1946	EFFICIENCY OF GRANULATED SYSTEMIC INSECTICIDES TO ELIMINATE THE COPTOTERMES HAVILANDI COLONIES ATTACKING ROOTS OF TREES	I	490	23/08/00	16:30	CC		10	PS	10
Bicalho, A. C.	3504	ADAPTATION OF THE SUBTERRANEAN TERMITE COPTOTERMES HAVILANDI (ISOPTERA: RHINOTERMITIDAE) TO THE INTERIOR OF BRAZIL	II	884	22/08/00	16:30	CC		19	PS	19
Bicalho, A. C.	4089	OCCURRENCE OF RHINOTERMES MARGINALIS(ISOPTERA: RHINOTERMITIDAE) IN URBAN AREAS OF RIO DE JANEIRO CITY	II	1032	24/08/00	16:30	CC		23	PS	23
Bicalho, A. C.	3466	FORAGING BEHAVIOR OF THE SUBTERRANEAN TERMITE COPTOTERMES HAVILANDI (ISOPTERA: RHINOTERMITIDAE) IN RESIDENTIAL AREAS	II	875	21/08/00	16:30	CC		19	PS	19
Bicalho, A. C.	3467	SELECTION OF DYES FOR MARKING THE SUBTERRANEAN TERMITE COPTOTERMES HAVILANDI (ISOPTERA: RHINOTERMITIDAE) IN LABORATORY	II	875	21/08/00	16:30	CC		19	PS	19
Bicalho, A. C.	3468	WOOD-CONSUMPTION RATE BY THE SUBTERRANEAN TERMITE COPTOTERMES HAVILANDI (ISOPTERA: RHINOTERMITIDAE) IN RESIDENTIAL AREAS	II	875	21/08/00	16:30	CC		19	PS	19
Bicker, G.	2348	NITRIC OXIDE: AN UNCONVENTIONAL TRANSMITTER IN INSECT NERVOUS SYSTEMS	II	593	22/08/00	10:20	HB	I	13	3	13
Bicudo, H. E. M. C.	2199	INVERSION POLYMORPHISM AND EVOLUTIONARY RELATIONSHIPS OF DROSOPHILA SPECIES IN THE SALTANS SUBGROUP (SALTANS GROUP)	I	555	23/08/00	15:05	HB	L	12	6	12
Bicudo, H. E. M. C.	1352	CAN CAFFEINE BE USED AS AN AUXILIARY AGENT IN THE CONTROL OF AEDES AEGYPTI ?	I	341	23/08/00	16:30	CC		7	PS	7
Bicudo, H. E. M. C.	2323	THE USE OF PHENOBARBITAL IN STUDIES OF AEDES AEGYPTI RESISTANCE TO INSECTICIDES	I	586	25/08/00	16:30	CC		12	PS	12
Biémont, C.	2212	CODON USAGE OF TRANSPOSABLE ELEMENTS AND HOST GEMONE	I	558	24/08/00	15:55	HB	L	12	8	12
Biessmann, H.	2927	STRUCTURE AND EXPRESSION OF THE LARVAL AND ADULT HEXAMERIN GENES, MDH1.1 AND MDH2.1, IN MUSCA DOMESTICA	II	739	25/08/00	11:20	Bol	R	15	9	15
Bilej, M.	2362	EVIDENCE FOR PHENOLOXIDASE ACTIVITY IN EARTHWORMS	II	597	23/08/00	13:50	HB	I	13	5	13
Bilikova, K.	2322	FROM GENE OF HONEYBEE (APIS MELLIFERA) TO MOLECULAR PROPERTIES AND FUNCTION OF MAJOR PROTEINS OF ROYAL JELLY	I	586	25/08/00	16:30	CC		12	PS	12
Bilinski, S. M.	3036	THE OVARY STRUCTURE AND OOGENESIS IN MECOPTERANS	II	766	21/08/00	11:15	HB	G	16	1	16
Bili•ski, S. M.	3108	THE OVARIES OF CHAULIODIDS, AS THOSE OF CORYDALIDS, ARE PANOISTIC (SECONDARY PANOISTIC)	II	784	21/08/00	16:30	CC		16	PS	16
Bili•ski, S. M.	3146	DIFFERENT MECHANISMS ENSURE THE FLOW OF CYTOPLASMIC CONSTITUENTS IN NURSE CELL-OOCYTE SYNCYTIA	II	794	23/08/00	16:30	CC		16	PS	16
Biliński, S. M.	3188	STRUCTURE OF OVARIOLES IN ADELGES LARICIS (INSECTA, HEMIPTERA, APHIDINEA: ADELGIDAE)	II	804	25/08/00	16:30	CC		16	PS	16
Billings, R. F.	1908	SUPPRESSION OF SOUTHERN PINE BEETLE INFESTATIONS USING VERBENONE, AN ANTI-AGGREGATION PHEROMONE	I	481	23/08/00	16:30	CC		10	PS	10
Billingsley, R. P.	2890	INTERACTIONS BETWEEN MALARIA PARASITES AND THE MOSQUITO VECTOR	II	729	22/08/00	14:35	Bol	R	15	4	15
Bilotta, I. G.	3109	MORPHOLOGY OF PESSONIA CATENARIA (LEPIDOPTERA: NYMPHALIDAE: MORPHINAE)	II	784	21/08/00	16:30	CC		16	PS	16
Bilotta, I. G.	3110	INCIDENCE AND MORPHOLOGIC ASPECTS OF LONOMIA OBLIQUA (LEPIDOPTERA: SATURNIIDAE).	II	785	21/08/00	16:30	CC		16	PS	16
Bin, F.	3145	SPIRACULAR GLANDS OF DROSOPHILA MELANOGASTER PUPARIA ELICIT RECOGNITION RESPONSE IN TRICHOPRIA DROSOPHILAE	II	793	23/08/00	16:30	CC		16	PS	16
Bin, F.	1456	SPIRACULAR GLANDS OF DROSOPHILA MELANOGASTER PUPARIA ELICIT RECOGNITION REPONSE IN TRICHOPRIA DROSOPHILAE	I	367	23/08/00	15:15	HM	O	8	6	8
Bin, F.	1457	EGG PARASITOIDS ATTACKING HOMOLOGOUS HOSTS: EQUIVALENCES AND DIFFERENCES BETWEEN TWO ALLOPATRIC CABBAGE BUGS	I	368	23/08/00	15:35	HM	O	8	6	8
Bin, F.	1807	HOST LOCATION AND OVIPOSITION IN THE ORUSSIDAE (HYMENOPTERA), A BASAL PARASITIC WASP FAMILY	I	455	25/08/00	16:30	CC		9	PS	9
Bin, F.	1468	CRITICAL ISSUES IN EGG PARASITOIDS	I	370	26/08/00	9:35	HM	O	8	8	8
Binazzi, A.	1836	RECORDS OF CONIFER APHIDS FROM ARGENTINA (HOMOPTERA, APHIDIDAE)	I	463	22/08/00	15:35	HB	M	10	3	10
Binazzi, A.	1920	DISTRIBUTION AND ABUNDANCE OF MONOCHAMUS SPECIES ON PINES IN ITALY	I	484	22/08/00	16:30	CC		10	PS	10
Binazzi, A.	2277	MITOCHONDRIAL DNA ANALYSIS IN SPECIES OF DREYFUSIA IN ITALY	I	575	23/08/00	16:30	CC		12	PS	12
Bindu, J.	4102	THE SEASONAL ABUNDANCE AND CONTROL OF CHRYSOMYA MEGACEPHALA INFESTING DRYING FISH IN SOUTH-WEST INDIA	II	1036	24/08/00	16:30	CC		23	PS	23
Birgersson, G.	741	ANTENNAL AND BEHAVIORAL RESPONSES TO NONHOST ANGIOSPERM LEAF AND BARK VOLATILES BY CONIFER INSECT	I	187	25/08/00	16:30	CC		4	PS	4
Birkle, L. M.	902	IMPACT OF THE GENOTYPE OF A SYMBIOTIC BACTERIA ON THE FITNESS OF A PHYTOPHAGOUS INSECT	I	228	21/08/00	16:30	CC		6	PS	6
Biseau, J. C. de	3536	CONTACT POISONS IN THE ANT GENUS CREMATOGASTERY: CHEMICAL DIVERSITY AND BIOLOGICAL FUNCTIONS	II	892	24/08/00	16:30	CC		19	PS	19
Bisevac, L.	427	AN EVALUATION OF ARTHROPODS FOR POSSIBLE USE IN COMPLETION CRITERIA FOR MINESITE REHABILITATION	I	108	24/08/00	11:50	HB	C	3	5	3
Bispo, S. W. P.	1490	LONGEVITY AND REPRODUCTION OF DIACHASMIMORPHA LONGICAUDATA (HYMENOPTERA: BRACONIDAE) BRED IN LARVAE OF CERATITIS CAPITATA (DIPTERA: TEPHRITIDAE)	I	376	21/08/00	16:30	CC		8	PS	8
Bissoli, G.	715	AZADIRACTA INDICA AND BOUGAINVILLEA SPECTABILIS EXTRACTS TO CONTROL VELVETBEAN CATERPILLAR	I	181	24/08/00	16:30	CC		4	PS	4
Bissolli, G.	1687	EFFECT OF DIATRAEA SACCHARALIS TREATED EGGS ON CRISOPIDS LARVAE	I	425	25/08/00	16:30	CC		8	PS	8
Bissolli, G.	3111	EFFECT OF TWO PLANT EXTRACTS ON CERAEOCHRYSA CINCTA AND C. CUBANA (NEUROPTERA: CHRYSOPIDAE)	II	785	21/08/00	16:30	CC		16	PS	16
Bissolli, G.	978	VELVETBEAN CATERPILLAR PREFERENCE TO SOYBEAN AND PENUTS VARIETIES	I	247	22/08/00	16:30	CC		6	PS	6
Bissolli, G.	1479	HOST SPECIES AND AGE SELECTION BY TRICHOGRAMMA PRETIOSUM IN GREEN LACEWING SPECIES	I	373	21/08/00	16:30	CC		8	PS	8
Bitondi, M. M. G.	3316	JUVENILE HORMONE PROMOTES VITELLOGENIN EXPRESSION IN POST-EMBRYONIC STAGES OF APIS MELLIFERA FEMALES	II	837	21/08/00	16:30	CC		18	PS	18

Sub-titles: (HB=Hotel Bourbon) - (HM=Hotel Mabu) - (CC=Convention Center) - (Bol=Foz Boulevard) - (PS=Poster Session) - (PL=Plenary Lecturer)

AUTHOR	Nº	TITLE	Book	Page	Date	Time	Local	Room	Session	Symp	New Session
Bittencourt, M. A. L.	1491	DEVELOPMENT OF IMMATURE STAGES OF PALMISTICHUS ELAEISIS (HYM.: EULOPHIDAE) ON LEPIDOPTERA PUPAE	I	376	21/08/00	16:30	CC		8	PS	8
Bittencourt, M. A. L.	1492	BIOLOGICAL CYCLE, REPRODUCTION AND LONGEVITY OF PALMISTICHUS ELAEISIS (HYM.: EULOPHIDAE) IN LABORATORY	I	376	21/08/00	16:30	CC		8	PS	8
Bizzaro, D.	1299	RELATIONSHIP BETWEEN EXPRESSION, AMPLIFICATION AND METHYLATION OF PE4 GENE IN MYZUS PERSICAE (HOMOPTERA, APHIDIDAE)	I	328	21/08/00	16:30	CC		7	PS	7
Bizzaro, D.	2276	THE PRESENCE OF THE TRANSPOSABLE ELEMENTS R1 AND R2 IS ASSOCIATED TO MITOTIC CROSSING OVER IN SEVERAL APHID SPECIES	I	574	23/08/00	16:30	CC		12	PS	12
Blackburn, M. B.	2431	TIMING AND ECDYSTEROID REGULATION OF THE MOLT IN LAST INSTAR GREENHOUSE AND SILVERLEAF WHITEFLIES	II	614	23/08/00	16:30	CC		13	PS	13
Blackman, R. L.	2327	LIFE CYCLE, MORPHOLOGICAL AND GENETIC VARIATION IN CLONES OF MYZUS PERSICAE (HOMOPTERA: APHIDIDAE)	I	587	25/08/00	16:30	CC		12	PS	12
Blackmer, J. L.	903	A COMPARATIVE ANALYSIS OF THE FLIGHT BEHAVIOR OF LYGUS HESPERUS AND LYGUS LINEOLARIS (HEMIPTERA: MIRIDAE)	I	228	24/08/00	11:15	HB	F	6	3	6
Blackmer, J. L.	1169	CONTRIBUTIONS TO THE BIOLOGY AND ECOLOGY OF NEOLEUCINODES ELEGANTALIS (LEPIDOPTERA: CRAMBIDAE)	I	295	25/08/00	16:30	CC		6	PS	6
Blackmer, J. L.	1170	OVIPOSITION PREFERENCE AND DEVELOPMENT OF NEOLEUCINODES ELEGANTALIS (LEPIDOPTETRA: CRAMBIDAE) ON TOMATO GENOTYPES	I	295	25/08/00	16:30	CC		6	PS	6
Blackmer, J. L.	1171	TOXICITY OF TOMATO ALLELOCHEMICALS TO EGGS AND NEONATE LARVAE OF NEOLEUCINODES ELEGANTALIS (LEPIDOPTERA: CRAMBIDAE)	I	295	25/08/00	16:30	CC		6	PS	6
Blahnik, R. J.	3688	THE HIGHER LEVEL PHYLOGENY OF TRICHOPTERA WITH AN EMPHASIS ON THE RELATIONSHIPS AMONG SUBORDERS	II	931	25/08/00	15:50	HB	E	21	8	21
Blandin, S.	2353	THIOESTER-CONTAINING PROTEINS IN INNATE IMMUNITY OF MOSQUITO ANOPHELES GAMBIAE	II	594	23/08/00	10:45	HB	I	13	4	13
Blanford, S.	3915	ECOLOGICAL APPROACHES TO DETERMINING THE RISK OF MICROBIAL CONTROL AGENTS	II	988	25/08/00	13:30	HB	H	22	7	22
Blasco, C.	698	MASS TRAPPING EXPERIENCE OF CERATITIS CAPITATA(DIPTERA: TEPHRITIDAE) WITH SYNTHETIC FEMALE FOOD ATTRACTANTS IN A CITRUS ORCHARD (MALLORCA. SPAIN)	I	176	24/08/00	16:30	CC		4	PS	4
Blatrix, R.	3469	WORKERS OF THE POLYGYNOUS PONERINE ANT GNAMPTOGENYS STRIATULA DO NOT CARE PREFERENTIALLY FOR SISTER LARVAE	II	876	22/08/00	16:30	CC		19	PS	19
Bleckmann, H.	736	A NEW AUTOMATIC BIOASSAY TO TEST THE ATTRACTION OF HOST STIMULI IN CRAWLING INSECTS	I	186	25/08/00	16:30	CC		4	PS	4
Blenau, W.	2343	MOLECULAR PROPERTIES OF BIOGENIC AMINE RECEPTORS CLONED FROM HONEYBEE (APIS MELLIFERA) BRAIN	II	592	21/08/00	14:05	HB	I	13	2	13
Bloch Jr., C.	2063	EFFECTS IN VITRO AND IN VIVO OF SOYBEAN KUNITZ TRYPSIN INHIBITORS AGAINST THE BOOL WEEVIL ANTHONOMUS GRANDIS	I	520	22/08/00	16:30	CC		11	PS	11
Blochtein, B.	398	HOW FAR NORTH AND SOUTH DOES THE APIFAUNA OF AMAZONIA REACH, ESPECIALLY THE BEE SPECIES VISITING MASS-FLOWERING TREES	I	101	22/08/00	15:05	HB	C	3	2	3
Block, K.	2903	SPATIAL AND TEMPORAL HETEROGENEITY IN DENGUE VIRUS TRANSMISSION AND AEDES AEGYPTI POPULATION DENSITIES IN IQUITOS, PERU	II	733	23/08/00	14:35	Bol	R	15	6	15
Bloem, K.	1661	FRUIT FLY BIOLOGICAL CONTROL IN LATIN AMERICA: MINIMIZING THE RISKS POSED BY TEPHRITIDAE IN MEXICO AND CENTRAL AMERICA	I	419	25/08/00	16:30	CC		8	PS	8
Bloem, K. A.	2540	AREAWIDE APPROACHES TO ERADICATION OF ESTABLISHED PESTS IN PERENNIAL SYSTEMS	II	642	21/08/00	10:05	HB	B	14	1	14
Bloem, K. A.	2225	SUCCESSFULLY MANAGING LEPIDOPTERAN PESTS WITH GENETIC METHODS: THE FUTURE IS NOW	I	562	25/08/00	10:35	HB	L	12	11	12
Bloem, S.	2225	SUCCESSFULLY MANAGING LEPIDOPTERAN PESTS WITH GENETIC METHODS: THE FUTURE IS NOW	I	562	25/08/00	10:35	HB	L	12	11	12
Bloem, S.	3725	A PREDICTIVE MODEL TO ENHANCE SAFEGUARDING CAPABILITIES AGAINST WEEVILS BASED ON ECOLOGY, BEHAVIOR AND PHYLOGENY	II	940	21/08/00	16:30	CC		21	PS	21
Bloem, S.	2540	AREAWIDE APPROACHES TO ERADICATION OF ESTABLISHED PESTS IN PERENNIAL SYSTEMS	II	642	21/08/00	10:05	HB	B	14	1	14
Blomefield, T. L.	2548	CODLING MOTH MANAGEMENT: MONITORING METHODS, CONTROL GUIDELINES AND PREDICTIVE MODELS	II	644	21/08/00	14:35	HB	B	14	2	14
Blomefield, T. L.	3945	PAST AND PRESENT STRATEGIES FOR THE ECONOMICAL CONTROL OF CODLING MOTH IN SOUTH AFRICAN ORCHARDS USING MATING DISRUPTION	II	996	21/08/00	16:30	CC		22	PS	22
Blomquist, G. J.	599	ENDOCRINE REGULATION AND MECHANISM OF HYDROCARBON PHEROMONE PRODUCTION IN THE HOUSEFLY, MUSCA DOMESTICA	I	152	23/08/00	10:35	Bol	S	4	4	4
Blomquist, G. J.	601	MICROSOMAL REACTIONS INVOLVED IN THE FORMATION OF HYDROCARBONS AND THE CONTACT SEX PHEROMONE IN BLATELLA GERMANICA INTEGUMENT	I	152	23/08/00	11:10	Bol	S	4	4	4
Blomquist, G. J.	2992	HYDROCARBONS OF THE CHAGAS DISEASE VECTOR RHODNIUS PROLIXUS	II	755	23/08/00	16:30	CC		15	PS	15
Blomquist, G. J.	602	MOLECULAR STUDIES ON THE ENDOCRINE REGULATION AND TISSUE LOCALIZATION OF DE NOVO MONOTERPENOID PHEROMONE COMPONENT BIOSYNTHESIS IN PINE BARK BEETLES	I	152	23/08/00	11:25	Bol	S	4	4	4
Blumberg, D.	1415	INFLUENCE OF SPINOSAD ON SOME HYMENOPTEROUS NATURAL ENEMIES OF AVOCADO, CITRUS AND OTHER ORCHARD PESTS	I	357	25/08/00	16:30	CC		7	PS	7
Blumer, L.	1617	PARASITISM EFFICIENCY OF THE BRACONIDAE WASPS, DIACHASMIMORPHA LONGICAUDATA, ON LARVAE OF MEDFLY IN GUAVAS	I	408	24/08/00	16:30	CC		8	PS	8
Boaretto, M. A. C.	3525	RESPONSE OF ATTA BISPHAERICA (HYMENOPTERA, FORMICIDAE) TO METHANOLIC EXTRACTS OF SUGAR CANE AND ANDROPOGON GRASS	II	889	24/08/00	16:30	CC		19	PS	19
Boaventura, M. A. D.	4101	INSECTICIDE ACTION OF ETHANOLIC EXTRACT FROM ANNONA CRASSIFLORA SEEDS AGAINST SPODOPTERA FRUGIPERDA	II	1035	24/08/00	16:30	CC		23	PS	23
Bochow, H.	1749	ANALYSIS OF SOME IMPORTANT FACTORS AFFECTING OVIPOSITION AND LONGEVITY OF THE ECTOPARASITIC WASP LAELIUS PEDATUS (HYMENOPTERA: BETHYLIDAE), A PARASITOID OF DERMESTIDE PESTS	I	441	21/08/00	16:30	CC		9	PS	9
Bockaert, J.	2342	DROSOPHILA METABOTROPIC GLUTAMATE RECEPTORS: STRUCTURE AND FUNCTIONS	II	592	21/08/00	13:35	HB	I	13	2	13
Boddington, J.	1999	POTENTIAL IN AUSTRALIA FOR A HELICOVERPA BACULOVIRUS	I	504	22/08/00	9:20	HM	P	11	3	11
Boddington, J.	2106	POTENTIAL IN AUSTRALIA FOR A HELICOVERPA BACULOVIRUS	I	531	23/08/00	16:30	CC		11	PS	11
Boeckh, J.	642	RESPONSE SPECTRA OF SENSILLA TRICHODEA (A2-TYPE) OF FEMALE AEDES AEGYPTI TO HUMAN VOLATILES	I	162	21/08/00	16:30	CC		4	PS	4
Boeckh, J.	2929	ATTRACTION OF FEMALE AEDES AEGYPTI TO IDENTIFIED COMPOUNDS ON HUMAN SKIN	II	739	25/08/00	11:50	Bol	R	15	9	15
Boeckh, J.	2872	HOW THE FINE-SCALE PLUME STRUCTURE OF HOST-ODOURS AFFECT THE FLIGHT BEHAVIOUR OF MOSQUITOES	II	725	21/08/00	10:50	Bol	R	15	1	15
Boeckh, J.	2980	L-LACTIC ACID IS AN IMPORTANT HOST STIMULUS FOR THE ANTHROPOPHILIC ANOPHELES GAMBIAE S.S.	II	752	22/08/00	16:30	CC		15	PS	15
Boer, A. J. de	467	CICADA BIOGEOGRAPHY AND WALLACE'S LINE, DO CICADAS SING A DIFFERENT SONG?	I	118	21/08/00	16:30	CC		3	PS	3
Boetel, M. A.	241	ROOTWORM EMERGENCE FROM Cry3Bb HYBRIDS COMPARED TO THAT OBSERVED WITH INSECTICIDE-TREATED MAISE.	I	61	22/08/00	16:30	CC		2	PS	2
Boethel, D. J.	2568	IPM SYSTEMS FOR SOYBEAN IN THE SOUTHERN USA: SUCCESSES AND CHALLENGES	II	649	22/08/00	15:20	HB	B	14	4	14
Boethel, D. J.	1297	MIGRATION AND SELECTION AFFECTING INSECTICIDE RESISTANCE IN PSEUDOPLUSIA INCLUDENS	I	327	21/08/00	16:30	CC		7	PS	7
Boga, A.	4088	INVASION OF AEDES AEGYPTI (DIPTERA: CULICIDAE) IN URUGUAY	II	1032	23/08/00	16:30	CC		23	PS	23
Bogado, M.	2988	PHLEBOTOMINAE SAND FLIES AND LEISHMANIASIS IN ARGENTINA	II	754	23/08/00	16:30	CC		15	PS	15
Bøgh, C.	2964	THE IMPORTANCE OF MOSQUITO LARVAL SURVEYS IN THE MAPPING OF MALARIA TRANSMISSION RISK	II	748	21/08/00	16:30	CC		15	PS	15

Sub-titles: (HB=Hotel Bourbon) - (HM=Hotel Mabu) - (CC=Convention Center) - (Bol=Foz Boulevard) - (PS=Poster Session) - (PL=Plenary Lecturer)

AUTHOR	Nº	TITLE	Book	Page	Date	Time	Local	Room	Session	Symp	New Session
Bogorni, P. C.	1800	FEEDING PREFERENCE OF PHTHIA PICTA (HEMIPTERA: COREIDAE) BY FRUITS OF THREE CULTIVARS OF TOMATO	I	453	25/08/00	16:30	CC		9	PS	9
Bográn, C. E.	823	INTERSPECIFIC INTERACTIONS AMONG PARASITOIDS IN AGROECOSYSTEMS	I	208	22/08/00	15:35	HB	D	6	4	6
Boiça Junior, A. L.	2840	OVIPOSITION PREFERENCE OF SILVERLEAF WHITEFLY (HEMIPTERA: ALEYRODIDAE) FOR SQUASH GENOTYPES	II	717	22/08/00	16:30	CC		14	PS	14
Boiça Júnior, A. L.	199	EFFICIENCY OF PYRETHROID INSECTICIDES IN THE CONTROL OF ALABAMA ARGILLACEA IN COTTON CROP	I	51	21/08/00	16:30	CC		2	PS	2
Boiça Júnior, A. L.	2782	PROTECTION PERIODS OF BEMISIA TABACI BIOTYPE B (HEMIPTERA: ALEYRODIDAE) ATTACK, ON BEAN CROP (PHASEOLUS VULGARIS), IN THREE SOWING DATE	II	702	24/08/00	16:30	CC		14	PS	14
Boiça Júnior, A. L.	2783	MACROSIPHUM EUPHORBIAE (HEMIPTERA: APHIDIDAE) CONTROL AND FRANKLINIELLA SCHULZEI (THYSANOPTERA: THRIPIDAE) WITH DIFFERENT INSECTICIDES ON TOMATO CROP (LYCOPERSICUM ESCULENTUM)	II	703	24/08/00	16:30	CC		14	PS	14
Boiça Júnior, A. L.	629	RESISTANCE OF FRUITS OF PASSION FRUIT GENOTYPES TO ANISOSCELES FOLIACEA MARGINELLA	I	159	21/08/00	16:30	CC		4	PS	4
Boiça Júnior, A. L.	630	ATTRACTIVITY OF PASSION FRUIT GENOTYPES TO Holhymenia histrio AND FEEDING PREFERENCE	I	159	21/08/00	16:30	CC		4	PS	4
Boissot, N.	1649	BEMISIA TABACI BIOTYPE B (HEMIPTERA: ALEYRODIDAE) AND ITS PARASITOIDS: GUADELOUPE ISLAND AS A REPRESENTATIVE SITE OF THE CARIBBEAN	I	416	24/08/00	16:30	CC		8	PS	8
Boiteau, G.	3904	PNEUMATIC CONTROL OF INSECTS IN PLANT PROTECTION	II	985	24/08/00	10:35	HB	H	22	6	22
Boiteau, G.	3905	PHYSICAL BARRIERS FOR INSECT PESTS IN VEGETABLES AND SMALL FRUITS	II	986	24/08/00	11:05	HB	H	22	6	22
Bolzani, V.S.	703	SUSCEPTIBILITY TESTS OF 4,5-DIIDROPIPERLONGUMININA ISOLATED FROM PIPER TUBERCULATUM SEEDS ON VELVETBEAN CATERPILLAR	I	178	21/08/00	16:30	CC		4	PS	4
Bolckmans, K.	1430	WILL ARTIFIAL REARING SYSTEMS CAUSE A REAL BREAKTHROUGH IN BIOLOGICAL CONTROL? NA INDUSTRY VIEWPOINT	I	361	21/08/00	14:35	HM	O	8	2	8
Bolger, P. M.	112	OVERVIEW OF FDA'S PESTICIDE RESIDUE MONITORING PROGRAM	I	29	23/08/00	11:35	HB	A	2	5	2
Bolland, P.	1626	COEXISTENCE IN ONE FIELD OF DIFFERENT TRICHOGRAMMA SPECIES SHOWING DIFFERENT MODES OF REPRODUCTION AND DIFFERENT LEVELS OF WOLBACHIA INFECTION	I	410	24/08/00	16:30	CC		8	PS	8
Bolognesi, R.	2399	ISOLATION OF PERITROPHIC MEMBRANE PROTEINS AND THEIR SECRETION BY SPODOPTERA FRUGIPERDA (LEPIDOPTERA) LARVAE	II	606	21/08/00	16:30	CC		13	PS	13
Bolzani, V. S.	1365	INSECTICIDE PROPERTIES OF ETHANOLIC EXTRACT ISOLATED FROM SEEDS OF PIPER TUBERCULATUM SEEDS (PIPERACEAE) ON DIATRAEA SACCHARALIS (LEPIDOPTERA: PYRALI DAE)	I	344	25/08/00	16:30	CC		7	PS	7
Bombonato, M. T. S	1608	MORPHOLOGICAL AND QUANTITATIVE STUDIES OF THE HEMOCYTES IN DIATRAEA SACCHARALIS (LEPIDOPTERA: PYRALIDAE) LARVAE PARASITIZED BY COTESIA FLAVIPES (HYMENOPTERA: BRACONIDAE)	I	405	23/08/00	16:30	CC		8	PS	8
Bonato, O.	30	SPACIAL AND TEMPORAL DISTRIBUTION OF CALACARUS HEVEAE ON RUBBER TREES IN BRAZIL	I	8	22/08/00	16:30	CC		1	PS	1
Bonato, O.	64	POPULATION DYNAMICS OF BREVIPALPUS PHOENICIS ON DIFFERENT CITRUS VARIETIES IN BRAZIL: I - INFLUENCE OF CITRUS LEAF MINER INJURIES	I	16	25/08/00	16:30	CC		1	PS	1
Bonato, O.	65	POPULATION DYNAMICS OF BREVIPALPUS PHOENICIS ON DIFFERENT CITRUS VARIETIES IN BRAZIL: II - INFLUENCE OF CITRUS VARIETY	I	17	25/08/00	16:30	CC		1	PS	1
Bonato, O.	1678	SPATIO-TEMPORAL DISTRIBUTION OF CITRUS LEAFMINER AND ITS NATURAL ENEMIES IN SÃO PAULO STATE, BRAZIL	I	423	25/08/00	16:30	CC		8	PS	8
Bonato, O.	73	STABILITY ANALYSIS IN A CLASSICAL PREDATOR-PREY MODEL: EXAMPLE OF CASSAVA MITES SYSTEM	I	19	25/08/00	16:30	CC		1	PS	1
Bonato, S. L.	3798	PHYLOGENETIC USEFULNESS OF THE ELONGATION FACTOR-1ALPHA (EF-1ALPHA) IN DITRYSIA GROUP (INSECTA: LEPIDOPTERA)	II	959	24/08/00	16:30	CC		21	PS	21
Bond, W.	99	HABITAT FRAGMENTATION AND ITS CONSEQUENCES FOR PLANT-POLLINATOR MUTUALISMS IN SOUTH AFRICA	I	26	22/08/00	12:00	HB	A	2	3	2
Bondoni, M.	1911	ARTHROPODS IN RELATION WITH ARAUCARIA ARAUCANA: AN APPROACH TO ITS BIODIVERSITY IN ARGENTINA	I	482	21/08/00	16:30	CC		10	PS	10
Bondoni, M.	35	MITE POPULATIONS IN RELATION TO CYDIA POMONELLA CONTROL IN THE ALTO VALLE DE RÍO NEGRO Y NEUQUÉN (ARGENTINA)	I	9	22/08/00	16:30	CC		1	PS	1
Bonfanti-Almeida, J. C.	543	LITTER MICROARTHROPOD COMMUNITY IN AN URDAN FOREST STAND OF SÃO JOSÉ DO RIO PRETO, STATE OF SÃO PAULO, BRAZIL	I	137	24/08/00	16:30	CC		3	PS	3
Bonfim, I.	3543	CONTROL OF UNDERGROUND TERMITES AMITERMES SP. (ISOPTERA: TERMITIDAE, TERMITINAE) ON PINEAPPLE CROP IN SEMIARID ZONE OF NORTHEAST BRAZIL	II	894	25/08/00	16:30	CC		19	PS	19
Bonfim, K.	2103	PATHOGENICITY OF NEW ISOLATES OF BACILLUS THURINGIENSIS AGAINST LEPIDOPTERAN AND DIPTERAN PESTS	I	530	23/08/00	16:30	CC		11	PS	11
Bonfim, K.	2102	A CULTURE COLLECTION OF BACILLUS THURINGIENSIS AND BACILLUS SPHAERICUS PATHOGENIC TO INSECTS	I	530	23/08/00	16:30	CC		11	PS	11
Bonifácio, L. P.	1975	DISTRIBUTION OF BARK AND WOOD-BORING INSECTS IN MARITIME PINE TREES INFECTED WITH BURSAPHELENCHUS XYLOPHILUS IN PORTUGAL	I	498	25/08/00	16:30	CC		10	PS	10
Bonizzoni, M.	2230	POLYMORPHIC MICROSATELLITE MARKERS TO ASSESS THE GENETIC VARIABILITY IN THE MEDITERRANEAN FRUIT FLY, CERATITIS CAPITATA, SPECIES RANGE	I	563	21/08/00	16:30	CC		12	PS	12
Bonning, B. C.	2072	THE USE OF PROTEASES TO ENHANCE THE INSECTICIDAL POTENTIAL OF BACULOVIRUSES	I	523	22/08/00	16:30	CC		11	PS	11
Bonning, B. C.	2503	JUVENILE HORMONE ESTERASE BINDING PROTEINS IN MANDUCA SEXTA	II	632	24/08/00	16:30	CC		13	PS	13
Bonoldi, V. L. N.	3248	SEROLOGY FOR BABESIA BOVIS IN HUMAN PATIENTS WITH LYME-LYKE DISEASE SYNDROME, SYPHILIS, SEPTICEMIA AND AUTOIMMUNE DISEASES	II	820	25/08/00	16:30	CC		17	PS	17
Bonoldi, V. L. N.	1902	RELATIONSHIP BETWEEN TICKS AND SMALL WILD MAMMALS IN A DISTURBED ATLANTIC FOREST FRAGMENT IN ITAPEVI COUNTY, STATE OF SÃO PAULO, BRAZIL	I	479	21/08/00	16:30	CC		10	PS	10
Bonsall, M. B.	1493	APPARENT COMPETITION MEDIATED VIA INSECT PARASITOIDS IN HETEROGENEOUS ENVIRONMENTS	I	377	21/08/00	16:30	CC		8	PS	8
Boo, K. S.	641	TRIALS OF CONTROLLING LEPIDOPTERAN PESTS WITH SEX PHEROMONES IN KOREAN APPLE AND PEAR ORCHARDS	I	162	21/08/00	16:30	CC		4	PS	4
Boo, K. S.	3872	TRIALS OF CONTROLLING LEPIDOPTERAN PESTS WITH SEX PHEROMONES IN KOREAN APPLE AND PEAR ORCHARDS	II	977	21/08/00	11:05	HB	H	22	1	22
Boo, K. S.	3965	MONITORING OF TWO MAJOR FRUIT MOTHS WITH SEX PHEROMONE TRAPS IN KOREAN APPLE ORCHARDS	II	1001	23/08/00	16:30	CC		22	PS	22
Boomsma, J. J.	429	HOST-SPECIFICITY IN MACULINEA ALCON: A LARGE BLUE BUTTERFLY CONSERVATION ISSUE IN EUROPE	I	109	24/08/00	14:05	HB	C	3	6	3
Boomsma, J. J.	3430	MATING SYSTEM EVOLUTION IN ATTINE FUNGUS GROWING ANTS	II	866	23/08/00	10:50	HM	Q	19	4	19
Booth, R. G.	426	INSECTS AS INDICATORS OF THE RESTORATION OF AGRICULTURAL LAND	I	108	24/08/00	11:35	HB	C	3	5	3
Booth, R. G.	425	INSECTS AS INDICATORS OF SUBTLE, CLIMATE-INDUCED HABITAT FRAGMENTATION	I	108	24/08/00	11:20	HB	C	3	5	3
Borba, R da S	521	OCCURENCE OF LEAF-CUTTING ANTS IN DIFFERENT REGIONS OF RIO GRANDE DO SUL STATE	I	132	23/08/00	16:30	CC		3	PS	3
Borden, J.	1853	MECHANISMS OF RESISTANCE IN TREES TO SHOOT INSECTS	I	467	24/08/00	10:20	HB	M	10	5	10
Borden, J. H.	677	HINOTERMES MARGINALIS OLFACTORY RESPONSES BY MONOCHAMUS CLAMATOR, MONOCHAMUS SCUTELLATUS AND MONOCHAMUS OBTUSUS (COLEOPTERA: CERAMBYCIDAE) TO BARK BEETLE PHEROMONES	I	171	23/08/00	16:30	CC		4	PS	4

Sub-titles: (HB=Hotel Bourbon) - (HM=Hotel Mabu) - (CC=Convention Center) - (Bol=Foz Boulevard) - (PS=Poster Session) - (PL=Plenary Lecturer)

AUTHOR	N°	TITLE	Book	Page	Date	Time	Local	Room	Session	Symp	New Session
Bordignon, M. O.	1078	BATFLIES OF THE FISHBAT NOCTILIO LEPORINUS (MAMMALIA: CHIROPTERA): EFFECTS OF HOST SEX, SIZE, DEVELOPMENTAL STAGE AND SEASON	I	272	23/08/00	16:30	CC		6	PS	6
Borges do Heroismo, P. A. V.	3590	SPECIATION PROCESSES IN TWO SYMPATRIC CAVE-DWELLING TRECHUS FROM PICO ISLAND, AZORES	II	906	25/08/00	13:30	Bol	U	20	3	20
Borges, A. R.	3112	SCANNING AND TRANSMISSION ELECTRON MICROSCOPY OF THE MANDIBULAR GLAND IN THE SUGARCANE BORER DIATRAEA SACCHARALIS LEPIDOPTERA: PYRALIDAE)	II	785	21/08/00	16:30	CC		16	PS	16
Borges, L. M.	175	SURVEY OF THE ARTHROPODS ASSOCIATED TO MALPIGHIA GLABRA IN ANGULO, PARANA, BRAZIL	I	45	22/08/00	16:30	CC		2	PS	2
Borges, L. M.	173	EFFICIENCY OF INSECTICIDES IN THE CONTROL OF PECTINOPHORA GOSSYPIELLA IN COTTON CROP	I	44	22/08/00	16:30	CC		2	PS	2
Borges, M. A. Z.	2631	EFFECTS OF IVERMECTIN ON CARRION-BREEDING FLIES	II	665	21/08/00	16:30	CC		14	PS	14
Bonn, R. C.	221	AGRONOMIC EFFICIENCY THE INSECTICIDES AND DOSES OF CONTROL TO TIBRACA LIMBATIVENTRIS IN IRRIGATED RICE	I	56	22/08/00	16:30	CC		2	PS	2
Bonn, R. C.	2704	EFFECTS OF INSECTICIDE THIAMETHOXAM ON STERNECHUS SUBSIGNATUS (COL., CURCULIONIDAE) IN SOYBEAN	II	683	22/08/00	16:30	CC		14	PS	14
Borkova, D.	2915	MALARIA PARASITE ENCAPSULATION GENES IN ANOPHELES GAMBIAE	II	736	24/08/00	14:05	Bol	R	15	8	15
Borovsky, D.	3259	TMOF BIOTECHNOLOGY: A NEW BIORATIONAL APPROACH TO CONTROL INSECTS WITH PEPTIDE HORMONES	II	823	21/08/00	15:30	HB	K	18	1	18
Borsoi, G. A.	904	NUTRITIONAL AVALIATION OF PLANTS OF ERVA MATE ATTACKED AND NOT ATTACKED BY "BROCA" HEDYPATHES BETULINUS	I	228	21/08/00	16:30	CC		6	PS	6
Bortoli, S. A. De	1479	HOST SPECIES AND AGE SELECTION BY TRICHOGRAMMA PRETIOSUM IN GREEN LACEWING SPECIES	I	373	21/08/00	16:30	CC		8	PS	8
Bortoli, S. A. De	966	RESISTANCE MANAGEMENT OF TUTA ABSOLUTA (LEPIDOPTERA: GELECHIIDAE) TO SPINOSAD	I	244	23/08/00	16:30	CC		6	PS	6
Bortoli, S. A. de	1081	NUTRITIONAL AND BIOLOGICAL ASPECTS OF VELVETBEAN CATERPILLAR ON SOYBEAN GENOTYPES WITH AND WITHOUT INJURY	I	273	23/08/00	16:30	CC		6	PS	6
Bortoli, S. A. de	1082	VELVETBEAN CATERPILLARS PREFERENCE TO SOYBEAN GENOTYPES WITH AND WITHOUT INJURY	I	273	23/08/00	16:30	CC		6	PS	6
Bortoli, S. A. De	1322	PESTICIDES EFFECTS ON CHRYSOPERLA EXTERNA (NEUROPTERA: CHRYSOPIDAE)	I	334	22/08/00	16:30	CC		7	PS	7
Bortoli, S. A. De	2425	ELETROFORETIC PROFILES FROM ADULTS OF CHRYSOPERLA EXTERNA FED ON DIFFERENT DIETS	II	613	22/08/00	16:30	CC		13	PS	13
Bortoli, S. A. De	3519	EFFECTS OF METHOPRENE ON SILKWORM, BOMBYX MORI (LEPIDOPTERA: BOMBYCIDAE)	II	888	24/08/00	16:30	CC		19	PS	19
Bortoli, S. A. De	3520	EFFECTS OF PYRIPROXYFEN ON THE LARVAL DEVELOPMENT, THE COCOON AND SILK PRODUCTION OF BOMBYX MORI (LEPIDOPTERA: BOMBYCIDAE)	II	888	24/08/00	16:30	CC		19	PS	19
Bortoli, S. A. De	3521	EFFECTS OF TOPICAL APPLICATION OF FENOXYCARB AT DIFFERENT DOSES ON SILKWORM, BOMBYX MORI (LEPIDOPTERA: BOMBYCIDAE)	II	888	23/08/00	16:30	CC		19	PS	19
Bortoli, S. A. De	1200	BIOLOGICAL AND NUTRITIONAL ASPECTS OF ANTICARSIA GEMMATALIS (LEPIDOPTERA: NOCTUIDAE), RAISED ON SOYBEAN, PEANUT AND ARTIFICIAL DIET.	I	302	25/08/00	16:30	CC		6	PS	6
Bortoli, S. A. De	2419	EVALUATION OF VELVETBEEN CATERPILLAR SUSCEPTIBILITY TO ETANOLIC EXTRACTS ISOLATED FROM SEEDS OF CRYPTOCARIA MOSCHATA	II	611	21/08/00	16:30	CC		13	PS	13
Bortoli, S. A. de	3166	EXTERN ANATOMY DESCRIPTION OF ANTICARSIA GEMMATALIS (LEPIDOPTERA: NOCTUIDAE) THROUGH THE SCANNING ELECTRONIC MICROSCOPY	II	799	21/08/00	16:30	CC		16	PS	16
Bortoli, S. A. De	3550	ANTIBIOTIC OLAQUINDOX AS ADDICTIVE IN THE FEEDING OF BOMBYX MORI (LEPIDOPTERA: BOMBYCIDAE)	II	896	25/08/00	16:30	CC		19	PS	19
Bortoli, S. A. De	3551	FEEDING OF BOMBYX MORI WITH ARTIFICIAL DIET AND ITS EFFECT ON THE LARVAL DEVELOPMENT AND THE SILK PRODUCTION	II	896	25/08/00	16:30	CC		19	PS	19
Bortoli, S. A. De	978	VELVETBEAN CATERPILLAR PREFERENCE TO SOYBEAN AND PENUTS VARIETIES	I	247	22/08/00	16:30	CC		6	PS	6
Bortoli, S. A. De	1687	EFFECT OF DIATRAEA SACCHARALIS TREATED EGGS ON CRISOPIDS LARVAE	I	425	25/08/00	16:30	CC		8	PS	8
Bortoli, S. A. De	3522	MORPHOLOGICAL DESCRIPTION OF THE CATERPILLAR OF BOMBYX MORI (LEPIDOPTERA: BOMBYCIDAE) WITH THE USE OF SCANNING ELECTRONIC MICROSCOPY	II	889	23/08/00	16:30	CC		19	PS	19
Bortoli, S. A. de	3111	EFFECT OF TWO PLANT EXTRACTS ON CERAEOCHRYSA CINCTA AND C. CUBANA (NEUROPTERA: CHRYSOPIDAE)	II	785	21/08/00	16:30	CC		16	PS	16
Bortoli, S. A. de	703	SUSCEPTIBILITY TESTS OF 4,5-DIIDROPIPERLONGUMININA ISOLATED FROM PIPER TUBERCULATUM SEEDS ON VELVETBEAN CATERPILLAR	I	178	24/08/00	16:30	CC		4	PS	4
Bortoli, S. A. De	1365	INSECTICIDE PROPERTIES OF ETHANOLIC EXTRACT ISOLATED FROM SEEDS OF PIPER TUBERCULATUM SEEDS (PIPERACEAE) ON DIATRAEA SACCHARALIS (LEPIDOPTERA: PYRALI DAE)	I	344	25/08/00	16:30	CC		7	PS	7
Bortoli, S. A. De	715	AZADIRACTA INDICA AND BOUGAINVILLEA SPECTABILIS EXTRACTS TO CONTROL VELVETBEAN CATERPILLAR	I	181	24/08/00	16:30	CC		4	PS	4
Boscán de M., N.	200	AMMONIUM ACETATE: AN EFFICIENT ADULT ATTRACTANT OF ANASTREPHA SPP & CERATITIS CAPITATA IN MANGOES PLANTATIONS IN MARACAY, VENEZUELA	I	51	21/08/00	16:30	CC		2	PS	2
Bosch, D.	1394	MECHANISMS OF AZINPHOS-METHYL RESISTANCE IN A STRAIN OF CYDIA POMONELLA FROM SOUTHERN EUROPE	I	352	21/08/00	16:30	CC		7	PS	7
Bosch, O. J.	642	RESPONSE SPECTRA OF SENSILLA TRICHODEA (A2-TYPE) OF FEMALE AEDES AEGYPTI TO HUMAN VOLATILES	I	162	21/08/00	16:30	CC		4	PS	4
Bosch, O. J.	2929	ATTRACTION OF FEMALE AEDES AEGYPTI TO IDENTIFIED COMPOUNDS ON HUMAN SKIN	II	739	25/08/00	11:50	Bol	R	15	9	15
Bosque-Perez, N. A.	3884	USING LANDRACES AS SOURCES OF RESISTANCE TO PESTS: EVOLUTIONARY AND ECOLOGICAL CONSIDERATIONS	II	980	22/08/00	14:05	HB	H	22	3	22
Bossart, J. L.	4137	CHALLENGING THE INSECT CONSERVATION CHALLENGE	II	1045	21/08/00	16:30	CC		24	PS	24
Bossart, N.	2483	THE DESIGN AND APPLICATION OF AN ACTIGRAPH TO STUDY THE CIRCADIAN RHYTHM OF THE DUMP FLY, HYDROTAEA AENESCENS	II	627	24/08/00	16:30	CC		13	PS	13
Bostanian, N. J.	133	TOWARDS FEWER PESTICIDE APPLICATIONS IN QUEBEC VINEYARDS	I	34	24/08/00	14:45	HB	A	2	8	2
Bostanian, N. J.	1300	EFFECTS OF SEVERAL FUNGICIDES ON THE PREDACIOUS MITE AMBLYSEIUS FALLACIS (ACARI: PHYTOSEIIDAE) IN QUEBEC APPLE ORCHARDS	I	328	21/08/00	16:30	CC		7	PS	7
Bostanian, N. J.	1301	EFFECTS OF SEVERAL PESTICIDES ON THE PREDACIOUS MITE AGISTEMUS FLESCHNERI (ACARI: STIGMAEIDAE) IN QUEBEC APPLE ORCHARDS	I	328	21/08/00	16:30	CC		7	PS	7
Bostanian, N. J.	1302	INDOXACARB (DPX-MP062) A NEW OXIDIAZINE INSECTICIDE - ITS POTENTIAL IN QUEBEC APPLE ORCHARDS	I	329	22/08/00	16:30	CC		7	PS	7
Bot, A. N. M.	3430	MATING SYSTEM EVOLUTION IN ATTINE FUNGUS GROWING ANTS	II	866	23/08/00	10:50	HM	Q	19	4	19
Botelho, A. C. G.	4013	EVALUATION OF GAMMA RADIATION (COBALT 60) ABOUT THE ARCELIN PROTEIN AND ITS INFLUENCE ON RESISTANCE TO BEAN WEEVIL	II	1013	21/08/00	15:30	HB	J	23	2	23
Botelho, A. P.	284	CHEMICAL CONTROL OF THIPS TABACI (THYSANOPTERA: THRIPIDAE) WITH INSECTICIDE CONFIDOR (IMIDACLOPRID), IN POTATO CROP, SOLANUM TUBEROSUM	I	72	23/08/00	16:30	CC		2	PS	2
Botelho, P. S. M.	201	CHEMICAL CONTROL OF MAHANARVA FIMBRIOLATA (HEMIPTERA-HOMOPTERA: CERCOPIDAE) IN SUGARCANE	I	51	21/08/00	16:30	CC		2	PS	2
Bottecchia, M.	2297	GENETIC VARIABILITY OF CACOPHONY GENE IN LUTZOMYIA LONGIPALPIS POPULATIONS	I	580	24/08/00	16:30	CC		12	PS	12
Botto, E.	1882	RISK TO SOUTH AMERICAN RADIATA PINE RESOURCES BY THE PINE SHOOT MOTH, RHYACIONIA BUOLIANA	I	474	26/08/00	10:05	HB	M	10	9	10

Sub-titles: (HB=Hotel Bourbon) - (HM=Hotel Mabu) - (CC=Convention Center) - (Bol=Foz Boulevard) - (PS=Poster Session) - (PL=Plenary Lecturer)

AUTHOR	Nº	TITLE	Book	Page	Date	Time	Local	Room	Session	Symp	New Session
Botto, E. N.	1478	DIAPAUSE INDUCTION AND COLD STORAGE IN TRICHOGRAMMA NERUDAI	I	373	21/08/00	16:30	CC		8	PS	8
Botto, E. N.	1935	MAIN INSECT FOREST PESTS AFFECTING PINES IN THE PATAGONIA ARGENTINA	I	488	23/08/00	16:30	CC		10	PS	10
Botto, E. N.	1689	BIOLOGICAL STUDIES ON ENCARSIA PORTERI (HYMENOPTERA: APHELINIDAE)	I	426	22/08/00	16:30	CC		8	PS	8
Botto, E. N.	2852	BIOLOGICAL STUDIES ON THE ARG1 BIOTYPE OF THE BEMISIA TABACI COMPLEX (HEMIPTERA: ALEYRODIDAE)	II	720	25/08/00	16:30	CC		14	PS	14
Botton, M.	2632	IMIDACLOPRID AND THIAMETHOXAM AS NEW TOOLS FOR GRAPE PEST MANAGEMENT	II	665	21/08/00	16:30	CC		14	PS	14
Botton, M.	3946	ORIENTAL FRUIT MOTH CONTROL THROUGT MATING DISRUPTION WITH MICROENCAPSULATED PHEROMONE IN PEACH ORCHARDS	II	996	22/08/00	16:30	CC		22	PS	22
Botton, M.	693	MANAGING TEMPERATE FRUIT PESTS IN BRAZIL USING SEMIOCHEMICALS	I	175	23/08/00	16:30	CC		4	PS	4
Bouchard, P.	3113	ELYTRA-TO-BODY BINDING MECHANISM IN COELOMETOPINE TENEBRIONID BEETLES (INSECTA: COLEOPTERA): ADAPTATIONS TO FLIGHTLESSNESS AND TAXONOMIC IMPLICATIONS	II	785	21/08/00	16:30	CC		16	PS	16
Bouchard, P. B.	3726	SYSTEMATICS OF WET TROPICS COELOMETOPINI (COLEOPTERA: TENEBRIONIDAE: COELOMETOPINAE) FROM AUSTRALIA: RADIATION IN HIGH ELEVATION RAINFORESTS	II	941	22/08/00	16:30	CC		21	PS	21
Bourel, B.	2400	IMMUNOHISTOCHEMICAL CONTRIBUTION TO THE STUDY OF MORPHINE METABOLISM IN CALLIPHORIDAE LARVAE AND IMPLICATIONS IN FORENSIC ENTOMOTOXICOLOGY	II	606	21/08/00	16:30	CC		13	PS	13
Bourel, B.	2401	MORPHINE EXTRACTION IN NECROPHAGOUS INSECTS REMAINS FOR DETERMINING ANTE-MORTEM OPIATE INTOXICATION	II	607	21/08/00	16:30	CC		13	PS	13
Bourgeois, T.	385	BEFRI, GLOBIS AND THE MSEF INITIATIVES—INTERNATIONAL ENTOMOLOGICAL APPROACHES TO CBD, GTI AND GBIF	I	98	21/08/00	14:45	HB	C	3	1	3
Bourgoin, T.	3613	NEOTROPICAL KINNARIDS: THE MISSING LINK? (HEMIPTERA, FULGOROMORPHA)	II	912	21/08/00	10:35	HB	E	21	1	21
Bourgoin, T.	3616	THE NEOTROPICAL LOPHOPIDAE (HEMIPTERA) AND THE ENIGMA OF HESTICUS AND SILVANANA	II	913	21/08/00	11:20	HB	E	21	1	21
Bouvier, J. C.	1394	MECHANISMS OF AZINPHOS-METHYL RESISTANCE IN A STRAIN OF CYDIA POMONELLA FROM SOUTHERN EUROPE	I	352	21/08/00	16:30	CC		7	PS	7
Bouvier, J. C.	1304	INVOLVEMENT OF VOLTAGE-DEPENDENT SODIUM CHANNELS IN DELTAMETHRIN RESISTANCE IN A STRAIN OF CYDIA POMONELLA	I	329	21/08/00	16:30	CC		7	PS	7
Bouvier, J. C.	2549	INSECTICIDE RESISTANCE IN CODLING MOTH WORLDWIDE: MONITORING, MECHANISMS AND CROSS-RESISTANCES.	II	644	21/08/00	14:50	HB	B	14	2	14
Bouvier, J. C.	2812	INSECTICIDE RESISTANCE IN CODLING MOTH WORLDWIDE: MONITORING, MECHANISMS AND CROSS-RESISTANCES.	II	710	24/08/00	16:30	CC		14	PS	14
Bouvier, J. C.	640	NO PLEIOTROPIC EFFECT OF INSECTIDE RESISTANCE ON SEXUAL COMMUNICATION IN CYDIA POMOMELLA	I	162	21/08/00	16:30	CC		4	PS	4
Bové, J. M.	3215	INSERTIONAL MUTAGENESIS OF SPIROPLASMA CITRI IN RELATION TO PATHOGENICITY	II	812	22/08/00	15:30	Bol	U	17	2	17
Boveris, A.	2397	EFFECT OF PHLOXIN "B" INGESTION IN IMMATURE STAGES OF THE MEDFLY, CERATITIS CAPITATA	II	606	21/08/00	16:30	CC		13	PS	13
Bowers, W. S.	643	BIOPROSPECTING FOR NOVEL PEST MANAGEMENT CHEMISTRY	I	163	21/08/00	16:30	CC		4	PS	4
Bowman, A. S.	6	PROSTAGLANDINS IN TICK SALIVARY GLAND PHYSIOLOGY	I	2	24/08/00	16:05	HB	F	1	1	1
Bowman, A. S.	5	A NOVEL ANTI-INFLAMMATORY FACTOR IN THE SALIVA OF THE LONE STAR TICK AMBLYOMMA AMERICANUM	I	2	24/08/00	15:35	HB	F	1	1	1
Bownes, M.	3303	SOMATIC-GERM LINE CELL INTERACTION IN OOGENESIS AND SPERMATOGENESIS	II	834	25/08/00	15:05	HB	K	18	7	18
Bownes, M.	3319	OOGENESIS IN DROSOPHILA	II	838	22/08/00	16:30	CC		18	PS	18
Bowyer, J.	3223	INTERACTIONS BETWEEN INSECT VECTORS OF PLANT DISEASES IN AUSTRALIA	II	814	22/08/00	16:30	CC		17	PS	17
Boys, G. O.	271	DEVELOPMENT OF AN EXTENSION-BASED SAMPLING SERVICE FOR COTTON APHID FUNGUS, NEOZYGITES FRESENII	I	69	23/08/00	16:30	CC		2	PS	2
Bradley, C. A.	2015	MANIPULATION OF SPRAY PARAMETERS TO IMPROVE EFFICACY OF MYCOINSECTICIDES AGAINST INSECT PESTS OF FIELD CROPS	I	508	23/08/00	15:05	HM	P	11	6	11
Bradley, C. A.	2165	MANIPULATION OF SPRAY PARAMETERS TO IMPROVE EFFICACY OF MYCOINSECTICIDES AGAINST INSECT PESTS OF FIELD CROPS	I	546	25/08/00	16:30	CC		11	PS	11
Bradley, S. J.	3877	LURE AND KILL FOR PEST MANAGEMENT IN ORCHARDS	II	979	21/08/00	15:30	HB	H	22	1	22
Bradshaw, W. E.	3320	INVASION OF THE TEMPERATE ZONE AND THE EVOLUTION OF PHOTOPERIODIC TIME MEASUREMENT	II	838	21/08/00	16:30	CC		18	PS	18
Braekman, J. C.	4130	CHEMICAL DEFENSE IN NEOTROPICAL LEAF BEETLES	II	1043	25/08/00	14:40	HM	P	24	2	24
Braga Filho, J. R.	1523	ECOLOGICAL ASPECTS AND DAMAGE EVALUATION OF FUIT FLIES IN CAGAITA IN THE SAVANNAS OF GOIAS STATE, BRAZIL.	I	384	21/08/00	16:30	CC		8	PS	8
Braga Sobrinho, R.	905	SURVEY AND IDENTIFICATION OF FRUIT FLY SPECIES IN THE REGION OF BAIXO JAGUARIBE, STATE OF CEARÁ, BRAZIL	I	229	21/08/00	16:30	CC		6	PS	6
Braga Sobrinho, R.	2633	STRATATEGIC MANAGEMENT FOR THE CONTROL OF SOURSOP PESTS IN NORTHEAST BRAZIL	II	665	22/08/00	16:30	CC		14	PS	14
Braga, A. K.	1750	FRAGRANCE COLLECTION BY MALE EUGLOSSINE BEES, EUGLOSSA TOWNSENDI (HYMENOPTERA, APIDAE) IN FLOWERS OF CRINUM PROCERUM (AMARYLLIDACEAE)	I	441	21/08/00	16:30	CC		9	PS	9
Braga, I. A.	1303	EVALUATION OF THE STATUS OF RESISTANCE OF AEDES AEGYPTI TOTEMEPHOS IN THE STATE OF RIO DE JANEIRO - BRAZIL	I	329	21/08/00	16:30	CC		7	PS	7
Braga, I. A.	4076	EVALUATION OF TEMEPHOS SUSCEPTIBILITY IN AEDES AEGYPTI IN RIO DE JANEIRO, BRAZIL	II	1029	22/08/00	16:30	CC		23	PS	23
Braga, I. A.	4075	DISPERSION OF AEDES AEGYPTI AND AEDES ALBOPICTUS AND THEIR RELATIONSHIP TO DENGUE TRANSMISSION IN THE STATE OF RIO DE JANEIRO, BRAZIL, 1986•1997	II	1029	22/08/00	16:30	CC		23	PS	23
Braga, I. A.	1146	COMPARISON OF FOUR METHODS FOR COLLECTING ADULT ANOPHELINE MOSQUITOES IN AN ENDEMIC AREA IN PORTO VELHO – RONDONIA – BRAZIL	I	289	24/08/00	16:30	CC		6	PS	6
Braga, J. Z.	3110	INCIDENCE AND MORPHOLOGIC ASPECTS OF LONOMIA OBLIQUA (LEPIDOPTERA: SATURNIIDAE).	II	785	21/08/00	16:30	CC		16	PS	16
Braga, M. S.	1372	INTERCROPPING SYSTEM AND THIAMETHOXAM SPRAYING FOR EMPOASCA KRAEMERI (HEMIPTERA: CICADELLIDAE) CONTROL IN COWPEA	I	346	22/08/00	16:30	CC		7	PS	7
Bragança, M. A. L.	1751	OVIPOSITION BEHAVIOR AND BIOLOGICAL CHARACTERISTICS OF TWO PHORID FLY PARASITOIDS OF THE LEAF-CUTTING ANT ATTA LAEVIGATA	I	441	21/08/00	16:30	CC		9	PS	9
Braines, C.	1731	THE FUNCTION OF NUPTIAL FEEDING IN THE TETTIGONIID STEROPLEURUS STALI: FIELD EVIDENCE REFUTES THE PATERNAL INVESTMENT HYPOTHESIS	I	436	22/08/00	15:30	HB	F	9	3	9
Brakefield, P. M.	3298	EXPLORING HOW A BUTTERFLY WING PATTERN CAN EVOLVE	II	833	25/08/00	15:35	HB	K	18	6	18
Braks, M. A. H.	644	POSSIBLE ROLE OF AMMONIA IN HOST-SEEKING BEHAVIOR OF BLOOD-FEEDING INSECTS	I	163	25/08/00	11:35	Bol	R	4	9	15
Brancalhão, R. M. C.	2036	TRANSMISSION OF NUCLEOPOLYHEDROVIRUS IN BOMBYX MORI (LEPIDOPTERA: BOMBYCIDAE)	I	514	22/08/00	16:30	CC		11	PS	11
Brandão Filho, J. U. T.	172	EFFICIENCY OF DIFFERENT INSECTICIDES IN THE CONTROL OF THRIPS, FRANKLINIELLA SCHULTZEI, IN LETTUCE	I	44	21/08/00	16:30	CC		2	PS	2
Brandão Filho, J. U. T.	173	EFFICIENCY OF INSECTICIDES IN THE CONTROL OF PECTINOPHORA GOSSYPIELLA IN COTTON CROP	I	44	22/08/00	16:30	CC		2	PS	2
Brandão Filho, J. U. T.	171	AGRONOMIC EFFICIENCY OF INSECTICIDES AT DIFFERENT RATES TO THE CONTROL OF STERNECHUS SUBSIGNATUS IN SOYBEAN	I	44	21/08/00	16:30	CC		2	PS	2
Brandão Filho, S.	2926	PHLEBOTOMINE SANDFLIES TRANSMITTING LEISHMANIA IN CHANGING ENVIRONMENTS IN BRAZIL	II	738	25/08/00	11:05	Bol	R	15	9	15
Brandão, C. R. F.	2169	INSECT GUILDS GUIDE THE EVOLUTION OF MIMETISM	I	548	21/08/00	10:05	HB	L	12	1	12

Sub-titles: (HB=Hotel Bourbon) - (HM=Hotel Mabu) - (CC=Convention Center) - (Bol=Foz Boulevard) - (PS=Poster Session) - (PL=Plenary Lecturer)

AUTHOR	Nº	TITLE	Book	Page	Date	Time	Local	Room	Session	Symp	New Session
Brandão, I. R.	1143	OBSERVATIONS ON THE AQUATIC HEMIPTERA (GERRIDAE) DIVERSITY FAUNA FROM DISTURBED AND NON-DISTURBED ENVIRONMENT OF AMAZÔNIA CENTRAL, BRASIL	I	288	24/08/00	16:30	CC		6	PS	6
Brandenburg, R. L.	1011	SOUTHERN CORN ROOTWORM: BIOLOGY AND MANAGEMENT IN PEANUT	I	255	22/08/00	16:30	CC		6	PS	6
Brandenburg, R. L.	2009	BEHAVIORAL RESPONSE OF SOIL ARTHROPODS TO FUNGAL PATHOGENS	I	507	23/08/00	10:05	HM	P	11	5	11
Brandhorst-Hubbard, J.	943	INFERRING ACTIVITIES AND POPULATION DENSITY FROM INCIDENTAL SOILBORNE SOUNDS OF WHITE GRUBS	I	238	21/08/00	16:30	CC		6	PS	6
Brandl, F.	341	THIAMETHOXAM USED AS SEED TREATMENT (CRUISER/ADAGE®), OR AS SOIL APPLICATION (ACTARA/PLATINUM®)	I	86	25/08/00	16:30	CC		2	PS	2
Brandt, S. L.	3332	INGESTION AND DIGESTION OF GREEN FLUORESCENT PROTEIN BY THE WESTERN TARNISHED PLANT BUG, LYGUS HESPERUS	II	841	22/08/00	16:30	CC		18	PS	18
Brasil, G. H.	610	MASS TRAPPING OF RHYNCHOPHORUS PALMARUM USING PHEROMONE IN COCONUT PLANTATION, IN BRAZIL	I	154	24/08/00	10:05	Bol	S	4	6	4
Braverman, Y.	2922	THE INTERACTION BETWEEN CLIMATIC FACTORS AND BLUETONGUE OUTBREAKS IN ISRAEL, THE EASTERN MEDITERRANEAN AND THE FEASIBILITY OF ESTABLISHING BLUETONGUE-FREE ZONES	II	737	25/08/00	10:05	Bol	R	15	9	15
Braverman, Y.	2922	THE INTERACTION BETWEEN CLIMATIC FACTORS AND BLUETONGUE OUTBREAKS IN ISRAEL, THE EASTERN MEDITERRANEAN AND THE FEASIBILITY OF ESTABLISHING BLUETONGUE-FREE ZONES	II	737	25/08/00	10:05	Bol	R	15	9	15
Bravo, F.	3727	COMMENTS ON THE GENEALOGY OF THE GENUS TRICHOMYIA (DIPTERA, PSYCHODIDAE), WITH SPECIAL REFERENCE TO GROUP B	II	941	21/08/00	16:30	CC			PS	21
Brazil, R. P.	731	A COMPARATIVE STUDY OF PHEROMONE DISSEMINATING STRUCTURES IN TERGITES OF SOME LUTZOMYIA SPP. (DIPTERA: PSYCHODIDAE)	I	185	24/08/00	16:30	CC		4	PS	4
Brentassi, E.	3235	RESOURCE AVAILABILITY AND SPATIAL DISTRIBUTION OF DELPHACODES KUSCHELI (FULGOROMORPHA: DELPHACIDAE)	II	817	23/08/00	16:30	CC		17	PS	17
Bretas, G.	2907	MONITORING VECTOR-BORNE DISEASES OVER THE BRAZILIAN AMAZON, PROJECT SIVAM	II	734	23/08/00	16:05	Bol	R	15	6	15
Bretfeld, G.	907	COMMUNITIES OF SOIL COLLEMBOLA ON THE NORTH AND SOUTH FACING SLOPES OF A MEDITERRANEAN VALLEY	I	229	23/08/00	16:30	CC		6	PS	6
Breuer, M.	3249	MALE-FEMALE DIFFERENCES IN NEUROPEPTIDE PROFILES IN LOCUSTS	II	821	21/08/00	9:35	HB	K	18	1	18
Breuer, M.	3258	NEUROPEPTIDES IN LOCUSTS: PROGRESS IN THE SEARCH FOR FUNCTIONS	II	823	21/08/00	15:00	HB	K	18	1	18
Breuer, M.	3261	ANGIOTENSIN CONVERTING ENZYME-LIKE ACTIVITY IN THE FLESHFLY NEOBELLIERIA BULLATA	II	824	21/08/00	16:15	HB	K	18	1	18
Brey, P. T.	2358	GENOMIC STRUCTURE AND ECDYSONE REGULATION OF THE PROPHENOLOXIDASE 1 GENE IN THE MALARIA VECTOR ANOPHELES GAMBIAE	II	596	23/08/00	14:20	HB	I	13	5	13
Brey, P. T.	2269	GRAM-NEGATIVE BACTERIA BINDING PROTEIN, A PATTERN RECOGNITION RECEPTOR FOR LIPOPOLYSACCHARIDE AND b-1,3-GLUCAN, WHICH MEDIATES THE SIGNALING FOR THE INDUCTION OF INNATE IMMUNE GENES IN DROSOPHILA MELANOGASTER CELLS	I	573	22/08/00	16:30	CC		12	PS	12
Briano, J. A.	3414	THE MICROSPORIDIUM VAIRIMORPHA INVICTAE (MICROSPORIDA: BURENELLIDAE), A POTENTIAL CANDIDATE FOR THE BIOLOGICAL CONTROL OF THE IMPORTED FIRE ANTS IN THE UNITED STATES	II	862	22/08/00	11:50	HM	Q	19	2	19
Briceño, R. A.	3728	TAXONOMIC REVISION AND PHYLOGENY OF THE NEOTROPICAL GENUS SESIOCTONUS (HYMENOPTERA: BRACONIDAE)	II	941	21/08/00	16:30	CC		21	PS	21
Bridgewater, P.	443	BIOSPHERE RESERVES: A MODEL FOR THE ROLE OF TAXONOMIC SCIENCE IN BIODIVERSITY CONSERVATION	I	112	25/08/00	15:10	HB	C	3	8	3
Bridgwater, D.	373	EFFECTIVENESS OF METHYL BROMIDE ALTERNATIVES AGAINST POTENTIAL PESTS TO BE IMPORTED TO THE UNITED STATES FROM CHILE	I	94	25/08/00	16:30	CC		2	PS	2
Bridgwater, D.	2856	AN IPM APPROACH TO PREVENTION OF POTENTIAL PESTS THAT MIGHT BE IMPORTED TO THE UNITED STATES ON CHILEAN LOGS: PART I, EFFECTIVENESS OF METHYL BROMIDE ALTERNATIVES	II	721	24/08/00	16:30	CC		14	PS	14
Briese, D. T.	1702	EXPLORATION IN ARGENTINA FOR POTENTIAL BIOLOGICAL CONTROL AGENTS OF HELIOTROPIUM AMPLEXICAULE, AN INVASIVE WEED IN EASTERN AUSTRALIA	I	429	25/08/00	16:30	CC		8	PS	8
Brillet, Ch.	3475	ADDITIVE PRIMER AND RELEASER EFFECTS OF BROOD AND QUEEN PHEROMONE ON ADULTS WORKERS IN THE HONEY BEE	II	877	22/08/00	16:30	CC		19	PS	19
Brinkman, E. P.	1118	LINKING MULTITROPHIC INTERACTIONS ABOVE-BELOWGROUND	I	282	24/08/00	16:30	CC		6	PS	6
Briscoe, D. A.	483	BIOTRACK: CONCEPTUAL AND INFORMATION TECHNOLOGY SOLUTIONS FOR UNDERSTANDING MORE OF BIODIVERSITY	I	122	22/08/00	16:30	CC		3	PS	3
Briscoe, D. A.	3470	ANTIMICROBIAL COMPOUNDS FROM ANTS AND OTHER INSECTS AND THEIR ROLE IN THE EVOLUTION OF SOCIALITY	II	876	23/08/00	16:30	CC		19	PS	19
Brisson, J.	3071	MATERNAL VS ZYGOTIC CONTRIBUTIONS TO PATTERNING THE SHORT GERM EMBRYO OF TRIBOLIUM CASTANEUM	II	775	24/08/00	11:30	HB	G	16	6	16
Brito, C. H.	906	SURVEY OF FRUIT FLIES (DIPTERA: TEPHRITIDAE) IN FOUR CITIES IN PARAÍBA	I	229	21/08/00	16:30	CC		6	PS	6
Brito, L. G.	2966	CORRESPONDENCE BETWEEN THE WEIGHT OF THE LARVAE OF 3RD STATED AND THE ADULTS' SEX OF DERMATOBIA HOMINIS (DIPTERA: CUTEREBRIDAE)	II	748	21/08/00	16:30	CC		15	PS	15
Brito, L. G.	3002	INFLUENCE OF A DIET BASE OF FISH MEAT IN DIFFERENT PUTRAFATION STAGES ON THE POST-EMBRYONIC DEVELOPMENT OF LUCILIA CUPRINA (DIPTERA:CALLIPHORIDAE) UNDER LABORATORY CONDITIONS	II	757	24/08/00	16:30	CC		15	PS	15
Brito, L. G.	2965	CORRELATION BETWEEN THE WEIGHT OF THE THIRD INSTAR LARVAE AND THE SEX OF ADULTS OF DERMATOBIA HOMINIS (LINNAEUS, JR) (DIPTERA: CUTEREBRIDAE)	II	748	21/08/00	16:30	CC		15	PS	15
Brito, L. G.	2967	SEASONAL FLUCTUATION OF DERMATOBIA HOMINIS (DIPTERA: CUTEREBRIDAE) ON HIDES OF BUTCHERED BOVINES AT THE SLAUGHTERHOUSE OF PIRAI COUNTY, RIO DE JANEIRO, BRAZIL	II	749	21/08/00	16:30	CC		15	PS	15
Brito, L. G.	2968	STUDIES OF THE EFFECT OF CLIMATIC FACTORS ON SEASONAL FLUCTUATION OF DERMATOBIA HOMINIS (DIPTERA: CUTEREBRIDAE) ON SKINS OF BUTCHERED BOVINES AT THE SLAUGHTERHOUSE OF PIRAI COUNTY, RIO DE JANEIRO, BRAZIL	II	749	22/08/00	16:30	CC		15	PS	15
Brito, L. G.	2470	INFLUENCE OF DIFFERENT AGES OF FISH PUTREFATION ON THE POST EMBRIONIC DEVELOPMENT OF LUCÍLIA CUPRINA (DIPTERA:CALLIPHORIDAE) UNDER LABORATORY CONDITIONS	II	624	23/08/00	16:30	CC		13	PS	13
Brito, P.	1547	POSSIBILITIES FOR THE USE OF ENCARSIA HISPIDA DE SANTIS (HYMENOPTERA: APHELINIDAE) IN THE BIOLOGICAL CONTROL OF THE SPIRALLING WHITEFLIES ALEURODICUS DISPERSUS RUSSELL AND LECANOIDEUS FLOCCISSIMUS MARTIN ET AL. (HEMIPTERA: ALEYRODIDAE)	I	390	23/08/00	16:30	CC		8	PS	8
Brits, J. A.	645	SIRENE® 6.0 GS: ATTRACT AND KILL, A NOVEL WAY TO CONTROL CODLING MOTH WITH AN AGE OLD VICE	I	163	21/08/00	16:30	CC		4	PS	4
Brits, J. A.	2634	CRUISER® 70 WS: A NEW-LOOK NEONICOTINOID SEED TREATMENT FOR CEREAL CROPS.	II	665	22/08/00	16:30	CC		14	PS	14
Brits, J. A.	233	OVO LARVICIDAL EFFECTS OF LUFENURON TO POTATO TUBER MOTH, PHTHORIMAEA OPERCULELLA (ZELLER) (LEPIDOPTERA: GELECHIIDAE)	I	59	22/08/00	16:30	CC		2	PS	2
Brix, H. D.	1350	BAS 620 H - A NEW GRAMINICIDE FOR POST-EMERGENCE GRASS CONTROL IN BROADLEAF CROPS	I	341	23/08/00	16:30	CC		7	PS	7
Brlansky, R. H.	3224	TRANSMISSION OF CITRUS PATHOGENS FOREIGN TO THE U.S. BY ARTHROPODS ENDEMIC TO THE U.S. CONDUCTED UNDER HIGH QUARANTINE CONTAINMENT	II	814	22/08/00	16:30	CC		17	PS	17

Sub-titles: (HB=Hotel Bourbon) - (HM=Hotel Mabu) - (CC=Convention Center) - (Bol=Foz Boulevard) - (PS=Poster Session) - (PL=Plenary Lecturer)

AUTHOR	Nº	TITLE	Book	Page	Date	Time	Local	Room	Session	Symp	New Session
Broce, A. B.	4020	NEAR-INFRARED SPECTROSCOPY APPLIED TO DETECTING PARASITOIDS AND HIDDEN INSECT LARVAE, IDENTIFYING COLEOPTERA, AND CHRONOLOGICAL AGE-GRADING	II	1015	22/08/00	11:00	HB	J	23	3	23
Brock, H.	2380	NEUROPEPTIDE CONTROL OF INSECT HINDGUT REABSORPTION: RECENT MOLECULAR ADVANCES	II	601	25/08/00	11:05	HB	I	13	8	13
Brodbeck, B. V.	3219	NUTRITION AND DEVELOPMENT OF THE GLASSY-WINGED SHARPSHOOTER EXAMINED BY TRADITIONAL AND NOVEL NUTRITIONAL INDICES	II	813	21/08/00	16:30	CC		17	PS	17
Brodbeck, B. V.	3205	PHYSIOLOGICAL ADAPTATIONS OF LEAFHOPPERS THAT FEED ON XYLEM FLUID: EXPLORING NUTRIENT LIMITATIONS AS A COMPONENT OF INTEGRATED CROP MANAGEMENT	II	809	21/08/00	14:35	Bol	U	17	1	17
Brødsgaard, H. F.	824	INTERSPECIFIC INTERACTIONS AMONG ENTOMOPHAGOUS INSECTS IN PROTECTED CULTURES	I	208	22/08/00	16:05	HB	D	6	4	6
Broeck, J. V.	2345	MIMETIC INSECTATACHYKININ ANALOGS: INTERACTION WITH AN EXPRESSED STABLE FLY TACHYKININ-LIKE RECEPTOR AND ACTIVE CONFORMATION	II	592	21/08/00	15:05	HB	I	13	2	13
Broglio-Micheletti, S. M. F.	202	CERCONOTA ANONELLA (LEP., OECOPHORIDAE) IN SOURSOP (ANNONA MURICATA) IN ALAGOAS STATE, BRAZIL: OCCURRENCE AND CONTROL	I	52	21/08/00	16:30	CC		2	PS	2
Broning, H.	2591	MANAGEMENT STRATEGIES FOR BROWN CITRUS APHID AND CITRUS TRISTEZA VIRUS	II	655	24/08/00	15:20	HB	B	14	7	14
Brookes, C. P.	818	MOVEMENT OF APHID PARASITOIDS OVER DIFFERENT SPATIAL SCALES STUDIED USING MOLECULAR MARKERS	I	207	22/08/00	11:35	HB	D	6	3	6
Brookes, C. P.	147	STUDIES OF APHID MIGRATION USING MICROSATELLITE MARKERS	I	38	25/08/00	14:15	HB	A	2	9	2
Brotas, S.	2777	AN CONTRIBUTION TO IMPROVE THE IPM IN STONE FRUIT ORCHARDS IN PORTUGAL	II	701	25/08/00	16:30	CC		14	PS	14
Brothers, D. J.	1744	EVOLUTION OF APOSEMATIC SIGNALS IN MUTILLID WASPS (HYMENOPTERA)	I	439	23/08/00	11:45	HB	F	9	3	9
Broughton, S.	203	AREA-WIDE CONTROL OF MEDFLY (CERATITIS CAPITATA) IN CITRUS IN SOUTH WEST AUSTRALIA	I	52	22/08/00	16:30	CC		2	PS	2
Broughton, S.	1494	EFFECT OF ARTIFICIAL DEFOLIATION ON LANTANA GROWTH AND REPRODUCTION	I	377	21/08/00	16:30	CC		8	PS	8
Broussalis, A.	1310	IDENTIFICATION OF A CHEMICAL FRACTION FROM AROMATIC HERBS WITH INSECTICIDAL ACTIVITY AGAINST TRIBOLIUM CASTANEUM (COLEOPTERA, TENEBRIONIDAE)	I	331	21/08/00	16:30	CC		7	PS	7
Brower, A.V. Z.	3644	TO COLLABORATE, COMPETE, OR IGNORE?	II	920	22/08/00	16:30	HB	E	21	4	21
Brower, A.V. Z.	3698	PHYLOGENY OF NYMPHALIDAE, AS INFERRED FROM WINGLESS AND MTDNA SEQUENCES	II	934	26/08/00	11:35	HB	E	21	9	21
Brown Jr, K. S.	423	BUTTERFLIES AS INDICATORS FOR CONSERVATION IN FRAGMENTED LANDSCAPES IN THE NEOTROPICS	I	107	24/08/00	10:35	HB	C	3	5	3
Brown Jr., K. S.	469	CONSERVATION IN ANTHROPOGENIC LANDSCAPES IN THE NEOTROPICS: RICHNESS, COMPOSITION, SIMILARITY, AND ENVIRONMENTAL CORRELATES OF BUTTERFLY FAUNULAS	I	119	21/08/00	16:30	CC		3	PS	3
Brown Jr., K. S.	2195	CYTOGENETICS OF NEOTROPICAL BUTTERFLIES: PATTERNS OF EVOLUTIONARY DIVERSIFICATION IN CHROMOSOME NUMBERS	I	554	23/08/00	11:35	HB	L	12	5	12
Brown, J.	2937	CURRENT AND FUTURE APPLICATION TACHNOLOGY FOR MOSQUITO CONTROL	II	741	25/08/00	15:30	Bol	R	15	10	15
Brown, J. J.	106	THE POTENTIAL EFFECT OF UNITED STATES LEGISLATION, THE FOOD QUALITY PROTECTION ACT, ON INTERNATIONAL TRADE	I	28	23/08/00	9:35	HB	A	2	5	2
Brown, J. J.	3343	A NEW ARTIFICIAL DIET REDUCES THE DEVELOPMENTAL TIME OF HYLOBIUS TRANSVERSOVITTATUS BY A FACTOR OF FIVE	II	844	23/08/00	16:30	CC		18	PS	18
Brown, k.	428	URBAN FOREST RESERVES IN BRAZIL	I	109	24/08/00	13:35	HB	C	3	6	3
Brown, K. S.	3639	CONTRIBUTION OF JUVENILE, CHEMICAL, AND BEHAVIORAL CHARACTERS TO LEPIDOPTERAN SYSTEMATICS	II	919	22/08/00	14:25	HB	E	21	4	21
Brown, M. R.	2402	IDENTIFICATION OF TWO NEW BRAIN/MIDGUT PEPTIDES IN A MOSQUITO	II	607	21/08/00	16:30	CC		13	PS	13
Brown, M. R.	3252	ACTIVATION OF STEROIDOGENESIS IN FEMALE MOSQUITOES BY OVARY ECDYSTEROIDOGENIC HORMONE AND INSULIN	II	821	21/08/00	10:35	HB	K	18	1	18
Brown, S. J.	3071	MATERNAL VS ZYGOTIC CONTRIBUTIONS TO PATTERNING THE SHORT GERM EMBRYO OF TRIBOLIUM CASTANEUM	II	775	24/08/00	11:30	HB	G	16	6	16
Brown, S. L.	204	INFLUENCE OF CULTURAL PRACTICES ON PRE-HARVEST INFESTATIONS OF CORN BY MAIZE WEEVILS (SITOPHILUS ZEAMAIS)	I	52	21/08/00	16:30	CC		2	PS	2
Brown, S. L.	2635	DEVELOPMENT OF A METHOD OF RISK ASSESSMENT TO FACILITATE INTEGRATED MANAGEMENT OF SPOTTED WILT DISEASE OF PEANUT IN GEORGIA	II	666	22/08/00	16:30	CC		14	PS	14
Brown, S. L.	2566	SUCCESSES WITH PEANUT IPM IN THE SOUTHEASTERN UNITED STATES THROUGH INTERDISCIPLINARY APPROACHES	II	648	22/08/00	14:50	HB	B	14	4	14
Brown, V. K.	425	INSECTS AS INDICATORS OF SUBTLE, CLIMATE-INDUCED HABITAT FRAGMENTATION	I	108	24/08/00	11:20	HB	C	3	5	3
Brown, V. K.	3584	INSECTS ON CROWNS OF TABEBUIA OCHRACEA AND TABEBUIA AUREA IN NEOTROPICAL SAVANNAS: HOST SPECIFICITY AND HABITAT EFFECTS ON INSECT SPECIES RICHNESS AND ABUNDANCE	II	904	24/08/00	15:00	Bol	U	20	2	20
Brown, V. K.	426	INSECTS AS INDICATORS OF THE RESTORATION OF AGRICULTURAL LAND	I	108	24/08/00	11:35	HB	C	3	5	3
Broza, M.	907	COMMUNITIES OF SOIL COLLEMBOLA ON THE NORTH AND SOUTH FACING SLOPES OF A MEDITERRANEAN VALLEY	I	229	23/08/00	16:30	CC		6	PS	6
Brueckner, R.	2924	PREVENTION OF SPOROGONY OF PLASMODIUM VIVAX IN ANOPHELES DIRUS MOSQUITOES BY TRANSMISSION-BLOCKING ANTIMALARIALS	II	738	25/08/00	10:35	Bol	R	15	9	15
Bruin, A. S. De	717	FEMALE SEX PHEROMONE OF CASTNIA LICUS (LEPIDOPTERA:CASTNIIDEA): IDENTIFICATION AND FIELD APPLICATION	I	181	24/08/00	16:30	CC		4	PS	4
Brun-Barale, A.	1304	INVOLVEMENT OF VOLTAGE-DEPENDENT SODIUM CHANNELS IN DELTAMETHRIN RESISTANCE IN A STRAIN OF CYDIA POMONELLA	I	329	21/08/00	16:30	CC		7	PS	7
Brunner, J. F.	2543	SYSTEMWIDE BIOLOGICAL CHANGES: HARVESTING THE COLLATERAL BENEFITS OF AREAWIDE APPROACHES	II	643	21/08/00	11:30	HB	B	14	1	14
Brunner, J. F.	2552	MANAGEMENT OF CODLING MOTH WITH MASS TRAPPING, ATTRACT AND KILL, AND MATING DISRUPTION	II	645	21/08/00	15:50	HB	B	14	2	14
Brunner, J. F.	2636	MANAGEMENT OF CODLING MOTH WITH MASS TRAPPING, ATTRACT AND KILL, AND MATING DISRUPTION	II	666	21/08/00	16:30	CC		14	PS	14
Brunner, J. F.	120	SELECTIVE USE OF PARTICLE FILM TECHNOLOGY IN WASHINGTON POME FRUIT PEST MANAGEMENT	I	31	23/08/00	15:50	HB	A	2	6	2
Brunner, J. F.	2539	AREAWIDE MANAGEMENT OF LEPIDOPTEROUS PESTS IN PERENNIAL CROPPING SYSTEMS: OPPORTUNITIES AND CONSTRAINTS	II	642	21/08/00	9:35	HB	B	14	1	14
Bruyn, L. De	470	RESPONSES OF COLLEMBOLA COMMUNITIES TO LEAD SHOT DEPOSITIONS IN A HEATHLAND ENVIRONMENT	I	119	21/08/00	16:30	CC		3	PS	3
Bruyn, L. De	908	GENETIC AND SOIL NUTRIENT EFFECTS ON RESISTANCE OF COMMON REED TO A GALL-FORMER	I	229	21/08/00	16:30	CC		6	PS	6
Bruyn, L. De	1903	FOREST SOIL CLASSIFICATION BASED ON COLLEMBOLA FAUNA	I	480	22/08/00	16:30	CC		10	PS	10
Bruyn, L. De	1912	BEETLES, SPIDERS AND FLIES AS BIO-INDICATORS IN FORESTS: A LARGE SCALE RESEARCH PROJECT IN FLANDERS (BELGIUM)	I	482	21/08/00	16:30	CC		10	PS	10
Bruzzone, O. A.	496	GEOGRAPHIC RANGES AND PATTERNS OF DIVERSITY FOR PSEUDACTEON FLIES, PARASITOIDS OF SOLENOPSIS ANTS, FROM ARGENTINA AND BRAZIL	I	126	22/08/00	16:30	CC		3	PS	3
Bruzzone, O. A.	1528	PHENOLOGICAL PATTERNS FOR PARASITOIDS SPECIALIZED IN ATTACKING SOLENOPSIS FIRE ANTS, AT THE RESERVA ECOLÓGICA COSTANERA SUR, ARGENTINA	I	385	23/08/00	16:30	CC		8	PS	8
Bryce, J. R.	2909	NEW REGULATORY PROCEDURES FOR FILTH AND EXTRANEOUS MATERIALS IN FOOD	II	734	24/08/00	10:05	Bol	R	15	7	15

Sub-titles: (HB=Hotel Bourbon) - (HM=Hotel Mabu) - (CC=Convention Center) - (Bol=Foz Boulevard) - (PS=Poster Session) - (PL=Plenary Lecturer)

AUTHOR	Nº	TITLE	Book	Page	Date	Time	Local	Room	Session	Symp	New Session
Bryce, J. R.	3947	NEW REGULATORY PROCEDURES FOR FILTH AND EXTRANEOUS MATERIALS IN FOOD	II	996	21/08/00	16:30	CC		22	PS	22
Bryce, J. R.	2911	THE ROLE OF FLIES AS VECTORS OF SALMONELLA IN EGG FARM LAYER HOUSES	II	735	24/08/00	10:50	Bol	R	15	7	15
Buckland, A.	4023	THE EFFICACY OF THE INSECT GROWTH REGULATOR, FLUFENOXURON, FOR THE CONTROL OF MITE AND INSECT PESTS IN STORED GRAIN	II	1016	22/08/00	14:00	HB	J	23	4	23
Buckner, J. S.	1089	CHARACTERIZATION OF THE WAXY PARTICLES, AND THE PENETRATION AND FEEDING PROCESS OF WHITEFLIES	I	275	24/08/00	16:30	CC		6	PS	6
Buddenhagen, I. W.	3884	USING LANDRACES AS SOURCES OF RESISTANCE TO PESTS: EVOLUTIONARY AND ECOLOGICAL CONSIDERATIONS	II	980	22/08/00	14:05	HB	H	22	3	22
Buening, J.	3035	OOGENESIS IN COLEOPTERA AND NEUROPTERIDA: COMMON ROOTS	II	766	21/08/00	11:00	HB	G	16	1	16
Bueno, V. H. P	1636	PARASITISM RATE BY LYSIPHLEBUS TESTACEIPES (HYM.: APHIDIIDAE) ON SCHIZAPHIS GRAMINUM AND APHIS GOSSYPII (HEM.: APHIDIDAE)	I	412	24/08/00	16:30	CC		8	PS	8
Bueno, A. F.	3794	INVESTIGATION OF THE VALIDITY OF SPECIES STATUS OF IXODES DIDELPHIDIS (ACARI: IXODIDAE) USING THE SECOND INTERNAL TRANSCRIBED SPACER (ITS2) OF RIBOSOMAL DNA	II	958	23/08/00	16:30	CC		21	PS	21
Bueno, O. C.	3547	OBSERVATIONS ON BROOD CARE BEHAVIOR OF THE LEAF-CUTTING ANT ATTA SEXDENS (HYMENOPTERA: FORMICIDAE)	II	895	25/08/00	16:30	CC		19	PS	19
Bueno, O. C.	1309	METANOLIC EXTRACTS FROM DIMORPHANDRA MOLLIS (BARBATIMÃO) AND THEIR ACTIVITY IN WORKERS OF APIS MELLIFERA	I	330	21/08/00	16:30	CC		7	PS	7
Bueno, O. C.	2122	PIPERONYL DERIVATES BASED ON SESAMIN AND THEIR INHIBITION OF THE SYMBIOTIC FUNGUS OF LEAF-CUTTING ANTS	I	535	24/08/00	16:30	CC		11	PS	11
Bueno, O. C.	728	POLYSACCHARIDASES IN NESTS OF THE LEAF-CUTTING ANT ATTA SEXDENS	I	184	25/08/00	16:30	CC		4	PS	4
Bueno, O. C.	2149	ENZYME PRODUCTION BY THE FUNGUS SYMBIOTIC WITH THE ANT MYCETAROTES PARALLELUS	I	542	25/08/00	16:30	CC		11	PS	11
Bueno, O. C.	3433	GROWTH INHIBITION OF THE SYMBIOTIC FUNGUS OF ATTA SEXDENS, BY NATURAL PRODUCTS AND SYNTHETIC COMPOUNDS	II	867	23/08/00	11:35	HM	Q	19	4	19
Bueno, V. H. P.	1463	AUGMENTATION BIOLOGICAL CONTROL AS APPLIED IN LATIN AMERICA	I	369	24/08/00	11:05	HM	O	8	7	8
Bueno, V. H. P.	275	OCCURRENCE OF DEFOLIATOR CATTERPILARS (LEPIDOPTERA) ON EUCALYPTUS IN THE REGION OF LAVRAS-MG, BRAZIL	I	70	23/08/00	16:30	CC		2	PS	2
Bueno, V. H. P.	1639	FUNCIONAL AND NUMERICAL RESPONSE OF ORIUS INSIDIOSUS (HEMIPTERA:ANTHOCORIDAE) FED ON APHIS GOSSYPII (HEMIPTERA:APHIDIDAE)	I	413	24/08/00	16:30	CC		8	PS	8
Bueno, V. H. P.	1640	BIOLOGICAL ASPECTS AND PREDATION OF ORIUS INSIDIOSUS (HEMIPTERA:ANTHOCORIDAE) ON CALIOTHRIPS PHASEOLI (THYSANOPTERA: THRIPIDAE)	I	413	24/08/00	16:30	CC		8	PS	8
Bueno, V. H. P.	1645	PARASITISM OF APHIDIUS COLEMANI (HYMENOPTERA: APHIDIIDAE) IN DIFFERENT DENSITIES OF MYZUS PERSICAE (HEMIPTERA: APHIDIDAE)	I	415	24/08/00	16:30	CC		8	PS	8
Bueno, V. H. P.	1646	HOST PREFERENCE OF APHIDIUS COLEMANI (HYMENOPTERA:APHIDIIDAE) FOR MYZUS PERSICAE AND APHIS GOSSYPII (HEMIPTERA:APHIDIDAE)	I	415	24/08/00	16:30	CC		8	PS	8
Buffa, L. M.	909	HONEY ANTS ON THREE DIFFERENTS REWARDING ATTRACTANTS	I	230	21/08/00	16:30	CC		6	PS	6
Bulet, P.	2354	THE ROLE OF INNATE IMMUNE PEPTIDES TO REDUCE PARASITE DEVELOPMENT IN AEDES AEGYPTI	II	595	23/08/00	11:05	HB	I	13	4	13
Bull, N. J.	3471	INSURANCE AGAINST ORPHANING: A SOURCE OF FEMALE BIASED SEX ALLOCATION IN AN ALLODAPINE BEE	II	876	22/08/00	16:30	CC		19	PS	19
Bull, N. J.	3729	MOLECULAR PHYLOGENY, ECOLOGY AND SOCIAL EVOLUTION IN ALLODAPINE BEES	II	941	21/08/00	16:30	CC		21	PS	21
Bull, N. J.	3548	COMPLEXITY, NOT GROUP SIZE: A VERTEBRATE ANALOGUE IN THE LONG TERM SOCIAL EVOLUTION OF AUSTRALIAN ALLODAPINE BEES	II	895	25/08/00	16:30	CC		19	PS	19
Bull, R. M.	205	SELECTIVE TARGETING OF LOCUSTS WITH ULTRA-LOW DOSES OF FIPRONIL INSECTICIDE IN RANGELAND AND SORGHUM	I	52	21/08/00	16:30	CC		2	PS	2
Bull, R. M.	230	ANNIHILATION OF FOUR FRUIT FLY PEST SPECIES ON THE PACIFIC ISLAND OF NAURU USING FIPRONIL IN PASSIVE BAITING SYSTEMS	I	59	22/08/00	16:30	CC		2	PS	2
Bull, V. J.	2231	PREDATION AS A POST-MATING ISOLATION MECHANISM IN HELICONIUS CYDNO AND H.MELPOMENE	I	563	21/08/00	16:30	CC		12	PS	12
Bulla, L.	471	WHICH IS AN ADEQUATE DIVERSITY INDEX FOR INSECT COLLECTIONS?	I	119	22/08/00	16:30	CC		3	PS	3
Bulla, L.	1904	THE EFFECT OF THE INTRODUCTION OF A PINUS CARIBAEA PLANTATION ON THE ANTS POPULATIONS OF VENEZUELAN SAVANNAS	I	480	21/08/00	16:30	CC		10	PS	10
Bulla, L.	918	EARLY-MID SUCCESSIONAL TROPHIC PATTERNS IN AN ARTHROPOD COMMUNITY OF SAVANNA ECOSYSTEMS	I	232	21/08/00	16:30	CC		6	PS	6
Bulla, L.	1974	TROPHIC PATTERNS IN AN INSECT COMMUNITY OF PINE FOREST AND SAVANNA ECOSYSTEMS	I	497	25/08/00	16:30	CC		10	PS	10
Bullet, P.	2351	GOMESIN, AN ANTIMICROBIAL PEPTIDE OF THE SPIDER HEMOCYTES: SPECTRUM OF ACTIVITY AND cDNA CLONING	II	594	23/08/00	10:05	HB	I	13	4	13
Bullet, P.	4154	GOMESIN, AN ANTIMICROBIAL PEPTIDE OF THE SPIDER HEMOCYTES: SPECTRUM OF ACTIVITY AND cDNA CLONING	II	1049	21/08/00	16:30	CC		Erratum	PS	13
Bultman, T. L.	849	EFFECT OF ENDOPHYTES ON THE DICHOTOMY BETWEEN TOLERANCE AND DEFENSE IN FORAGES GRASSES	I	215	23/08/00	10:35	HB	D	6	6	6
Buma, M. O. S.	746	COMPUTERIZED VIDEO TRACKING, MOVEMENT ANALYSIS AND BEHAVIOR RECOGNITION IN INSECTS	I	188	21/08/00	10:55	Bol	T	5	1	5
Büning, J.	3036	THE OVARY STRUCTURE AND OOGENESIS IN MECOPTERANS	II	766	21/08/00	11:15	HB	G	16	1	16
Büning, J.	3365	VIVE LA DIFFERENCE! FUSOMES AND RING CANALS IN POLYTROPHIC INSECT OVARIES	II	850	24/08/00	16:30	CC		18	PS	18
Büning, J.	3040	GERM LINE AND SOMA DIFFERENTIATION IN BGCN MUTANT DROSOPHILA OVARIES	II	767	21/08/00	14:30	HB	G	16	1	16
Büning, J.	3378	CYTOSKELETON DYNAMICS DURING SPERMATOGENESIS IN APIS MELLIFERA DRONES	II	853	25/08/00	16:30	CC		18	PS	18
Buntin, G. D.	3948	ASSESSMENT OF TRANSGENIC Bt RESISTANCE FOR CONTROL OF FALL ARMYWORM AND CORN EARWORM INFESTATIONS AND REDUCING AFLATOXIN CONTAMINATION OF CORN	II	996	21/08/00	16:30	CC		22	PS	22
Burd, J. D.	464	BIOTYPIC AND GENOTYPIC DIVERSITY OF GREENBUGS: HOST ADAPTED OR CULTIVAR SELECTED	I	118	21/08/00	16:30	CC		3	PS	3
Burger, J. C.	910	PATTERNS AND PROCESSES OF ARTHROPOD COMMUNITY SUCCESSION AFTER A FIRE	I	230	21/08/00	16:30	CC		6	PS	6
Burger, J. C.	1103	DIPTERA COMMUNITY COMPOSITION AND SUCCESSION FOLLOWING HABITAT DISTURBANCE BY WILDFIRE	I	278	21/08/00	16:30	CC		6	PS	6
Burkholder, W. E.	1749	ANALYSIS OF SOME IMPORTANT FACTORS AFFECTING OVIPOSITION AND LONGEVITY OF THE ECTOPARASITIC WASP LAELIUS PEDATUS (HYMENOPTERA: BETHYLIDAE), A PARASITOID OF DERMESTIDE PESTS	I	441	21/08/00	16:30	CC		9	PS	9
Burt, P. J. A.	1133	MIGRATIONS OF LOCUSTS OUT OF THEIR NORMAL RANGE	I	286	24/08/00	16:30	CC		6	PS	6
Buschman, L. L.	911	DISPERSAL OF EUROPEAN AND SOUTHWESTERN CORN BORER MOTHS WITHIN AND BETWEEN CORNFIELDS	I	230	21/08/00	16:30	CC		6	PS	6
Buschman, L. L.	254	SOYBEAN STEM BORER IN KANSAS: LIFE HISTORY, SAMPLING, AND SEVERITY OF RECENT INFESTATIONS	I	65	23/08/00	16:30	CC		2	PS	2
Buso, J. A.	2739	ENVIRONMENT PROTECTION THROUGH RESISTANT POTATO: RESEARCH, EDUCATION AND DELIVERING INFORMATION IN BRAZIL	II	692	23/08/00	16:30	CC		14	PS	14
Busoli, A. C.	244	DAMAGE LEVELS AND EVALUATION OF COTTON YIELD LOSSES CAUSED BY ANTHONOMUS GRANDIS (COLEOPTERA: CURCULIONIDAE)	I	62	23/08/00	16:30	CC		2	PS	2

Sub-titles: (HB=Hotel Bourbon) - (HM=Hotel Mabu) - (CC=Convention Center) - (Bol=Foz Boulevard) - (PS=Poster Session) - (PL=Plenary Lecturer)

AUTHOR	Nº	TITLE	Book	Page	Date	Time	Local	Room	Session	Symp	New Session
Busoli, A. C.	4178	INFLUENCE OF TEMPERATURE ON DEVELOPMENT OF IMMATURE Pentilia egena MULSANT (COLEOPTERA : COCCINELLIDAE)	II	1055	22/08/00	16:30	CC		Erratum	PS	8
Busoli, A. C.	3515	#N/D	#N/D	#N/D	#N/D	#N/D	#N/D	#N/D	#N/D	#N/D	#N/D
Bustamante, C.	1097	MODELLING THE POPULATION DYNAMICS OF ATHERIGONA ORIENTALIS (DIPTERA, MUSCIDAE)	I	277	25/08/00	16:30	CC		6	PS	6
Bustamante, J.	2397	EFFECT OF PHLOXIN "B" INGESTION IN IMMATURE STAGES OF THE MEDFLY, CERATITIS CAPITATA	II	606	21/08/00	16:30	CC		13	PS	13
Bustillo, A. E.	329	SPATIAL DISTRIBUTION OF THE COFFEE BERRY BORER HYPOTHENEMUS HAMPEI ON COFFEE TREES, ANS ITS IMPLICATIONS FOR SAMPLING	I	83	24/08/00	16:30	CC		2	PS	2
Bustillo, A. E. P.	2527	DIGESTIVE ALPHA-AMYLASES FROM COFFEE BERRY BORER (HYPOTHENEMUS HAMPEI) AND THEIR INHIBITION BY AMYLASE INHIBITORS FROM PLANTS.	II	638	25/08/00	16:30	CC		13	PS	13
Bustillo, A. E. P.	3329	IN VITRO DEVELOPMENT OF COFFEE BERRY BORER (HYPOTHENEMUS HAMPEI) IN AN FREEZE DRY DIET	II	841	22/08/00	16:30	CC		18	PS	18
Buszczak, M.	3301	ECDYSTEROID-TRIGGERED REGULATORY HIERARCHIES IN INSECT REPRODUCTION	II	834	25/08/00	14:05	HB	K	18	7	18
Butignol, C. A.	912	BIOLOGY OF THE LEAF GALL MAKER NEOTRIOZA TAVARESI IN STRAWBERRY GUAVA TREE	I	230	21/08/00	16:30	CC		6	PS	6
Butignol, C. A.	913	PREFERENCES OF LEAF GALL MAKER NEOTRIOZA TAVARESI IN DIFFERENT SHOOTING STAGES OF THE STRAWBERRY GUAVA TREE	I	231	21/08/00	16:30	CC		6	PS	6
Butler, J.	3890	MESSENGER TM: INTRODUCING A NEW PROTEIN CHEMISTRY TO AGRICULTURE	II	982	24/08/00	15:00	HB	H	22	4	22
Butler, L.	1877	MACROLEPIDOPTERA OF EASTERN NORTH AMERICAN DECIDUOUS FORESTS: ASSOCIATIONS WITH HOST TREES AND PARASITOIDS IN THE CENTRAL APPALACHIAN MOUNTAINS	I	473	25/08/00	15:05	HB	M	10	8	10
Butovski, R. O.	2421	ENZYME ACTIVITIES IN ARTHROPODA COLLECTED FROM HEAVY METAL POLLUTED SITES	II	612	22/08/00	16:30	CC		13	PS	13
Buzzi , Z. J.	3856	SYSTEMATIC POSITION OF TWO POLYMORPHIC SPECIES OF CHELYMORPHA BOH. (COLEOPTERA: CHRYSOMELIDAE: CASSIDINAE)	II	973					21		21
Buzzi, Z. J.	4127	SYSTEMATIC POSITION OF TWO POLYMORPHIC SPECIES OF CHELYMORPHA BOH. (COLEOPTERA: CHRYSOMELIDAE: CASSIDINAE)	II	1042	25/08/00	13:40	HM	P	24	2	24
Byers, J. A.	646	BARK BEETLE RESPONSE TO AGGREGATION PHEROMONE INHIBITED BY MONOTERPENES RELEASED BY A PIEZOELECTRIC SPRAYER	I	163	21/08/00	16:30	CC		4	PS	4
Byers, J. A.	914	PREDICTING MEAN DISPERSAL DISTANCE OF POPULATIONS USING CORRELATED RANDOM WALK EQUATIONS RESOLVED BY SIMULATION	I	231	22/08/00	16:30	CC		6	PS	6
Byrne, D.	815	SHORT-RANGE MIGRATION BY BEMISIA WHITEFLIES	I	206	22/08/00	10:50	HB	D	6	3	6
Byrne, D. N.	2037	DISPERSAL CAPABILITIES OF THE WHITEFLY PARASITOID, ERETMOCERUS EREMICUS	I	514	24/08/00	11:30	HB	F	11	3	6
Byrne, M. J.	1495	CLIMATIC CONSTRAINTS ON BIOCONTROL AGENTS: TRICHILOGASTER ACAIALONGIFOLIAE IN SOUTH AFRICA	I	377	22/08/00	16:30	CC		8	PS	8
Byrne, M. J.	3127	DUNG BEETLE SPIRACLES: DIFFERENT APPROACHES TO THE SAME PROBLEM	II	789	22/08/00	16:30	CC		16	PS	16
C. Adler	3949	EXTREME TEMPERATURES FOR RAPID AND NON-TOXIC STORED PRODUCT PROTECTION	II	997	21/08/00	16:30	CC		22	PS	22
C. Adler	4053	EFFICACY OF CHENOPODIUM AMBROSIOIDES, PIPER GUINENSE, AND XYLOPIA AETHIOPICA AS GRAIN PROTECTANTS AGAINST STORED PRODUCT PESTS	II	1023	24/08/00	14:00	HB	J	23	9	23
C. Berón	2038	CHARACTERIZATION OF A BACILLUS THURINGIENSIS STRAIN TOXIC AGAINST LEPIDOPTERANS AND COLEOPTERANS	I	514	21/08/00	16:30	CC		11	PS	11
C. C. Labandeira	3078	HOW HAVE INSECTS PARTITIONED THEIR FOOD RESOURCE WORLD DURING THE PAST 420 MILLION YEARS?	II	777	25/08/00	9:45	HB	G	16	7	16
C. Cruz-Landim	2537	CALYX CELLS AND POLYDNAVIRUS (PDV) PRODUCTION IN THE OVARY OF COTESIA FLAVIPES (HYMENOPTERA, BRACONIDAE)	II	641	25/08/00	16:30	CC		13	PS	13
C. K. Gerber	1496	PREDATION OF PHYLLOPHAGA (COLEOPTERA: SCARABAEIDAE) EGGS IN NO-TILL AND CONVENTIONAL-TILL MAIZE.	I	377	21/08/00	16:30	CC		8	PS	8
C. Wilsher	3677	TOWARDS A MOLECULAR PHYLOGENY OF SCARABAEID DUNG BEETLES	II	928	24/08/00	16:05	HB	E	21	7	21
C.Corallini	2969	OBSERVATIONS ON SOME COLEOPTERA DERMESTIDAE SPECIES OF ZOOTECHNICAL INTEREST IN UMBRIA,CENTRAL ITALY	II	749	21/08/00	16:30	CC		15	PS	15
Caballero, P. P.	915	DOES GALLING AND FOLIVOROUS INSECTS SUPPORT THE RESOURCE CONCENTRATION HYPOTHESIS? THE CASE OF SCHINUS POLYGAMUS (ANACARDIACEAE)	I	231	21/08/00	16:30	CC		6	PS	6
Caballero, P. P.	2232	GENETIC CONSTRAINTS IN THE SPECIALIZATION PATTERN OF AN APHID	I	563	22/08/00	16:30	CC		12	PS	12
Cabral, F.	916	EFFECT OF LARVAL DIETS ON THE SENSIVITY OF ANAGASTA KUEHNIELLA (LEPIDOPTERA, PYRALIDAE) TO MICROWAVES RADIATION (2.450 MHz)	I	231	21/08/00	16:30	CC		6	PS	6
Cabral, F.	1005	COMPARATIVE BIOLOGY OF ANAGASTA KUEHNIELLA (LEPIDOPTERA, PYRALIDAE) FED ON THREE DIFFERENT DIETS BASED ON WHEAT GRAINS	I	254	22/08/00	16:30	CC		6	PS	6
Cabrera, G.	2045	A NEW FUNGAL ISOLATE FOR THE CONTROL OF DIABROTICA SPECIOSA	I	516	21/08/00	16:30	CC		11	PS	11
Cabrera, N. C.	3594	HOST PLANTS OF ARGENTINEAN GALERUCINAE (COLEOPTERA, CHRYSOMELIDAE)	II	907	21/08/00	16:30	CC		20	PS	20
Caccone, A.	3705	PHYLOGENY, EVOLUTIONARY RATES, AND MORPHOLOGICAL ADAPTATION TO CAVE LIFE IN BATHYSCIINE BEETLES: CALIBRATING THE CLOCK FROM THE MITOCHONDRIAL COI GENE	II	935	26/08/00	15:35	HB	E	21	10	21
Cáceres, A. L.	2963	TAXONOMIC AND PHYLOGENETIC STUDIES OF PERUVIAN LUTZOMYIA SPECIES BASED ON MOLECULAR DATA	II	748	21/08/00	16:30	CC		15	PS	15
Caceres, C.	2226	GENETIC AND MOLECULAR APPROACHES IN SUPPORT OF THE STERILE INSECT TECHNIQUE	I	562	25/08/00	11:05	HB	L	12	11	12
Cáceres, M.	2197	NATURAL SELECTION EFFECTS ON INVERSION SIZE IN DIPTERA	I	555	23/08/00	14:05	HB	L	12	6	12
Cáceres, M.	2213	TRANSPOSONS ARE IMPLICATED IN THE GENERATION OF NATURAL CHROMOSOMAL REARRANGEMENTS IN INSECTS	I	559	24/08/00	16:15	HB	L	12	8	12
Cáceres, S.	1497	CURRENT STATUS OF CITRUS LEAFMINER AND ITS PARASITOIDS IN CORRIENTES (ARGENTINA)	I	378	21/08/00	16:30	CC		8	PS	8
Cade, W. H.	1739	SEXUAL SELECTION, SPECIES ISOLATION, AND CHARACTER DISPLACEMENT IN MALE SONG AND FEMALE PREFERENCE FOR SONG IN THE FIELD CRICKET GRYLLUS TEXENSIS	I	438	23/08/00	10:30	HB	F	9	3	9
Cade, W. H.	1759	WHAT IS SEXY ABOUT FIELD CRICKET COURTSHIP SONG?	I	443	21/08/00	16:30	CC		9	PS	9
Cadima, J.	168	GENERAL PATTERN OF BUMBLEBEE VISITS TO TOMATO FLOWERS IN GREENHOUSE CONDITIONS	I	43	21/08/00	16:30	CC		2	PS	2
Cadima, J.	334	PATTERN OF BUMBLEBEE VISITS TO GREENHOUSE MUSKMELON FLOWERS	I	85	25/08/00	16:30	CC		2	PS	2
Caetano, L. M.	4069	BEHAVIOUR'S ESTIMATION OF PANSTRONGYLUES MEGISTUS (HEMIPTERA-REDUVIIDAE) UNDER THE ACTION OF LIME (CAOH)	II	1027	21/08/00	16:30	CC		23	PS	23
Caetano, A. C.	628	EFFECTS OF SQUASH GENOTYPES ON BIOLOGY AND FEEDING PREFERENCE OF LEPTOGLOSSUS GONAGRA	I	159	21/08/00	16:30	CC		4	PS	4
Caetano, A. C.	629	RESISTANCE OF FRUITS OF PASSION FRUIT GENOTYPES TO ANISOSCELES FOLIACEA MARGINELLA	I	159	21/08/00	16:30	CC		4	PS	4
Caetano, A. C.	630	ATTRACTIVITY OF PASSION FRUIT GENOTYPES TO Hothyinenia histrio AND FEEDING PREFERENCE	I	159	21/08/00	16:30	CC		4	PS	4
Caetano, A. C.	2861	EFFICIENCY OF THIAMETHOXAM TO CONTROL ONCOMETOPIA FACIALIS (HEMIPTERA: CICADELLIDAE) IN CITRUS	II	722	25/08/00	16:30	CC		14	PS	14
Caetano, F. H.	3114	THE ULTRAMORPHOLOGY OF THE RECTAL PADS OF MALE OF THE ANTS ATTA SEXDENS RUBROPILOSA: A UNUSUAL FEATURE	II	786	21/08/00	16:30	CC		16	PS	16
Caetano, F. H.	3104	ULTRAMORPHOLOGY OF THE MIDGUT OF SOLENOPSIS SAEVISSIMA (FORMICIDAE: MYRMICINAE)	II	783	21/08/00	16:30	CC		16	PS	16

Sub-titles: (HB=Hotel Bourbon) - (HM=Hotel Mabu) - (CC=Convention Center) - (Bol=Foz Boulevard) - (PS=Poster Session) - (PL=Plenary Lecturer)

AUTHOR	Nº	TITLE	Book	Page	Date	Time	Local	Room	Session	Symp	New Session
Caetano, F. H.	3115	RHYNCOPHORUS PALMARUM A MORPHOLOGICAL AND ULTRASTRUCTURAL STUDY OF FEMALE REPRODUCTOR SYSTEM (COLEOPTERA)	II	786	21/08/00	16:30	CC		16	PS	16
Caetano, F. H.	3155	COMPARATIVE ULTRAMORPHOLOGY OF THE HEART OF DOLICHODERUS AND CAMPONOTUS (FORMICIDAE)	II	796	23/08/00	16:30	CC		16	PS	16
Caetano, F. H.	3173	ULTRAMORPHOLOGY OF THE ECTAL MANDIBULAR GLAND OF POLISTES VERSICOLOR (HYMENOPTERA: VESPIDAE)	II	800	24/08/00	16:30	CC		16	PS	16
Caetano, F. H.	3174	ULTRAMORPHOLOGY OF THE ECTAL MANDIBULAR GLAND OF POLISTES VERSICOLOR (HYMENOPTERA: VESPIDAE)	II	801	24/08/00	16:30	CC		16	PS	16
Caetano, F. H.	3202	THE SALIVARY GLANDS OF PACHYCONDYLA (= NEOPONERA) VILLOSA (HYMENOPTERA: FORMICIDAE) LARVA: FUNCTIONAL CHANGES IN LAST INSTAR	II	808	25/08/00	16:30	CC		16	PS	16
Caetano, F. H.	3129	ULTRAMORPHOLOGY OF THE HYPOPHARYNGEAL GLANDS OF POLISTES VERSICOLOR (HYMENOPTERA; VESPIDAE)	II	789	22/08/00	16:30	CC		16	PS	16
Caetano, W.	206	EFFECT DIFFERENT DOSES OF THE INSECTICIDE CRUIZER FOR CONTROL OF THE "LARVA-PIN" DIABROTICA SPECIOSA (COL.; CHRYSOMELIDAE) IN MAIZE CULTIVATION	I	53	21/08/00	16:30	CC		2	PS	2
Caetano, W.	196	DILOBODERUS ABDERUS (COL. SCARABAEIDAE) CONTROL THROUGH SEED WITH GAUCHO 600 FS IN WHEAT AND BARLEY ON RS	I	50	21/08/00	16:30	CC		2	PS	2
Caetano, W.	197	EFFICIENCY OF INSECTICIDE CRUISER IN THE CONTROL OF DILOBODERUS ABDERUS (COL. SCARABAEIDAE) BY SEED TREATMENT IN THE WHEAT, OAT, AND BARLEY	I	50	21/08/00	16:30	CC		2	PS	2
Caffarini, P.	3606	EFFECT OF INTERCROP WITH CHINESE BEET (BRASSICA JUNCEA) ON THE ABUNDANCE OF BREVICORYNE BRASSICAE AND THE QUALITY OF CABBAGE (BRASSICA OLERACEA VAR. CAPITATA)	II	910	24/08/00	16:30	CC		20	PS	20
Caffarini, P.	1905	WATER STRESS EFFECT ON WORKER CUTTING-ANTS OF ACROMYRMEX HISPIDUS ON THREE ORIGINS OF EUCALYPTUS GLOBULUS GLOBULUS	I	480	21/08/00	16:30	CC		10	PS	10
Cafferata, L. F. R.	2991	CHARACTERIZATION AND CARBON METABOLISM IN FUNGI PATHOGENOUS TO CHAGAS DISEASE VECTORS	II	755	23/08/00	16:30	CC		15	PS	15
Cagnolo, L.	1071	DIVERSITY AND FUNCTIONAL STRUCTURE OF INSECT COMMUNITIES UNDER GRAZING AND EXCLUSION REGIMES IN A MONTANE ARGENTINE GRASSLAND	I	270	23/08/00	16:30	CC		6	PS	6
Cagnon, C.	2210	TRANSPOSABLE ELEMENTS IN CULICINES MOSQUITO GENOMES : CLASSICAL AND ODD STRUCTURES, HIGH COPY NUMBER AND ROLE IN POPULATION POLYMORPHISM	I	558	24/08/00	15:15	HB	L	12	8	12
Cagnon, C.	2247	RAPID GENOME SHUFFLING BY TRANSPOSABLE ELEMENTS: WHAT CAN WE LEARN FROM CULEX PIPIENS MOSQUITOES?	I	567	21/08/00	16:30	CC		12	PS	12
Cai, Q. X.	2935	MICROBIAL PESTICIDES FOR MOSQUITO CONTROL IN CHINA: CURRENT AND FUTURE CONSIDERATIONS	II	741	25/08/00	15:00	Bol	R	15	10	15
Cailliez, J. C.	2400	IMMUNOHISTOCHEMICAL CONTRIBUTION TO THE STUDY OF MORPHINE METABOLISM IN CALLIPHORIDAE LARVAE AND IMPLICATIONS IN FORENSIC ENTOMOTOXICOLOGY	II	606	21/08/00	16:30	CC		13	PS	13
Caires, C. S	1683	CANDIDATE INSECTS FOR THE BIOCONTROL OF THE PLANT PHYTOPARASITE PSITTACANTHUS SP. (LORANTHACEAE) IN THE REGION OF THE PANTANAL, MATO GROSSO DO SUL STATE, BRAZIL	I	424	25/08/00	16:30	CC		8	PS	8
Caires, C. S.	2844	FRUIT FLIES AND FRUGIVOROUS LONCHAEIDAE (DIPTERA: TEPHRITOIDEA) ON URBAN HOSTS IN TWO CITIES OF THE STATE OF MATO GROSSO DO SUL, BRAZIL	II	718	25/08/00	16:30	CC		14	PS	14
Calado, D. C.	2970	EFFECT OF CONSTANT TEMPERATURES ON THE DEVELOPMENT AND VIABILITY OFAEDES ALBOPICTUS IMMATURES STAGES, FROM REGISTRO (SÃO PAULO BRAZIL)	II	749	21/08/00	16:30	CC		15	PS	15
Calado, D. C.	2971	TERMICS EXIGENCY, LONGEVITY AND REPRODUCTIVE ASPECTS OF AEDES ALBOPICTUSAT LABORATORY CONDITIONS	II	750	21/08/00	16:30	CC		15	PS	15
Calafiori, M. H.	2660	INFLUENCE OF ZINC ON THE WHITEFLY, BEMISIA TABACI, IN BEAN (PHASEOLUS VULGARIS) PLANT	II	672	21/08/00	16:30	CC		14	PS	14
Calafiori, M. H.	2770	EFFECT OF POTASSIUM FOR THE CONTROL OF WHITEFLY, BEMISIA TABACI (GENN., 1889) B GENOTYPE IN COTTON (GOSSYPIUM HIRSUTUM L.) PLANT	II	699	24/08/00	16:30	CC		14	PS	14
Calafiori, M. H.	2837	INFLUENCE OF PHOSPHORUS GRADES IN DIFFERENT VARIETIES OF CORN (ZEA MAYS) ON THE FALL ARMYWORM (SPODOPTERA FRUGIPERDA) GROWTH	II	716	25/08/00	16:30	CC		14	PS	14
Calafiori, M. H.	217	EFFECT OF PYRIPROXYFEN ON WHITEFLY (BEMISIA ARGENTIFOLII) EGGS, IN THE EGGPLANT (SOLANUM MELOGENA), IN FIELD CONDITIONS	I	55	22/08/00	16:30	CC		2	PS	2
Calafiori, M. H.	2043	EFFECT OF BACILLUS THURINGIENSIS, SUBSP. AIZAWAI FOR THE CONTROL OF PLUTELLA XYLOSTELLA ON CAULIFLOWER, BRASSICA OLERACEA	I	515	21/08/00	16:30	CC		11	PS	11
Calafiori, M. H.	2637	EFFECTS OF SEED TREATMENT WITH INSECTICIDE ON THE GERMINATION, NUTRIENTS, NODULATION, YIELD AND PEST CONTROL IN BEAN (PHASEOLUS VULGARIS) CULTURE	II	666	21/08/00	16:30	CC		14	PS	14
Calafiori, M. H.	2735	TONIC EFFECT OF SOIL INSECTICIDE ON THE COFFEE (COFFEA ARABICA) PLANT AND ITS COST-BENEFICE	II	691	23/08/00	16:30	CC		14	PS	14
Calampa, C.	2903	SPATIAL AND TEMPORAL HETEROGENEITY IN DENGUE VIRUS TRANSMISSION AND AEDES AEGYPTI POPULATION DENSITIES IN IQUITOS, PERU	II	733	23/08/00	14:35	Bol	R	15	6	15
Calcagno, A.	1925	THE ASSOCIATED FAUNA COMPOSITION AT THE EUPHALERUS SP (HEMIPTERA:PSYLLIDAE), IN SEROPÉDICA, RJ, BRAZIL	I	485	22/08/00	16:30	CC		10	PS	10
Caldas, A.	2233	GENETIC MARKERS IN CONGENERIC HERBIVORES: FINE-SCALE POPULATION STRUCTURE	I	564	21/08/00	16:30	CC		12	PS	12
Caldas, A.	536	GEOGRAPHIC DISTRIBUTION AND PHENOLOGY OF FIELD PLANTS AS PARAMETERS OF TROPHIC RESOURCES IN NEOTROPICAL ENTOMOTAXOCENOSES	I	136	22/08/00	16:30	CC		3	PS	3
Caldas, A.	894	COMPARISON OF THE MACROLEPIDOPTERAN ASSEMBLAGES OF SALIX NIGRA AND ACER NEGUNDO: A STORY OF CATERPILLARS, PLANTS, PARASITOIDS, AND PREDATORS	I	226	21/08/00	16:30	CC		6	PS	6
Caldas, A.	1423	HERBIVORE AND NATURAL ENEMY ASSEMBLAGE STRUCTURE: INFLUENCE ON TRI-TROPHIC INTERACTIONS AND BIOLOGICAL CONTROL	I	359	21/08/00	11:05	HM	O	8	1	8
Caldas, A.	1876	COMPARISON OF THE MACROLEPIDOPTERAN ASSEMBLAGES OF SALIX NIGRA AND ACER NEGUNDO: A STORY OF CATERPILLARS, PLANTS, PARASITOIDS, AND PREDATORS	I	473	25/08/00	14:35	HB	M	10	8	10
Caldas, R. C.	3543	CONTROL OF UNDERGROUND TERMITES AMITERMES SP. (ISOPTERA: TERMITIDAE, TERMITINAE) ON PINEAPPLE CROP IN SEMIARID ZONE OF NORTHEAST BRAZIL	II	894	25/08/00	16:30	CC		19	PS	19
Caldeira Castro, F. M.	836	RESOURCE ALLOCATION VERSUS SEASONAL VARIATIONS AND THE COMMUNITY OF GALLING-INSECTS ON THE TROPICAL DIOECIOUS SHRUB BACCHARIS CONCINNA (ASTERACEAE)	I	211	23/08/00	13:45	HB	D	6	5	6
Calderón, G.	2991	CHARACTERIZATION AND CARBON METABOLISM IN FUNGI PATHOGENOUS TO CHAGAS DISEASE VECTORS	II	755	23/08/00	16:30	CC		15	PS	15
Caleca, V.	2638	ASSESSMENT OF DAMAGE DUE TO PHYLLOCNISTIS CITRELLA STAINTON IN CITRUS NURSERIES IN SICILY; GROWTH DELAY, ESTHETICAL DAMAGE AND ECONOMIC INJURY LEVELS	II	666	21/08/00	16:30	CC		14	PS	14
Calegaro, P.	1414	THIACLOPRID - FIRST EXPERIENCES WITH THE NOVEL INSECTICIDE IN BRAZIL	I	357	25/08/00	16:30	CC		7	PS	7
Calil, E. R.	3731	KEY TO THE GENERA OF ANISOPTERA (ODONATA) LARVAE OCCURRING IN THE STATES OF RIO DE JANEIRO AND SÃO PAULO, BRAZIL	II	942	21/08/00	16:30	CC		21	PS	21
Calkins, C.	2539	AREAWIDE MANAGEMENT OF LEPIDOPTEROUS PESTS IN PERENNIAL CROPPING SYSTEMS: OPPORTUNITIES AND CONSTRAINTS	II	642	21/08/00	9:35	HB	B	14	1	14
Callaini, G.	3091	THE CENTRIOLE IN INSECT SPERMATOZOA	II	780	26/08/00	9:35	HB	G	16	9	16

Sub-titles: (HB=Hotel Bourbon) - (HM=Hotel Mabu) - (CC=Convention Center) - (Bol=Foz Boulevard) - (PS=Poster Session) - (PL=Plenary Lecturer)

AUTHOR	Nº	TITLE	Book	Page	Date	Time	Local	Room	Session	Symp	New Session
Callegari, O.	172	EFFICIENCY OF DIFFERENT INSECTICIDES IN THE CONTROL OF THRIPS, FRANKLINIELLA SCHULTZEI, IN LETTUCE	I	44	21/08/00	16:30	CC		2	PS	2
Callegari, O.	173	EFFICIENCY OF INSECTICIDES IN THE CONTROL OF PECTINOPHORA GOSSYPIELLA IN COTTON CROP	I	44	22/08/00	16:30	CC		2	PS	2
Callegari, O.	171	AGRONOMIC EFFICIENCY OF INSECTICIDES AT DIFFERENT RATES TO THE CONTROL OF STERNECHUS SUBSIGNATUS IN SOYBEAN	I	44	21/08/00	16:30	CC		2	PS	2
Calvo, E.	2234	PROTEIN PURIFICATION AND cDNA CLONING OF SALIVARY GLANDS COMPONENTS OF ANOPHELES DARLINGI	I	564	21/08/00	16:30	CC		12	PS	12
Calzolari, A	3492	THE USE OF HONEYBEES (APIS MELLIFERA) AS INDICATORS FOR THE PRESENCE OF THE PHYTOPATHOGEN BACTERIUM ERWINIA AMYLOVORA IN THE ENVIRONMENT	II	881	22/08/00	16:30	CC		19	PS	19
Camacho V., H.	4046	INTEGRATED HOUSE FLY MANNAGEMENT IN COSTA RICA	II	1022	24/08/00	10:30	HB	J	23	8	23
Camargo, F. R. A. de	1945	IMPACT OF DEFOLIATION BY COSTALIMAITA FERRUGINEA (COLEOPTERA: CHRYSOMELIDAE) IN EUCALYPTUS GRANDIS HILL EX MAIDEN	I	490	23/08/00	16:30	CC		10	PS	10
Camargo-Dietrich, C. R. R. de	222	THE USE OF ABOVE GROUND HEXAFLUMURON BAITS IN THE ELIMINATION OF A COPTOTERMES HAVILANDI COLONY LOCATED IN RIO CLARO, SP, BRAZIL (ISOPTERA, RHINOTERMITIDAE)	I	57	22/08/00	16:30	CC		2	PS	2
Camargo-Dietrich, C. R. R. de	940	FORAGING POPULATION ESTIMATES FOR TWO COLONIES OF COPTOTERMES HAVILANDI (ISOPTERA, RHINOTERMITIDAE) USING MARK-RECAPTURE STUDIES	I	237	21/08/00	16:30	CC		6	PS	6
Camargo-Mathias, M. I.	3115	RHYNCOPHORUS PALMARUM A MORPHOLOGICAL AND ULTRASTRUCTURAL STUDY OF FEMALE REPRODUCTOR SYSTEM (COLEOPTERA)	II	786	21/08/00	16:30	CC		16	PS	16
Cameron, E. A.	1873	MANAGEMENT VS. MITIGATION OF DAMAGE: CAN WE DO BETTER IN THE 21st CENTURY?	I	472	25/08/00	11:50	HB	M	10	7	10
Cameron, R. A.	1270	INDOXACARB: ATTRIBUTES THAT IMPACT FIELD PERFORMANCE AND CONTRIBUTE TO CONSERVATION OF BENEFICIALS	I	321	25/08/00	10:20	HM	N	7	9	7
Camino, M.	650	SEX ATTRACTION OF MALES OF COPITARSIA CONSUETA (LEPIDOPTERA: NOCTUIDAE) UNDER CONDITIONS OF LABORATORY	I	164	22/08/00	16:30	CC		4	PS	4
Camino, M.	3118	ANTENNAL SENSILLA OF COPITARSIA CONSUETA (LEPIDOPTERA: NOCTUIDAE)	II	787	21/08/00	16:30	CC		16	PS	16
Camino, N. B.	2039	LARVAE OF DILOBODERUS ABDERUS (COLEPTERA, SCARABAEIDAE) PARASITED BY NEMATODES, IN ARGENTINA	I	514	21/08/00	16:30	CC		11	PS	11
Camousseight, A.	407	CONSERVATION OF THE BIODIVERSITY OF INSECTS IN CHILE	I	103	23/08/00	10:50	HB	C	3	3	3
Camousseight, A.	541	THE SOCIEDAD CHILENA DE ENTOMOLOGIA	I	137	24/08/00	16:30	CC		3	PS	3
Campana, M. C.	3144	DESCRIPTION OF FINAL LARVAL INSTAR AND PUPA OF CURINUS COERULEUS (COLEOPTERA, COCCINELLIDAE, CHILOCORINAE), A PREDATOR OF ALEUROTHRIXUS SP. (HEMIPTERA, ALEYRODIDAE) AND NOTES ON THE ASSOCIATED BIOCOENOSIS	II	793	23/08/00	16:30	CC		16	PS	16
Campbell, L. R.	3243	HOW AND WHY DO THRIPS TRANSMIT TOSPOVIRUSES, A CELLULAR APPROACH TO UNDERSTANDING	II	819	25/08/00	16:30	CC		17	PS	17
Campelo, M. G.	1537	EFFECT OF THE AGE OF APHIDIUS COLEMANI (HYMENOPTERA: APHIDIIDAE) ON THE GREEN APHID SCHIZAPHIS GRAMINUM (HOMOPTERA: APHIDIDAE) PARASITISM	I	388	22/08/00	16:30	CC		8	PS	8
Campo, G.	1631	TEN YEARS OF STUDIES ON PARASITOIDS OF THE PEAR PSYLLA, CACOPSYLLA PYRI, IN SICILY (RHYNCHOTA PSYLLOIDEA)	I	411	24/08/00	16:30	CC		8	PS	8
Campobasso, C. P.	2954	THE FORENSIC ENTOMOLOGIST IN THE CONTEXT OF THE FORENSIC PATHOLOGIST'S ROLE	II	745	26/08/00	15:00	Bol	R	15	11	15
Campos P., J. C.	518	POPULATIONAL FLUCTUATION OF THE CITRUS LEAFMINER PHYLLOCNISTIS CITRELLA (LEPIDOPTERA: GRACILLARIDAE) IN THE PIEDMONT OF THE DEPARTMENT OF META	I	131	23/08/00	16:30	CC		3	PS	3
Campos P., J. C.	1566	PARASITOIDS OF THE CITRUS LEAFMINER PHYLLOCNISTIS CITRELLA (LEP: GRACILLARIDAE) IN THE PIEDMONT OF THE DEPARTMENT OF META	I	395	22/08/00	16:30	CC		8	PS	8
Campos, J.	2235	POLYTENE CHROMOSOMES OF CULEX QUINQUEFASCIATUS (DIPTERA: CULICIDAE)	I	564	21/08/00	16:30	CC		12	PS	12
Campos, L.	2272	BEMISIA TABACI POPULATIONS IN BRAZIL: GENETIC DIVERSITY REVEALED BY RAPD MARKERS	I	573	23/08/00	16:30	CC		12	PS	12
Campos, L.	2296	MORPHOLOGICAL AND MOLECULAR IDENTIFICATION OF WHITEFLIES SPECIES IN BRAZIL	I	579	24/08/00	16:30	CC		12	PS	12
Campos, L. A.	3634	CLADISTIC AND BIOGEOGRAPHICAL ANALYSIS OF OCHLERINI (HEMIPTERA, PENTATOMIDAE, DISCOCEPHALINAE)	II	918	22/08/00	11:20	HB	E	21	3	21
Campos, L. A. O.	2320	CYTOGENETICS OF SOME SPECIES OF PARASITIC WASPS OF THE FAMILIES PTEROMALIDAE AND EULOPHIDAE	I	585	25/08/00	16:30	CC		12	PS	12
Campos, M. B. S.	274	THIAMETHOXAM ON THE CONTROL OF SUGARCANE BORER DIATRAEA SACCHARALIS (LEP., CRAMBIDAE)	I	70	23/08/00	16:30	CC		2	PS	2
Campos, M. B. S.	917	FORAGING ACTIVITY OF HETEROTERMES TENUIS (ISOPTERA: RHINOTERMITIDAE) IN SUGARCANE AREA ACCORDING TO YEAR SEASONS	I	232	21/08/00	16:30	CC		6	PS	6
Campos, M. S.	201	CHEMICAL CONTROL OF MAHANARVA FIMBRIOLATA (HEMIPTERA-HOMOPTERA: CERCOPIDAE) IN SUGARCANE	I	51	21/08/00	16:30	CC		2	PS	2
Campos, O. R.	944	WHITEFLY TRIALEURODES VAPORARIUM (HEMIPTERA: HOMOPTERA: ALEYRODIADE) COMPARED BIOLOGY IN SOYBEAN AND IN FIVE BEAN CULTIVARS	I	238	21/08/00	16:30	CC		6	PS	6
Campos, T. B. de	4070	USE OF SYNTHETIC PHEROMONE TRAPS FOR MONITORING OF STORED GRAINS PESTS	II	1028	21/08/00	16:30	CC		23	PS	23
Campos, T. B. de	3143	MORPHOLOGY OF THE LARVA AND OBSERVATIONS ON BIOLOGY OF PLATYPUS MUTATUS (COLEOPTERA, CURCULIONIDAE, PLATYPODINAE)	II	793	24/08/00	16:30	CC		16	PS	16
Campos-Farinha, A. E. de C.	3144	DESCRIPTION OF FINAL LARVAL INSTAR AND PUPA OF CURINUS COERULEUS (COLEOPTERA, COCCINELLIDAE, CHILOCORINAE), A PREDATOR OF ALEUROTHRIXUS SP. (HEMIPTERA, ALEYRODIDAE) AND NOTES ON THE ASSOCIATED BIOCOENOSIS	II	793	23/08/00	16:30	CC		16	PS	16
Campos-Farinha, A. E.de C.	3022	EFFICACY OF DIFFERENT INSECTICIDES ON THE CONTROL OF THE ADULT MUSCA DOMESTICA IN LABORATORY CONDITIONS	II	762	25/08/00	16:30	CC		15	PS	15
Camps, F.	667	COPULATION PHEROMONE OF THE VECTOR OF CHAGAS DISEASE, TRIATOMA infestans: IDENTIFICATION AND BIOASSAY	I	169	22/08/00	16:30	CC		4	PS	4
Camps, F.	668	NITROGENOUS COMPOUNDS AS ATTRACTANTS OF TRIATOMA INFESTANS	I	169	22/08/00	16:30	CC		4	PS	4
Camps, F. D.	1416	COMPARISON OF ROTENONE CONTENT AND INSECT BIOACTIVITY BETWEEN ROOTS AND CALLUS CULTURES OF DERRIS ELLIPTICA	I	357	25/08/00	16:30	CC		7	PS	7
Can, P.	647	THE HARMFUL INSECTS ON P•NUS BRUT•A TEN	I	164	22/08/00	16:30	CC		4	PS	4
Canal, N. A.	1305	BOTANICAL EXTRACT EFFECT ON ANASTREPHA FRATERCULUS (DIP., TEPHRITIDAE) BIOLOGY	I	329	21/08/00	16:30	CC		7	PS	7
Canale, D. M.	2973	POPULATION DYNAMICS OF TRIATOMA INFESTANS (HEMIPTERA: REDUVIIDAE), VECTOR OF CHAGAS DISEASE, IN EXPERIMENTAL HUTS UNDER NATURAL CLIMATIC CONDITIONS	II	750	22/08/00	16:30	CC		15	PS	15
Canavoso, .E.	2403	METABOLIC PATHWAYS FOR DIACYLGLYCEROL BIOSYNTHESIS AND RELEASE IN THE MIDGUT OF LARVAL MANDUCA SEXTAL	II	607	21/08/00	16:30	CC		13	PS	13
Canavoso, L. E.	2404	RELEASE OF DIACYLGLYCEROL FROM THE LARVAL MIDGUT OF MANDUCA SEXTA: IN VITRO ROLE OF THE LIPID TRANSFER PARTICLE	II	607	21/08/00	16:30	CC		13	PS	13
Canavoso, L. E.	2497	TRIACYLGLYCEROL LIPASE FROM THE MIDGUT OF LARVAL MANDUCA SEXTA: PROPERTIES AND PARTIAL CHARACTERIZATION	II	631	24/08/00	16:30	CC		13	PS	13

Sub-titles: (HB=Hotel Bourbon) - (HM=Hotel Mabu) - (CC=Convention Center) - (Bol=Foz Boulevard) - (PS=Poster Session) - (PL=Plenary Lecturer)

AUTHOR	Nº	TITLE	Book	Page	Date	Time	Local	Room	Session	Symp	New Session
Canaveso, L. E.	2972	VECTOR-TRYPANOSOMA CRUZI RELATIONSHIP: CHANGES IN THE HEMOLYMPHATIC PROTEIN COMPOSITION OF DIPETALOGASTER MAXIMUS AFTER EXPERIMENTAL INFECTION	II	750	21/08/00	16:30	CC		15	PS	15
Cancello, E. M.	3485	SWARMING BEHAVIOUR OF THE ECONOMICALLY MOST IMPORTANT TERMITE, COPTOTERMES HAVILANDI, IN SOUTHEAST BRAZIL	II	880	22/08/00	16:30	CC		19	PS	19
Candia, R.	918	EARLY-MID SUCCESSIONAL TROPHIC PATTERNS IN AN ARTHROPOD COMMUNITY OF SAVANNA ECOSYSTEMS	I	232	21/08/00	16:30	CC		6	PS	6
Candia, R.	1904	THE EFFECT OF THE INTRODUCTION OF A PINUS CARIBAEA PLANTATION ON THE ANT'S POPULATIONS OF VENEZUELAN SAVANNAS	I	480	21/08/00	16:30	CC		10	PS	10
Candia, R.	471	WHICH IS AN ADEQUATE DIVERSITY INDEX FOR INSECT COLLECTIONS?	I	119	22/08/00	16:30	CC		3	PS	3
Candia, R.	1974	TROPHIC PATTERNS IN AN INSECT COMMUNITY OF PINE FOREST AND SAVANNA ECOSYSTEMS	I	497	25/08/00	16:30	CC		10	PS	10
Candiani, P. B.	946	ALLOMETRIC RELATIONSHIPS BETWEEN BIOMASS, VOLUME AND POPULATION SIZE IN COLONIES OF SOLENOPSIS INVICTA(HYMENOPTERA: FORMICIDAE)	I	239	22/08/00	16:30	CC		6	PS	6
Candy, S. G.	2639	INTEGRATED PEST MANAGEMENT OF A LEAF BEETLE IN EUCALYPT PLANTATIONS IN TASMANIA, AUSTRALIA	II	667	21/08/00	16:30	CC		14	PS	14
Cane, J. H.	98	NORTH AMERICAN POLLINATORS AND HABITAT FRAGMENTATION: DURABLE BEE FAUNAS AND THE PROMISE OF SMALL RESERVES	I	26	22/08/00	11:45	HB	A	2	3	2
Canete, C. L.	1629	CHARACTERIZATION OF THREE SPECIES OF THE GENUS TRICHOGRAMMA	I	411	22/08/00	16:30	CC		8	PS	8
Cañete, C. L.	1498	EGG PARASITOIDS OF HELICOVERPA ZEA IN SOUTHERN PARANÁ, BRAZIL AND REARING OF TRICHOGRAMMA ATOPOVIRILIA ON AN ALTERNATIVE HOST	I	378	21/08/00	16:30	CC		8	PS	8
Cañete, C. L.	1527	EGG PARASITOIDS OF ANTICARSIA GEMMATALIS (LEPIDOPTERA: NOCTUIDAE) ON SOYBEANS IN BRAZIL.	I	385	22/08/00	16:30	CC		8	PS	8
Canguçu, R.	610	MASS TRAPPING OF RHYNCHOPHORUS PALMARUM USING PHEROMONE IN COCONUT PLANTATION, IN BRAZIL	I	154	24/08/00	10:05	Bol	S	4	6	4
Canhos, D.	753	INTERNATIONAL INFORMATION SYSTEM ABOUT BIOLOGICAL CONTROL OF PESTS THROUGH THE INTERNET	I	190	22/08/00	10:05	Bol	T	5	2	5
Cannard, M.	3223	INTERACTIONS BETWEEN INSECT VECTORS OF PLANT DISEASES IN AUSTRALIA	II	814	22/08/00	16:30	CC		17	PS	17
Cano, R. C.	2972	VECTOR-TRYPANOSOMA CRUZI RELATIONSHIP: CHANGES IN THE HEMOLYMPHATIC PROTEIN COMPOSITION OF DIPETALOGASTER MAXIMUS AFTER EXPERIMENTAL INFECTION	II	750	21/08/00	16:30	CC		15	PS	15
Cansian, A. M.	2236	MALE COURTSHIP SONG PATTERN OF THE DROSOPHILA SERIDO AND DROSOPHILA SP D (REPLETA GROUP) IN A HYBRID ZONE AREA	I	564	21/08/00	16:30	CC		12	PS	12
Cantagalli, D.	3492	THE USE OF HONEYBEES (APIS MELLIFERA) AS INDICATORS FOR THE PRESENCE OF THE PHYTOPATHOGEN BACTERIUM ERWINIA AMYLOVORA IN THE ENVIRONMENT	II	881	22/08/00	16:30	CC		19	PS	19
Cantor, F.	648	LOCAL DETERRENCE OF MULTIPLE ATTACKS BY THE COFFEE BERRY BORER	I	164	22/08/00	16:30	CC		4	PS	4
Canto-Silva, C. R.	919	POPULATION ECOLOGY OF CORECORIS DENTIVENTRIS (HEMIPTERA; COREIDAE) IN AN EXPERIMENTAL PLOT OF NICOTIANA TABACUM (SOLANACEAE): SEASONAL FLUCTUATIONS, MORTALITY AND PARASITIZATION	I	232	21/08/00	16:30	CC		6	PS	6
Canto-Silva, C. R.	1130	POPULATION ECOLOGY OF CORECORIS DENTIVENTRIS (HEMIPTERA: COREIDAE) IN AN EXPERIMENTAL PLOT OF NICOTIANA TABACUM (SOLANACEAE): SPATIAL DISTRIBUTION AND DISPERSAL.	I	285	24/08/00	16:30	CC		6	PS	6
Cao, C.	3252	ACTIVATION OF STEROIDOGENESIS IN FEMALE MOSQUITOES BY OVARY ECDYSTEROIDOGENIC HORMONE AND INSULIN	II	821	21/08/00	10:35	HB	K	18	1	18
Capalbo, D. M. F.	1247	SOME ASPECTS OF THE ENVIRONMENTAL RISK ASSESSMENT OF GENETICALLY MODIFIED PLANTS IN BRAZIL	I	315	23/08/00	11:20	HM	N	7	5	7
Capdevila, A.	4088	INVASION OF AEDES AEGYPTI (DIPTERA: CULICIDAE) IN URUGUAY	II	1032	23/08/00	16:30	CC		23	PS	23
Caprio, M. A.	1260	THE IMPACT OF POLYPHAGOUS INSECT DISPERSAL ON DEPLOYMENT DECISIONS FOR TRANSGENIC CROPS	I	318	24/08/00	14:05	HM	N	7	8	7
Capurro, M. de L.	2916	GENETICALLY-ENGINEERED MOSQUITOES RESISTANT TO THE TRANSMISSION OF MALARIA	II	736	24/08/00	14:35	Bol	R	15	8	15
Capurro, M. de L.	2927	STRUCTURE AND EXPRESSION OF THE LARVAL AND ADULT HEXAMERIN GENES, MDH1.1 AND MDH2.1, IN MUSCA DOMESTICA	II	739	25/08/00	11:20	Bol	R	15	9	15
Capy, P.	2212	CODON USAGE OF TRANSPOSABLE ELEMENTS AND HOST GEMONE	I	558	24/08/00	15:55	HB	L	12	8	12
Carapelli, A.	3730	THE PHYLOGENY OF BASAL INSECTS: MOLECULAR AND MORPHOLOGICAL DATA COMPARED	II	942	21/08/00	16:30	CC		21	PS	21
Carbonari, J. J.	2744	FOLIAR SPRAY STRATEGY FOR RATIONAL CHEMICAL CONTROL OF ORYZOPHAGUS ORYZAE ON FLOODED RICE	II	693	23/08/00	16:30	CC		14	PS	14
Carchini, G.	3116	FLUCTUATING ASYMMETRY, MATING SUCCESS, BODY SIZE AND HETEROZYGOSITY IN MALES OF COENAGRION SCITULUM (ODONATA: COENAGRIONIDAE)	II	786	21/08/00	16:30	CC		16	PS	16
Carcupino, M.	3707	ULTRASTRUCTURE OF FILTERING MOUTH PARTS IN HIGHLY SPECIALIZED TROGLOBITIC LEPTODIRINAE (COLEOPTERA, CHOLEVIDAE)	II	936	26/08/00	Poster dentro da sessão	HB	E	21	10	21
Carcupino, M.	1033	STRUCTURE OF THE CROP IN THE ADULT QUEEN BLOWFLY, PHORMIA REGINA	I	261	23/08/00	16:30	CC		6	PS	6
Carcupino, M.	3149	STRUCTURE OF THE CROP IN THE ADULT QUEEN BLOWFLY, PHORMIA REGINA	II	794	24/08/00	16:30	CC		16	PS	16
Cardé, R. T.	608	SENSORY INPUTS GOVERNING UPWIND FLIGHT OF MALE MOTHS ALONG PHEROMONE PLUMES	I	154	23/08/00	15:35	Bol	S	4	5	4
Cardé, R. T.	730	PHEROMONES SYSTEM OF LEPTOGLOSSUS ZONATUS (HETEROPTERA:COREIDAE)	I	184	24/08/00	16:30	CC		4	PS	4
Cardé, R. T.	2980	L-LACTIC ACID IS AN IMPORTANT HOST STIMULUS FOR THE ANTHROPOPHILIC ANOPHELES GAMBIAE S.S.	II	752	22/08/00	16:30	CC		15	PS	15
Cardenas, V. R.	3984	ACCELERATING ADOPTION OF AGRICULTURAL RECOMMENDATIONS THROUGH PARTNERSHIPS BETWEEN GOs, NGOs, And Pos	II	1005	24/08/00	16:30	CC		22	PS	22
Cardoso, A. M.	207	CHARACTERIZATION OF GREENBUG POPULATIONS COLLECTED IN ARGENTINA AND CHILE	I	53	22/08/00	16:30	CC		2	PS	2
Cardoso, A. M.	920	INFLUENCE OF PHOSPHATE-POTASSIC FERTILIZATION ON THE OCCURRENCE THE NATURAL ENEMIES ASSOCIATED TO SOYBEAN	I	232	21/08/00	16:30	CC		6	PS	6
Cardoso, A. M.	921	BIOECOLOGICAL STUDIES OF RUSSIAN WHEAT APHID IN ARGENTINA AND CHILE	I	233	21/08/00	16:30	CC		6	PS	6
Cardoso, A. M.	3357	ARTIFITIAL INDUCTION OF SEXUALS IN GREENBUG	II	848	24/08/00	16:30	CC		18	PS	18
Cardoso, A. M.	922	INFLUENCE OF PHOSPHATE-POTASSIC FERTILIZATION ON THE OCCURRENCE OF SOYBEAN INSECT PESTS	I	233	21/08/00	16:30	CC		6	PS	6
Cardoso, J. T.	208	IMPACT OF CHRYSOPERLA EXTERNA (NEUROPTERA: CHRYSOPIDAE) ON CINARA SPP. (HOMOPTERA: APHIDIDAE) IN LABORATORY	I	53	21/08/00	16:30	CC		2	PS	2
Carey, J. R.	923	GENERAL PRINCIPLES OF INSECT MORTALITY DYNAMICS	I	233	21/08/00	16:30	CC		6	PS	6
Carey, J. R.	2889	BIODEMOGRAPHIC AND EPIDEMIOLOGIC CONSEQUENCES OF MORTALITY IN THE YELLOW FEVER MOSQUITO	II	729	22/08/00	14:20	Bol	R	15	4	15
Carey, J. R.	3978	CERATITIS CAPITATA OVERWINTERING IN MEDITERRANEAN CLIMATE	II	1004	24/08/00	16:30	CC		22	PS	22
Cariac, M.	649	INSECTICIDE ACTIVITY OF COTTON CRUDE OIL ON ADULTS OF CYDIA POMONELLA (LEPIDOPTERA:TORTRICIDAE)	I	164	23/08/00	16:30	CC		4	PS	4
Carisey, N.	924	HOW THE NUTRITION OF SPRUCE BUDWORM PARENTS INFLUENCES THE OFFSPRING	I	233	21/08/00	16:30	CC		6	PS	6
Carleton, A.	3073	BICOID AS A PHYLOGENETIC ADDITION TO THE INSECT BODY PLAN	II	775	24/08/00	14:00	HB	G	16	6	16

Sub-titles: (HB=Hotel Bourbon) - (HM=Hotel Mabu) - (CC=Convention Center) - (Bol=Foz Boulevard) - (PS=Poster Session) - (PL=Plenary Lecturer)

AUTHOR	Nº	TITLE	Book	Page	Date	Time	Local	Room	Session	Symp	New Session
Carli, D. L. De	1319	DIFFERENT DOSAGES OF IMIDACLOPRID 60 FS (GAUCHO 60 FS•) IN ONION SEED TREATMENT ON THE GERMINATION AND THE EMERGED PLANTS	I	333	24/08/00	16:30	CC		7	PS	7
Carlini, C. R.	1306	INSECTICIDAL PROPERTIES OF CANATOXIN, A TOXIC PROTEIN FROM CANAVALIA ENSIFORMIS SEEDS, AND ITS ENTOMOTOXIC PEPTIDES	I	330	21/08/00	16:30	CC		7	PS	7
Carlson, D. A.	2392	BEHAVIORAL RESPONSE OF STOMOXYS CALCITRANS (DIPTERA: MUSCIDAE) TO ITS OWN FECES	II	604	21/08/00	16:30	CC		13	PS	13
Carlson, D. R.	2992	HYDROCARBONS OF THE CHAGAS DISEASE VECTOR RHODNIUS PROLIXUS	II	755	23/08/00	16:30	CC		15	PS	15
Carlson, G. R.	1841	TEBUFENOZIDE: AN EFFECTIVE AND SELECTIVE CONTROL AGENT FOR CATERPILLAR PESTS IN FORESTRY	I	464	23/08/00	11:05	HB	M	10	4	10
Carlson, G. R.	3289	PHOTOAFFINITY LABELED NON-STEROIDAL ECDYSONE AGONIST AS A TOOL TO STUDY LIGAND-ECDYSONE RECEPTOR COMPLEX INTERACTION	II	831	23/08/00	15:35	HB	K	18	5	18
Carlsson, M. A.	2405	THE ANTENNAL LOBE – A FUNCTIONAL OLFACTORY MAP IN NEURAL SPACE?	II	608	21/08/00	16:30	CC		13	PS	13
Carlton, C. E.	472	DIVERSITY OF TWO LOWLAND RAINFOREST BEETLE TAXA (HISTERIDAE AND STAPHYLINIDAE: PSELAPHINAE) AT A WESTERN AMAZONIAN LOCALITY	I	120	21/08/00	16:30	CC		3	PS	3
Carlton, C. E.	4137	CHALLENGING THE INSECT CONSERVATION CHALLENGE	II	1045	21/08/00	16:30	CC		24	PS	24
Carme, B.	2961	TRIATOMINES SPECIES (HEMIPTERA, REDUVIIDAE, TRIATOMINAE) AND TRYPANOSOMA CRUZI IN FRENCH GUYANA	II	747	21/08/00	16:30	CC		15	PS	15
Carnero, A.	209	EVALUATION OF THE EFFICACY ON AN AGGREGATION PHEROMONE AS A MEANS OF CAPTURE AND PROTECTION AGAINST COSMOPOLITES SORDIDUS GERMAR (COLEOPTERA: CURCULIONIDAE) IN THE CANARY ISLANDS	I	53	22/08/00	16:30	CC		2	PS	2
Carnero, A.	253	CURRENT STUDIES ON THE WHITEFLY FAUNA (HOMOPTERA: ALEYRODIDAE) OF THE CANARY ISLANDS (SPAIN)	I	64	22/08/00	16:30	CC		2	PS	2
Carnero, A.	1547	POSSIBILITIES FOR THE USE OF ENCARSIA HISPIDA DE SANTIS (HYMENOPTERA: APHELINIDAE) IN THE BIOLOGICAL CONTROL OF THE SPIRALLING WHITEFLIES ALEURODICUS DISPERSUS RUSSELL AND LECANOIDEUS FLOCCISSIMUS MARTIN ET AL. (HEMIPTERA: ALEYRODIDAE)	I	390	23/08/00	16:30	CC		8	PS	8
Carnevale, A. B.	218	DETERMINATION OF INJURY AND DAMAGE OF THE MEALYBUG DYSMICOCCUS BREVIPES (HEMIPTERA: PSEUDOCOCCIDAE) IN PINEAPPLE	I	56	22/08/00	16:30	CC		2	PS	2
Carnevalli, P. C.	2735	TONIC EFFECT OF SOIL INSECTICIDE ON THE COFFEE (COFFEA ARABICA) PLANT AND ITS COST-BENEFICE	II	691	23/08/00	16:30	CC		14	PS	14
Carori, A. de S	2406	CHARACTERIZATION OF THE DIGESTIVE PROCESS IN NEOTROPICAL ANOPHELINES	II	608	21/08/00	16:30	CC		13	PS	13
Carpenter, J.	3406	SOCIAL WASPS AS URBAN PESTS IN THE NORTHERN HEMISPHERE	II	860	22/08/00	10:05	HM	Q	19	2	19
Carpenter, J. E.	2225	SUCCESSFULLY MANAGING LEPIDOPTERAN PESTS WITH GENETIC METHODS: THE FUTURE IS NOW	I	562	25/08/00	10:35	HB	L	12	11	12
Carpinella, M. C.	657	ANTIFEEDANT EFFECTS OF ARGENTINE MELIA AZEDARACH FRUIT EXTRACT AND ITS ACTIVE COMPOUND MELIARTENIN	I	166	22/08/00	16:30	CC		4	PS	4
Carptenter, J. E.	1435	LABORATORY PRODUCTION AND FIELD EVALUATION OF HYMEMOPTEROUS ECTOPARASITOIDS REARED ON ARTIFICIAL DIETS	I	362	21/08/00	15:50	HM	O	8	2	8
Carrière, Y.	1251	PINK BOLLWORM RESISTANCE TO BT COTTON	I	316	23/08/00	15:05	HM	N	7	6	7
Carrizo, M. B.	1000	COMPARISON OF SENSITIVITY TO COLD IN SOUTH AMERICAN FRUIT FLY AND MEDFLY (DIPTERA: TEPHRITIDAE)	I	252	22/08/00	16:30	CC		6	PS	6
Carrizo, P.	1905	WATER STRESS EFFECT ON WORKER CUTTING-ANTS OF ACROMYRMEX HISPIDUS ON THREE ORIGINS OF EUCALYPTUS GLOBULUS GLOBULUS	I	480	21/08/00	16:30	CC		10	PS	10
Carrizo, P. I.	210	EFFECT OF BLUE-YELLOW STRIPING ON STICKY TRAPS FOR THRIPS AND WHITEFLIES	I	54	22/08/00	16:30	CC		2	PS	2
Carrizo, P. I.	211	LEAST COUNTING SURFACE IN STICKY TRAPS FOR THYSANOPTERA AND ALERODOIDEA. I. PRELIMINARY TESTS	I	54	22/08/00	16:30	CC		2	PS	2
Carrizo, P. I.	212	MULCH COLOR ATTRACTIVENESS FOR TRIPS AND WHITEFLIES BY MEANS OF STICKY TRAPS TRIALS	I	54	22/08/00	16:30	CC		2	PS	2
Carrizo, P. I.	3220	WEEDS AS A SOURCE FOR THRIPS VECTORS AND TSWV IN A TOMATO NURSERY, FOR AN ISOLATED WEEDY AREA IN LA PLATA, ARGENTINE	II	813	21/08/00	16:30	CC		17	PS	17
Carrizo, P. I.	328	BASIL-TOMATO INTERCROPPING EFFECT ON MACROSIPHUM EUPHORBIAE (HEMIPTERA: APHIDIDAE) ABUNDANCE	I	83	24/08/00	16:30	CC		2	PS	2
Carroll, S. S.	389	SPATIAL PATTERNS OF SPECIES RICHNESS: TIGER BEETLES OF NORTHWESTERN SOUTH AMERICA (COLEOPTERA: CICINDELIDAE)	I	99	22/08/00	10:50	HB	C	3	2	3
Cartagena, M. C.	925	LOSS OF TENEBRIONID DIVERSITY IN MEDITERRANEAN ISLANDs AS INDICATOR OF ENVIROMENTAL DEGRADATION (COLEOPTERA TENEBRIONIDAE)	I	234	21/08/00	16:30	CC		6	PS	6
Carton, B.	1403	SIGNIFICANCE OF UPTAKE AND BINDING IN LEPIDOPTERA AND COLEOPTERA ON TOXICITY OF DIBENZOYLHYDRAZINE ECDYSONE AGONISTS	I	354	25/08/00	16:30	CC		7	PS	7
Carvalho, A. G.	926	COMPARATIVE BIOLOGY OF URBANUS PROTEUS (LEPIDOPTERA: HESPERIIDAE) IN CENTROSEMA PUBESCENS, CLITORIA FAIRCHILDIANA, GLYCINE MAX AND PHASEOLUS VULGARIS (LEGUMINOSAE)	I	234	22/08/00	16:30	CC		6	PS	6
Carvalho, A. G.	1050	BIOECOLOGY OF URBANUS ACAWOIOS (LEPIDOPTERA, HESPERIIDAE) IN CLITORIA FAIRCHILDIANA IN CONTROLLED TEMPERATURE	I	265	22/08/00	16:30	CC		6	PS	6
Carvalho, A. G.	1906	ANALYSIS OF THE DAMAGES CAUSED FOR ONCIDERES SAGA (COLEOPTERA: CERAMBYCIDAE) IN A FORESTRY REMNANT IN THE CAMPUS OF UFRRJ, BRASIL	I	480	21/08/00	16:30	CC		10	PS	10
Carvalho, A. G.	1907	OCCURRENCE AND DAMAGES CAUSED FOR ONCIDERES SAGA (COLEOPTERA: CERAMBYCIDAE) IN ARBORIZATION	I	481	21/08/00	16:30	CC		10	PS	10
Carvalho, A. G.	1964	OCCURRENCE OF WOOD BORING BEETLES IN THE NATIONAL FOREST MÁRIO XAVIER, RJ, BRASIL	I	495	21/08/00	16:30	CC		10	PS	10
Carvalho, A. G.	1965	WOOD BORING BEETLES IN PLANTATION OF SAPUCAIA, LECYTHIS PISONIS (LECYTHIDACEAE), IN THE NATIONAL FOREST MÁRIO XAVIER, SEROPÉDICA, RJ, BRASIL	I	495	24/08/00	16:30	CC		10	PS	10
Carvalho, A. G.	1967	COMPOSITION OF SCOLYTIDAE (COLEOPTERA) IN THREE FOREST MACROHABITATS OF SEROPÉDICA, RJ, BRASIL	I	496	24/08/00	16:30	CC		10	PS	10
Carvalho, A. G.	1968	ECOLOGY OF SCOLYTIDAE (COLEOPTERA) IN FORESTRY REMNANTS BELONGING TO CHAMPION Co. IN MOGI GUAÇU, SP, BRASIL	I	496	24/08/00	16:30	CC		10	PS	10
Carvalho, A. G.	1809	LEAF AREA CONSUMPTION OF URBANUS ESMERALDUS (LEPIDOPTERA: HESPERIIDAE) IN CENTROSEMA PUBESCENS, CLITORIA FAIRCHILDIANA AND ALTERNATE FEEDING	I	456	21/08/00	16:30	CC		9	PS	9
Carvalho, A. G.	1940	ANALYSIS OF THE DEGRADATION OF THE WOOD OF SIX FOREST SPECIES FOR SCOLYTIDAE (COLEOPTERA)	I	489	24/08/00	16:30	CC		10	PS	10
Carvalho, A. G.	3383	BIOLOGY OF URBANUS ESMERALDUS (LEPIDOPTERA: HESPERIIDAE) IN CENTROSEMA PUBESCENS, CLITORIA FAIRCHILDIANA, GALACTIA STRIATA AND ALTERNATE FEEDING	II	854	25/08/00	16:30	CC		18	PS	18
Carvalho, A. G.	223	OCCURRENCE AND DAMAGES OF ONCIDERES SAGA (COLEOPTERA, CERAMBYCIDAE) IN MIMOSA CAESALPINAEFOLIA (LEGUMINOSAE, CAESALPINOIDAE)	I	57	22/08/00	16:30	CC		2	PS	2
Carvalho, A. G.	1049	DETERMINATION OF THE INFLUENCE OF THE MATURITY OF THE LEAVES OF CLITORIA FAIRCHILDIANA IN THE DEVELOPMENT OF URBANUS ACAWOIOS (LEPIDOPTERA: HESPERIIDAE)	I	265	23/08/00	16:30	CC		6	PS	6
Carvalho, A. G.	1625	OCCURRENCE OF SCALES, WHITEFLIES AND NATURAL ENEMIES IN CITRIC PLANTS IN THE MUNICIPAL DISTRICT OF CÁCERES, MT, BRASIL	I	410	25/08/00	16:30	CC		8	PS	8
Carvalho, A. G.	2055	EVALUATION OF THE EFFICIENCY OF BACILLUS THURINGIENSIS IN THE CONTROL OF URBANUS ACAWOIOS (LEPIDOPTERA: HESPERIIDAE)	I	518	21/08/00	16:30	CC		11	PS	11
Carvalho, A. G.	3359	BIOLOGY OF URBANUS ACAWOIOS (LEPIDOPTERA, HESPERIIDAE) IN LABORATORY	II	848	23/08/00	16:30	CC		18	PS	18
Carvalho, A. G.	3533	INFESTATION OF TERMITES IN EUCALYPTUS SP. AT THE "UNIVERSIDADE FEDERAL RURAL DO RIO DE JANEIRO"	II	891	25/08/00	16:30	CC		19	PS	19

Sub-titles: (HB=Hotel Bourbon) - (HM=Hotel Mabu) - (CC=Convention Center) - (Bol=Foz Boulevard) - (PS=Poster Session) - (PL=Plenary Lecturer)

AUTHOR	Nº	TITLE	Book	Page	Date	Time	Local	Room	Session	Symp	New Session
Carvalho, A. G. de	1924	DISTRIBUTION OF EUPHALERUS SP (HEMIPTERA: PSYLLIDAE) IN STATE OF RIO DE JANEIRO, BRAZIL	I	485	22/08/00	16:30	CC		10	PS	10
Carvalho, A. G. de	1925	THE ASSOCIATED FAUNA COMPOSITION AT THE EUPHALERUS SP (HEMIPTERA:PSYLLIDAE), IN SEROPÉDICA, RJ, BRAZIL	I	485	22/08/00	16:30	CC		10	PS	10
Carvalho, A. L.	3731	KEY TO THE GENERA OF ANISOPTERA (ODONATA) LARVAE OCCURRING IN THE STATES OF RIO DE JANEIRO AND SÃO PAULO, BRAZIL	II	942	21/08/00	16:30	CC		21	PS	21
Carvalho, A. O. R.	3117	COMPARISON OF PRESERVATION METHODS OF ATTA SPP. (HYMENOPTERA; FORMICIDAE) FOR DNA STUDIES	II	786	21/08/00	16:30	CC		16	PS	16
Carvalho, C. F.	1576	INFLUENCE OF TEMPERATURE ON THE WEIGHT OF LARVAE AND ADULTS OF CHRYSOPERLA EXTERNA (NEUROPTERA: CHRYSOPIDAE) FED ON SCHIZAPHIS GRAMINUM (HEMIPTERA: APHIDIDAE)	I	397	24/08/00	16:30	CC		8	PS	8
Carvalho, C. F.	1664	INFLUENCE OF ISOLATED OR GROUPED CLIMATIC FACTORS ON CHRYSOPERLA EXTERNA (NEUROPTERA: CHRYSOPIDAE) ADULT POPULATIONS	I	419	25/08/00	16:30	CC		8	PS	8
Carvalho, C. J. B de	3711	PHYLOGENETIC ANALYSIS OF THE HYBOTINAE (DIPTERA: EMPIDOIDEA)	II	937	21/08/00	16:30	CC		21	PS	21
Carvalho, C. J. B.	3664	RECENT ADVANCES ON THE PHYLOGENY AND BIOGEOGRAPHY OF MUSCIDAE (DIPTERA)	II	925	24/08/00	11:20	HB	E	21	6	21
Carvalho, C. J. B. de	3775	BATFLIES (DIPTERA: STREBLIDAE AND NYCTERIBIIDAE) OF PARANÁ STATE, BRAZIL	II	953	24/08/00	16:30	CC		21	PS	21
Carvalho, C.F.	976	EFFECT OF TEMPERATURE ON THE SEX RATIO AND WEIGHT OF CHRYSOPERLA EXTERNA ADULTS OBTAINED FROM LARVAE FED ON SCHIZAPHIS GRAMINUM	I	246	22/08/00	16:30	CC		6	PS	6
Carvalho, C.F.	1529	FUNCTIONAL RESPONSE OF CHRYSOPERLA EXTERNA FED ON SCHIZAPHIS GRAMINUM	I	386	22/08/00	16:30	CC		8	PS	8
Carvalho, D. R.	538	DEVELOPMENT OF PHYTOPHAGOUS HETEROPTERANS ON DRY ARTIFICIAL DIETS	I	136	24/08/00	16:30	CC		3	PS	3
Carvalho, G. A.	2640	SELECTIVITY OF INSECTICIDES USED IN CHRYSANTEMUS PEST CONTROL TO ORIUS INSIDIOSUS	II	667	21/08/00	16:30	CC		14	PS	14
Carvalho, G. S.	1157	FEEDING TIME OF PHTHIA PICTA (HEMIPTERA: COREIDAE) IN DIFFERENTS AGES ON FRUITS OF TWO CULTIVARS OF TOMATO	I	292	25/08/00	16:30	CC		6	PS	6
Carvalho, G. S.	3843	DESCRIPTION OF THE IMMATURE AND ADULT PHASES OF PHTHIA PICTA (HEMIPTERA: COREIDAE)	II	970	24/08/00	16:30	CC		21	PS	21
Carvalho, G. S.	1117	COMPARATIVE STUDY OF NYMPHS AND ADULTS OF NUBITHIA GRISESCENS (HEMIPTERA, FULGOROIDEA, ISSIDAE)	I	282	24/08/00	16:30	CC		6	PS	6
Carvalho, G. S.	1800	FEEDING PREFERENCE OF PHTHIA PICTA (HEMIPTERA: COREIDAE) BY FRUITS OF THREE CULTIVARS OF TOMATO	I	453	25/08/00	16:30	CC		9	PS	9
Carvalho, G. S.	3370	BIOLOGY OF Phthia picta (HEMIPTERA: COREIDAE) IN THREE CULTIVARS OF TOMATO	II	851	25/08/00	16:30	CC		18	PS	18
Carvalho, G. S.	3717	CLADISTIC ANALYSIS OF THE CERESINI GENERA: A REAPPRAISAL (HEMIPTERA, AUCHENORRHYNCHA, MEMBRACIDAE)	II	938	21/08/00	16:30	CC		21	PS	21
Carvalho, J. C.	3177	EARLY EMBRYOLOGY AND SEGMENTATION GENES EXPRESSION IN THE TEPHRITID FLY ANASTREPHA SP. 2 (DIPTERA; TEPHRITIDAE)	II	801	24/08/00	16:30	CC		16	PS	16
Carvalho, L. M. L.	2948	FLIES AND DRUGS IN SOUTHEASTERN BRAZIL	II	744	26/08/00	13:30	Bol	R	15	11	15
Carvalho, L. M. L.	2955	LEGAL MEDICINE X FORENSIC ENTOMOLOGY IN BRAZIL	II	746	26/08/00	15:15	Bol	R	15	11	15
Carvalho, M. M. C.	2036	TRANSMISSION OF NUCLEOPOLYHEDROVIRUS IN BOMBYX MORI (LEPIDOPTERA: BOMBYCIDAE)	I	514	22/08/00	16:30	CC		11	PS	11
Carvalho, P.	1499	A FIRST APPROACH ON THE POTENTIAL ROLE OF DICYPHUS CERASTII WAGNER (HEMIPTERA: MIRIDAE), AS NATURAL CONTROL AGENT IN PORTUGUESE GREENHOUSES	I	378	21/08/00	16:30	CC		8	PS	8
Carvalho, P.	1500	THE ROLE OF CHRYSOPIDS AS NATURAL CONTROL AGENTS IN PORTUGUESE GREENHOUSES	I	378	21/08/00	16:30	CC		8	PS	8
Carvalho, R. C. Z. de	1957	APHIDS (HOMOPTERA: APHIDIDAE: LACHNINAE: CINARINI) ON PINUS SPP. AND CUPRESSUS SP. IN SOUTHERN BRAZIL	I	493	24/08/00	16:30	CC		10	PS	10
Carvalho, R. da S.	1647	BIOLOGICAL ASPECTS OF EXOTIC PREDATOR CRYPTOLAEMUS MONTROUZIERI (COLEOPTERA: COCCINELLIDAE), REARED ON PLANOCOCCUS CITRI IN LABORATORY	I	415	24/08/00	16:30	CC		8	PS	8
Carvalho, R. da S.	1657	EVALUATION OF THE PREDACIOUS CAPACITY OF CRYPTOLAEMUS MONTROUZIERI (COLEOPTERA: COCCINELLIDAE) IN ORTHEZIA PRAELONGA, PLANOCOCCUS CITRI AND DYSMICOCCUS BREVIPES	I	418	24/08/00	16:30	CC		8	PS	8
Carvalho, V. A. M. de	2154	INTEGRATED SYSTEM TO SIMULATE THE IMPACT OF THE FUNGUS NOMURAEA RILEYI ON BRAZILIAN ANTICARSIA GEMMATALIS POPULATIONS	I	543	25/08/00	16:30	CC		11	PS	11
Carvalho, V. L. de	1537	EFFECT OF THE AGE OF APHIDIUS COLEMANI (HYMENOPTERA: APHIDIIDAE) ON THE GREEN APHID SCHIZAPHIS GRAMINUM (HOMOPTERA: APHIDIDAE) PARASITISM	I	388	22/08/00	16:30	CC		8	PS	8
Casagrande, M. M.	3107	MORPHOLOGY AND BIOLOGY OF THE IMMATURE STAGES OF CITHERONIA (CITHERONIA) BRISSOTII BRISSOTII (LEPIDOPTERA, SATURNIIDADE, CERATOCAMPINAE)	II	784	21/08/00	16:30	CC		16	PS	16
Casagrande, M. M.	3126	LIFE HISTORY AND MORPHOLOGY OF THE IMMATURE STAGES OF THE HAIRSTREAK BUTTERFLY "THECLA" CISSUSA (LEPIDOPTERA, LYCAENIDAE, THECLINAE)	II	789	22/08/00	16:30	CC		16	PS	16
Casale, A.	3707	ULTRASTRUCTURE OF FILTERING MOUTH PARTS IN HIGHLY SPECIALIZED TROGLOBITIC LEPTODIRINAE (COLEOPTERA, CHOLEVIDAE)	II	936	26/08/00	Poster dentro da sessão	HB	E	21	10	21
Casari, S. A.	927	REVIEW OF CHALCOLEPIDIUS ESCHSCHOLTZ, 1829 (ELATERIDAE, AGRYPNINAE, HEMIRHIPINI)	I	234	21/08/00	16:30	CC		6	PS	6
Casartelli, M.	2456	ROLE OF ACTIVATORS OF THE ABSORPTION OF AMINO ACIDS BY THE MIDGUT IN BOMBYX MORI LARVAL NUTRITION	II	620	23/08/00	16:30	CC		13	PS	13
Casas, J.	2496	NUTRITIONAL STATUS AND THE BEHAVIOURAL ECOLOGY OF PARASITOIDS	II	630	24/08/00	16:30	CC		13	PS	13
Cascales, E.	3826	SOME WINTER GEOMETRIDS FROM CENTRAL SPAIN (INSECTA: LEPIDOPTERA, GEOMETRIDAE)	II	966	24/08/00	16:30	CC		21	PS	21
Casella, J.	3410	INFLUENCE OF ARGENTINE AND COASTAL BROWN ANT (HYMENOPTERA: FORMICIDAE) INVASIONS ON RICHNESS AND SPECIES COMPOSITION OF ANTS IN GARDENS IN PERTH, AUSTRALIA	II	861	22/08/00	11:05	HM	Q	19	2	19
Casimero, V.	2428	EFFECT OF LARVAL DIETS ON THE SURVIVAL AND DEVELOPMENT OF LARVAE IN THE COTTON BOLLWORM, HELICOVERPA ARMIGERA (LEPIDOPTERA: NOCTUIDAE)	II	613	22/08/00	16:30	CC		13	PS	13
Cassimiro, J.	1017	A POSSIBLE CASE OF MIMICRY BETWEEN AN INSECT AND A TADPOLE	I	257	23/08/00	16:30	CC		6	PS	6
Cassinelli, M.	2641	CONTROL OF ANTICARSIA GEMMATALIS IN SOYBEAN BY RIMON 10 EC (NOVALURON) IN PARANÁ, BRAZIL. 1999	II	667	22/08/00	16:30	CC		14	PS	14
Cassinelli, M.	2642	EFFECT OF THE CONTROL OF ARMY WORMS SPODOPTERA FRUGIPERDA IN CORN BY RIMON 10 EC (NOVALURON). 1999	II	667	21/08/00	16:30	CC		14	PS	14
Cassinelli, M.	2643	EFFICACY OF CONTROL OF ANTICARSIA GEMMATALIS IN SOYBEAN BY RIMON 10 EC (NOVALURON) AND OTHER INSECTICIDES. 1999	II	668	22/08/00	16:30	CC		14	PS	14
Cassinelli, M.	2644	EVALUATION OF AGRONOMIC EFFICIENCY AND PRACTIBILITY OF INSECTICIDES ON COTTON WORM (ALABAMA ARGILLACEA) CONTROL ON COTTON CROP. 1999	II	668	21/08/00	16:30	CC		14	PS	14
Cassinelli, M.	298	EFFECT OF DIFFERENT DOSAGES OF NOVALURON (RIMON 100 EC) FOR SPODOPTERA FRUGIPERDA CONTROL IN CORN AT LONDRINA - PR - BRAZIL	I	76	25/08/00	16:30	CC		2	PS	2

Sub-titles: (HB=Hotel Bourbon) - (HM=Hotel Mabu) - (CC=Convention Center) - (Bol=Foz Boulevard) - (PS=Poster Session) - (PL=Plenary Lecturer)

AUTHOR	Nº	TITLE	Book	Page	Date	Time	Local	Room	Session	Symp	New Session
Cassino, P. C. R.	2618	EFFICACY OF THIAMETHOXAM AND ALDICARB IN THE CONTROL OF DIABROTICA SPECIOSA GERM, 1824 (COLEOPTERA – CHRYSOMELIDAE – GALERUCINAE) ON POTATO CROP (SOLANUM TUBEROSUM) IN PINHEIRAL CITY, RJ -BRAZIL	II	661	21/08/00	16:30	CC		14	PS	14
Cassino, P. C. R.	2619	FIELD EVALUATION OF EFFICACY OF THIAMETHOXAN 250WG AND ALDICARB 150G IN THE CONTROL OF CEROTOMA ARCUATA (COLEOPTERA: CHRYSOMELIDAE) IN BEAN (PHASEOLUS VULGARIS) IN PINHEIRAL CITY , RJ, BRAZIL	II	662	21/08/00	16:30	CC		14	PS	14
Cassino, P. C. R.	2645	CONTROL OF PHYLLOCNISTIS CITRELLA (LEPIDOPTERA, GRACILLARIIDAE) BY THIAMETHOXAM IN CITRUS IN ARARUAMA CITY-RJ	II	668	21/08/00	16:30	CC		14	PS	14
Cassino, P. C. R.	2646	USE OF THIAMETHOXAM IN THE CONTROL DE SELENASPIDUS ARTICULATUS (HOMOPTERA:DIASPIDIDAE) AND EFFECT ON THE POPULATION OF THEIR NATIVE PREDATORS IN CITRUS IN SÃO VICENTE DE PAULO (ARARUAMA, RJ), BRAZIL	II	668	21/08/00	16:30	CC		14	PS	14
Cassino, P. C. R.	2800	EFFECT OF DIFFERENT LEVELS OF NITROGENOUS AND POTASSIC FERTILIZATION ON THE POPULATION OF COCCUS VIRIDIS (HOMOPTERA; COCCIDAE) IN SWEET ORANGE (CITRUS SINENSIS), CULTIVAR "FOLHA MURCHA"	II	707	24/08/00	16:30	CC		14	PS	14
Cassino, P. C. R.	237	PEST-INSECTS ASSOCIATED WITH CITRUS IN BOM JESUS DO ITABAPOANA, RJ, BRAZIL	I	60	22/08/00	16:30	CC		2	PS	2
Cassino, P. C. R.	238	PRELIMINARY SURVEY OF TEPHRITID FRUIT FLIES IN THE NORTHWEST OF THE RIO DE JANEIRO STATE, BRAZIL	I	61	22/08/00	16:30	CC		2	PS	2
Cassino, P. C. R.	1108	NITROGEN AND POTASSIUM FERTILIZATION WERE INFLUENCING THE WHITEFLIES POPULATIONS IN CITRIC PLANTS	I	279	24/08/00	16:30	CC		6	PS	6
Cassino, P. C. R.	1109	INFLUENCE OF DIFFERENT LEVELS OF NITROGEN AND POTASSIUM FERTILIZATION ON THE SCALES POPULATIONS ASSOCIATED WITH CITRIC PLANTS	I	280	24/08/00	16:30	CC		6	PS	6
Cassino, P. C. R.	2620	USE OF THIAMETHOXIAM IN THE OF CONTROL PINNASPIS ASPIDISTRAE (HOMOPTERA:STERNORHYNCHA) AND ITS ON THE POPULATION OF NATIVE PARASITOIDES IN CITRUS SPP., IN ARARUAMA CITY, RJ, BRAZIL	II	662	21/08/00	16:30	CC		14	PS	14
Cassino, P. C. R.	2621	OCCURRENCE OF THE ENTOMOPATHOGENIC FUNGUS ASCHERSONIA SP. INFESTING SELENASPIDUS ARTICULATUS (HOMOPTERA: DIASPIDIDAE), IN THE STATE OF RIO DE JANEIRO, BRAZIL	II	662	21/08/00	16:30	CC		14	PS	14
Cassino, P. C. R.	2824	EFFECT OF THIAMETHOXAM ON THE POPULATION OF COCCUS VIRIDIS (HOMOPTERA:COCCIDAE) IN CITURS PLANTS IN ARARUAMA CITY, RJ, BRAZIL	II	713	25/08/00	16:30	CC		14	PS	14
Cassino, P. C. R.	1158	DAMAGE CAUSED BY SNOUT BEETLES OF THE GENERA PANTOMORUS AND NAUPACTUS IN THE "TAHITI" TRUE LIME IN ARARUAMA CITY, RJ - BRAZIL	I	292	25/08/00	16:30	CC		6	PS	6
Cassino, P. C. R.	2799	EFFECT OF NITROGENOUS AND POTASSIC FERTILIZATION ON THE POPULATION OF ALEUROTHRIXUS FLOCCOSUS (HOMOPTERA; ALEYRODIDAE), IN SWEET ORANGE (CITRUS SINENSIS), CULTIVAR "FOLHA MURCHA"	II	707	24/08/00	16:30	CC		14	PS	14
Cassino, P. C. R.	1625	OCCURRENCE OF SCALES, WHITEFLIES AND NATURAL ENEMIES IN CITRIC PLANTS IN THE MUNICIPAL DISTRICT OF CÁCERES, MT, BRASIL	I	410	25/08/00	16:30	CC		8	PS	8
Cassino, P. C. R.	1659	PARASITOIDS OF PHYLLOCNISTIS CITRELLA IN RIO DE JANEIRO STATE, BRASIL	I	418	25/08/00	16:30	CC		8	PS	8
Cassino, P.C.R.	1172	OCCURRENCE AND BIOECOLOGICAL ASPECTS OF WHITEFLIES (HOMOPTERA:ALEYRODIDAE) ON CITRUS ORCHARDS IN THE STATE OF RIO GRANDE DO SUL, BRAZIL	I	295	25/08/00	16:30	CC		6	PS	6
Cassino, P.C.R.	1173	DETERMINATION OF THE SPATIAL DISTRIBUTION OF CITRUS 'WHITEFLEIS' BY OF TAYLOR'S POWER LAW COEFFICIENTS AND WILSON & ROOM'S MATHEMATICAL MODEL ON 'VALÊNCIA' CITRUS ORCHARDS, STATE OF RIO GRANDE DO SUL, BRAZIL	I	296	25/08/00	16:30	CC		6	PS	6
Cassis, G.	3631	SCENT GLAND MORPHOLOGY AND THE CLASSIFICATION OF THE MIRIDAE	II	917	22/08/00	10:35	HB	E	21	3	21
Castañe, C.	1426	ARTIFICIAL DIETS FOR REARING PREDATORS AND PARASITOIDS OF GREENHOUSE PEST INSECTS	I	360	21/08/00	13:35	HM	O	8	2	8
Castañera, P.	2460	ANTIFEEDANT ACTIVITY AND POST-INGESTIVE EFFECT OF TERPENOIDS ISOLATED FROM TRICHILIA HAVANENSIS AND SCUTELLARIA ALPINA ON COLORADO POTATO BEETLE LARVAE	II	621	25/08/00	16:30	CC		13	PS	13
Castañera, P.	2482	PHYSIOLOGICAL RESPONSES OF COLORADO POTATO BEETLE AND BEET ARMYWORM LARVAE TO ANTISENSE-MEDIATED DEPLETION OF WOUND-INDUCIBLE PROTEINASE INHIBITORS IN POTATO	II	627	25/08/00	16:30	CC		13	PS	13
Castelo Branco, M.	1307	SUSCEPTIBILITY TO CARTAP AND ABAMECTIN IN DIAMONDBACK MOTH STRAINS FROM BRAZIL	I	330	21/08/00	16:30	CC		7	PS	7
Castelo Branco, M.	2647	USE OF INSECTICIDES FOR CONTROLLING THE BRAZILIAN TOMATO PINWORM AND THE DIAMONDBACK MOTH IN THE FEDERAL DISTRICT, BRAZIL: A CASE STUDY	II	669	22/08/00	16:30	CC		14	PS	14
Castelo Branco, M. P.	2470	INFLUENCE OF DIFFERENT AGES OF FISH PUTREFATION ON THE POST EMBRIONIC DEVELOPMENT OF LUCÍLIA CUPRINA (DIPTERA:CALLIPHORIDAE) UNDER LABORATORY CONDITIONS	II	624	23/08/00	16:30	CC		13	PS	13
Castiglioni, E. A.	3472	ATTRACTION/REPELLENCE OF SUBTERRANEAN TERMITES WITH PLANT EXTRACTS	II	876	22/08/00	16:30	CC		19	PS	19
Castiglioni, E. A.	3473	EFFECTS OF PLANT EXTRACTS AND ENTOMOPATHOGENIC FUNGI ON SUBTERRANEAN TERMITES	II	877	22/08/00	16:30	CC		19	PS	19
Castle Branco, M. P.	3002	INFLUENCE OF A DIET BASE OF FISH MEAT IN DIFFERENT PUTRAFATION STAGES ON THE POST-EMBRYONIC DEVELOPMENT OF LUCILIA CUPRINA (DIPTERA:CALLIPHORIDAE) UNDER LABORATORY CONDITIONS	II	757	24/08/00	16:30	CC		15	PS	15
Castle, S. J.	101	ECOLOGICAL CONSIDERATIONS FOR MANAGEMENT OF A MULTIPLE-CROP PEST	I	26	22/08/00	14:00	HB	A	2	4	2
Castrejón, V. R.	650	SEX ATTRACTION OF MALES OF COPITARSIA CONSUETA (LEPIDOPTERA: NOCTUIDAE) UNDER CONDITIONS OF LABORATORY	I	164	22/08/00	16:30	CC		4	PS	4
Castrejón, V. R.	3118	ANTENNAL SENSILLA OF COPITARSIA CONSUETA (LEPIDOPTERA: NOCTUIDAE)	II	787	21/08/00	16:30	CC		16	PS	16
Castrillo, L. A.	3282	USING ICE NUCLEATING BACTERIA TO REDUCE WINTER SURVIVAL OF COLORADO POTATO BEETLES: DEVELOPING A NOVEL STRATEGY FOR BIOLOGICAL CONTROL	II	829	23/08/00	10:50	HB	K	18	4	18
Castro, D.	1331	INFLUENCE OF INSECTICIDES ON THE SPIDERS COMMUNITY IN A SOY CULTIVATION (BUENOS AIRES, ARGENTINA)	I	336	22/08/00	16:30	CC		7	PS	7
Castro, F. M. C.	1856	MECHANISMS OF RESISTANCE IN TREES TO GALL-FORMING INSECTS	I	468	24/08/00	11:35	HB	M	10	5	10
Castro, F. S. de	497	COMPOSITION AND RELATIVE ABUNDANCE OF DIPTERAN FAMILIES (EXCLUDING NEMATOCERA AND ACALYPTRATAE) COLLECTED BY MALAISE TRAPS, WITHIN AND OUTSIDE FOREST FRAGMENTS IN TWO DIFFERENT AREAS	I	126	22/08/00	16:30	CC		3	PS	3
Castro, J. P. de	1777	HYBRID MALE STERILITY AND COURTSHIP ANALYSIS IN DROSOPHILA BUZZATII CLUSTER SPECIES (DIPTERA, DROSOPHILIDAE)	I	448	23/08/00	16:30	CC		9	PS	9
Castro, L. C.	473	THE INFLUENCE OF ORGANIC MATTER ON THE DIVERSITY OF SIMULIDAE ON THE MICROBASIN OF LAGEADO DOS FRAGOSOS IN CONCÓRDIA, SANTA CATARINA STATE, BRAZIL	I	120	21/08/00	16:30	CC		3	PS	3
Castro, M. E. B.	2040	ANTICARSIA GEMMATALIS NUCLEOPOLYHEDROVIRUS INFECTIVITY IN SEVEN INSECT CELL LINES	I	515	21/08/00	16:30	CC		11	PS	11
Castro, M. S. de	213	AFRICANIZED HONEYBEE AND STINGLESS BEE AS POTENCIAL POLLINATORS OF SOME TROPICAL AND EXOTIC FRUITS IN BAHIA STATE, BRAZIL	I	54	22/08/00	16:30	CC		2	PS	2
Castro, M. S. de	474	BEE FAUNA DIVERSITY OF BAHIA STATE, BRAZIL	I	120	21/08/00	16:30	CC		3	PS	3
Castro, T. M. M. G.	22	BIOLOGY OF TETRANYCHUS DESERTORUM (ACARI: TETRANYCHIDAE) ON PAPAYA TREE AND ITS OCCURRENCE IN PROTECTED ENVIRONMENT	I	6	21/08/00	16:30	CC		1	PS	1

Sub-titles: (HB=Hotel Bourbon) - (HM=Hotel Mabu) - (CC=Convention Center) - (Bol=Foz Boulevard) - (PS=Poster Session) - (PL=Plenary Lecturer)

AUTHOR	Nº	TITLE	Book	Page	Date	Time	Local	Room	Session	Symp	New Session
Castro, V. L. S. S.	1247	SOME ASPECTS OF THE ENVIRONMENTAL RISK ASSESSMENT OF GENETICALLY MODIFIED PLANTS IN BRAZIL	I	315	23/08/00	11:20	HM	N	7	5	7
Caterino, M. S.	3699	PAPILIONIDAE PHYLOGENY: MOLECULES AND MORPHOLOGY CONVERGE	II	934	26/08/00	11:50	HB	E	21	9	21
Caterino, M. S.	2330	A MOLECULAR PHYLOGENY OF COLEOPTERA FROM 18S rRNA SEQUENCES	I	588	25/08/00	16:30	CC		12	PS	12
Cates, R. G.	3364	THE EFFECT OF EXTRACTS FROM ARID AND SEMI-ARID PLANTS ON FALL ARMYWORM GROWTH	II	849	24/08/00	16:30	CC		18	PS	18
Catussi, F.	2735	TONIC EFFECT OF SOIL INSECTICIDE ON THE COFFEE (COFFEA ARABICA) PLANT AND ITS COST-BENEFICE	II	691	23/08/00	16:30	CC		14	PS	14
Catterucia, F.	2918	STABLE TRANSFORMATION OF ANOPHELINE MOSQUITOES WITH THE MINOS TRANSPOSABLE ELEMENT FROM DROSOPHILA HYDEI	II	736	24/08/00	15:35	Bol	R	15	8	15
Caudwell, R.	3648	MORPHOLOGY AND BIOGEOGRAPHY OF FEMALE MYRMECOLACIDAE PARASITIC IN ORTHOPTERA IN PAPUA NEW GUINEA	II	921	23/08/00	14:20	HB	E	21	5	21
Causton, C. E.	1501	HOST SPECIFICITY TESTING OF RODOLIA CARDINALIS, A CENTURY LATER	I	379	21/08/00	16:30	CC		8	PS	8
Causton, C. E.	3595	THE INTRODUCED INSECT PROBLEM IN THE GALÁPAGOS ISLANDS	II	907	22/08/00	16:30	CC		20	PS	20
Cavada, B. S.	1404	INSECTICIDAL ACTIVITY AND MOLECULAR TARGETS OF LEGUME LECTINS ON THE PEA APHID, ACYRTHOSIPHON PISUM	I	354	25/08/00	16:30	CC		7	PS	7
Cavalcanti Neto, F. J.	2095	LARGE SCALE BACILLUS SPHAERICUS PRODUCTION	I	528	23/08/00	16:30	CC		11	PS	11
Cavalcanti, G. M.	2847	WEEDS AS HOSTS FOR BEMISIA TABACI STRAIN B (= B. ARGENTIFOLII) (HEMIPTERA: ALEYRODIDAE) IN THE SEMI-ARID REGION OF BRAZIL	II	719	22/08/00	16:30	CC		14	PS	14
Cavalcanti, R. S.	2150	BIOLOGIC CONTROL OF CULEX QUINQUEFASCIATUS IN CITIES FROM PERNAMBUCO STATE APPLYING BACILLUS SPHAERICUS	I	542	25/08/00	16:30	CC		11	PS	11
Cavalheiro, A. J.	2419	EVALUATION OF VELVETBEEN CATERPILLAR SUSCEPTIBILITY TO ETANOLIC EXTRACTS ISOLATED FROM SEEDS OF CRYPTOCARIA MOSCHATA	II	611	21/08/00	16:30	CC		13	PS	13
Caveney, S.	2461	A HIGH-AFFINITY OCTOPAMINE/TYRAMINE TRANSPORTER CLONED FROM THE INSECT CENTRAL NERVOUS SYSTEM	II	622	23/08/00	16:30	CC		13	PS	13
Cavichioli, R. R.	3732	TAXONOMIC STATUS AND NOTES ON BIOLOGY OF ACROGONIA FROM CITRUS: ACROGONIA TERMINALIS OR A NEW SPECIES?	II	942	21/08/00	16:30	CC		21	PS	21
Cayol, J. P.	3881	BEHAVIORAL STUDIES FOR A BETTER CONTROL OF FRUIT FLY PESTS	II	980	22/08/00	10:50	HB	H	22	2	22
Cazzaniga, N. J.	336	FACTORS AFFECTING QUALITY OF ALFALFA-LEAFCUTTING BEE COCOONS IN SOUTHERN BUENOS AIRES PROVINCE, ARGENTINA	I	85	25/08/00	16:30	CC		2	PS	2
Ceballos, L. A.	2925	A LONGITUDINAL PAIRED TRIAL OF TWO SENSING DEVICES FOR DETECTING PERIDOMESTIC POPULATIONS OF TRIATOMA INFESTANS (HEMIPTERA: REDUVIIDAE) IN RURAL NORTHWESTERN ARGENTINA	II	738	25/08/00	10:50	Bol	R	15	9	15
Cecere, M. C.	2973	POPULATION DYNAMICS OF TRIATOMA INFESTANS (HEMIPTERA: REDUVIIDAE), VECTOR OF CHAGAS DISEASE, IN EXPERIMENTAL HUTS UNDER NATURAL CLIMATIC CONDITIONS	II	750	22/08/00	16:30	CC		15	PS	15
Cechettini, A.	3037	OVARIAN FOLLICLE DIFFERENTIATION IN INSECT OVARIOLES	II	766	21/08/00	11:30	HB	G	16	1	16
Cédola, C.	928	EFFECT OF TOMATO HAIRINESS IN SURVIVAL AND FECUNDITY OF T. URTICAE AND N. CALIFORNICUS [ACARI:TETRANYCHIDAE-PHYTOSEIIDAE	I	234	21/08/00	16:30	CC		6	PS	6
Cedro, R. G.	979	BEETLE ASSEMBLAGES (COLEOPTERA) IN THE PARQUE ESTADUAL XIXOVÃ-JAPUI, SÃO VICENTE-PRAIA GRANDE, SÃO PAULO	I	247	24/08/00	16:30	CC		6	PS	6
Celoto, F. J.	1292	EFFECT OF THE MICROENCAPSULATED FORMULATION OF LAMBDA-CYHALOTHRIN FOR THE CONTROL OF THE BLACK CUTWORM, AGROTIS IPSILON (LEPIDOPTERA: NOCTUIDAE), IN CORN	I	326	21/08/00	16:30	CC		7	PS	7
Celoto, F. J.	1377	EFFECT OF A SPECIAL THERMONEBULIZATION FORMICIDE FORMULATION FOR THE CONTROL OF THE LEAF-CUTTING ANT, ATTA CAPIGUARA (HYMENOPTERA:FORMICIDAE)	I	347	24/08/00	16:30	CC		7	PS	7
Celoto, F. J.	1407	PERFORMANCE OF THE MICROENCAPSULATED FORMULATION OF LAMBDA-CYHALOTHRIN FOR THE CONTROL OF THE WHITEFLY, BEMISIA TABACI (BIOTYPE B) (HEMIPTERA: ALEYRODIDAE), IN BEANS	I	355	25/08/00	16:30	CC		7	PS	7
Centeno, N. D.	2974	PRELIMINARY FOUNDINGS OF NECROPHAGOUS FAUNA ON DOMESTIC PIG IN ARGENTINA	II	750	22/08/00	16:30	CC		15	PS	15
Center, T. D.	3839	MOLECULAR SYSTEMATICS OF FERGUSONINA SPP. (DIPTERA: FERGUSONINIDAE): HOST SPECIFICITY, HOST-USE EVOLUTION, AND IMPLICATIONS FOR BIOCONTROL OF MELALEUCA QUINQUENERVA IN THE FLORIDA EVERGLADES	II	969	25/08/00	16:30	CC		21	PS	21
Cerda, H.	1308	CAN THE RESISTANCE TO INSECTICIDAL TRANSGENIC PLANT PRODUCE NEW SPECIES OF INSECT PEST?: IMPLICATIONS OF DEVELOPMENT ASYNCHRONY OF RESISTENCE PEST TO BACILLUS THURINGIENSIS TRANSGENIC CROP	I	330	21/08/00	16:30	CC		7	PS	7
Ceretti-Jr, W.	4069	BEHAVIOUR'S ESTIMATION OF PANSTRONGYLUES MEGISTUS (HEMIPTERA-REDUVIIDAE) UNDER THE ACTION OF LIME (CAOH)	II	1027	21/08/00	16:30	CC		23	PS	23
Cerilza, A.	3543	CONTROL OF UNDERGROUND TERMITES AMITERMES SP. (ISOPTERA: TERMITIDAE, TERMITINAE) ON PINEAPPLE CROP IN SEMIARID ZONE OF NORTHEAST BRAZIL	II	894	25/08/00	16:30	CC		19	PS	19
Cerqueira, B.	1924	DISTRIBUTION OF EUPHALERUS SP (HEMIPTERA: PSYLLIDAE) IN STATE OF RIO DE JANEIRO, BRAZIL	I	485	22/08/00	16:30	CC		10	PS	10
Cerstiaens, A.	3249	MALE-FEMALE DIFFERENCES IN NEUROPEPTIDE PROFILES IN LOCUSTS	II	821	21/08/00	9:35	HB	K	18	1	18
Cerstiaens, A.	3258	NEUROPEPTIDES IN LOCUSTS: PROGRESS IN THE SEARCH FOR FUNCTIONS	II	823	21/08/00	15:00	HB	K	18	1	18
Ch. Reichmuth,	4042	INTEGRATED PEST MANAGEMENT IN STORED PRODUCT PROTECTION - OUTLOOK	II	1021	24/08/00	9:35	HB	J	23	8	23
Chaaban, A.	2994	INFLUENCE OF DIFFERENT MIXTURES OF BOVINE FECES WITH SOME INGREDIENTS TO REAR STOMOXYS CALCITRANS UNDER LABORATORY CONDITIONS	II	755	21/08/00	16:30	CC		15	PS	15
Chaaban, A.	2470	INFLUENCE OF DIFFERENT AGES OF FISH PUTREFATION ON THE POST EMBRIONIC DEVELOPMENT OF LUCÍLIA CUPRINA (DIPTERA:CALLIPHORIDAE) UNDER LABORATORY CONDITIONS	II	624	23/08/00	16:30	CC		13	PS	13
Chabán, A.	3002	INFLUENCE OF A DIET BASE OF FISH MEAT IN DIFFERENT PUTRAFATION STAGES ON THE POST-EMBRYONIC DEVELOPMENT OF LUCILIA CUPRINA (DIPTERA:CALLIPHORIDAE) UNDER LABORATORY CONDITIONS	II	757	24/08/00	16:30	CC		15	PS	15
Chae, K. S.	2445	COMPARATIVE ANALYSIS OF STORAGE PROTEIN GENE OF FALL WEBWORM, HYPHANTRIA CUNEA	II	618	22/08/00	16:30	CC		13	PS	13
Chagas, M. C. M.	1502	AGENIASPIS CITRICOLA: INTRODUCTION, LABORATORY REARING AND ADAPTATION IN BRAZIL	I	379	21/08/00	16:30	CC		8	PS	8
Chaika, S. A.	3733	2REVIEW OF CHALCOLEPIDIUS (ELATERIDAE, AGRYPNINAE, HEMIRHIPINI)	II	942	21/08/00	16:30	CC		21	PS	21
Chaika, S. Yu.	3119	MORPHOLOGICAL SPECIALIZATION OF THE SENSORY ORGANS IN HEMATOPHAGOUS INSECTS	II	787	21/08/00	16:30	CC		16	PS	16
Chaika, S. Yu.	3120	SENSORY ORGANS OF THE LABIUM AND ANTENNAE IN TERRESTRIAL AND WATER BUGS (HEMIPTERA)	II	787	21/08/00	16:30	CC		16	PS	16
Chalup, A.E.	3734	A CLADISTIC ANALYSIS OF THE MOTH TRIBE OURAPTERYGINI, WITH THE DESCRIPTION OF TWO NEW GENERA (LEPIDOPTERA: GEOMETRIDAE, ENNOMINAE)	II	943	21/08/00	16:30	CC		21	PS	21
Champlin, D.	2522	POSSIBLE MOLECULAR STRATEGIES THAT UNDERLIE THE EVOLUTION OF METAMORPHIC DEVELOPMENT	II	637	25/08/00	16:30	CC		13	PS	13
Champlin, D.	3288	CROSS TALK BETWEEN ECDYSTEROIDS AND JUVENILE HORMONE AT THE CELLULAR LEVEL	II	830	23/08/00	15:05	HB	K	18	5	18
Champlin, D.	3296	POSSIBLE MOLECULAR STRATEGIES THAT UNDERLIE THE EVOLUTION OF METAMORPHIC DEVELOPMENT	II	832	25/08/00	14:35	HB	K	18	6	18
Chan, K. K.	3047	ALLATOSTATINS AND THE REGULATION OF THE CORPORA ALLATA IN A COCKROACH	II	769	22/08/00	11:05	HB	G	16	2	16

Sub-titles: (HB=Hotel Bourbon) - (HM=Hotel Mabu) - (CC=Convention Center) - (Bol=Foz Boulevard) - (PS=Poster Session) - (PL=Plenary Lecturer)

AUTHOR	Nº	TITLE	Book	Page	Date	Time	Local	Room	Session	Symp	New Session
Chandler, C. K.	2790	TETRANYCHUS URTICAE RESISTANCE TO ABAMECTIN IN FLORIDA STRAWBERRY AND THE IMPACT ON ADOPTION OF BIOLOGICAL CONTROL BY PHYTOSEIULUS PERSIMILIS	II	704	24/08/00	16:30	CC		14	PS	14
Chandler, D. S.	3815	AN ILLUSTRATED GUIDE TO THE STAPHYLINIDAE (COLEOPTERA) OF MEXICO	II	963	24/08/00	16:30	CC		21	PS	21
Chandler, L. D.	161	AREAWIDE MANAGEMENT OF DIABROTICA SPP. (COLEOPTERA: CHRYSOMELIDAE): USE OF NOVEL CONTROL TECHNOLOGIES ACROSS THE LANDSCAPE	I	41	26/08/00	14:20	HB	A	2	11	2
Chandler, L. D.	1326	EFFECTS OF TRANSGENIC HYBRID MAIZE ON ADULT WESTERN CORN ROOTWORM EMERGENCE AND ROOT RATINGS	I	335	22/08/00	16:30	CC		7	PS	7
Chandler, L. D.	241	ROOTWORM EMERGENCE FROM Cry3Bb HYBRIDS COMPARED TO THAT OBSERVED WITH INSECTICIDE-TREATED MAISE.	I	61	22/08/00	16:30	CC		2	PS	2
Chandler, L. D.	160	INSECTICIDE RESISTANCE IN THE WESTERN CORN ROOTWORM: IMPLICATIONS TO CURRENT AND FUTURE MANAGEMENT STRATEGIES	I	41	26/08/00	14:35	HB	A	2	11	2
Chandra, P. K.	4063	INTERATION BETWEEN CROPPING FACTORS AND ACTION OF INSECTS AND MOLDS IN THE DEPRECIATION OF THE NUTRITIONAL QUALITIES OF THE CORN BR 2121-QPM DURING THE STORAGE	II	1026	21/08/00	16:30	CC		23	PS	23
Chandrapatya, A.	1190	BIONOMICS OF THE CITRUS YELLOW MITE, EOTETRANYCHUS CENDANAI (TETRANYCHIDAE)	I	300	25/08/00	16:30	CC		6	PS	6
Chandrapatya, A.	1679	BIONOMICS OF AMBLYSEIUS LONGISPINOSUS (PHYTOSEIDAE) AND ITS EFFICACY AS A BIOLOGICAL CONTROL AGENT OF EOTETRANYCHUS CENDANAI (TETRANYCHIDAE)	I	423	24/08/00	16:30	CC		8	PS	8
Chaneton, E. J.	1613	IMPACT OF A SYMBIOTIC GRASS-ENDOPHYTE ASSOCIATION ON INSECT HERBIVORES AND THEIR NATURAL ENEMIES	I	407	23/08/00	16:30	CC		8	PS	8
Chang, C. L.	3950	NUTRITIONAL REQUIREMENTS OF MEDITERRANEAN FRUIT FLY	II	997	21/08/00	16:30	CC		22	PS	22
Chang, C. P.	929	LIFE HISTORY AND INUNDATIVE RELEASE OF GREEN LACEWING, MALLADA BASALIS WALKER	I	235	21/08/00	16:30	CC		6	PS	6
Chang, C. Y.	2258	DIFFERENTIATION AND IDENTIFICATION OF AEDES AEGYPTI POPULATIONS IN TAIWAN	I	570	22/08/00	16:30	CC		12	PS	12
Chang, H. W.	3321	THE RELATIONSHIP BETWEEN LOCOMOTOR PACEMAKER AND CIRCADIAN RHYTHM OF ERG IN THE GERMAN COCKROACH, BLATTELLA GERMMANICA	II	839	21/08/00	16:30	CC		18	PS	18
Chang, K. S.	1083	OCCURRENCE PATTERNS OF SPODOPTERA LITURA (LEPIDOPTERA: NOCTUIDAE) IN SOUTHERN JAPAN AND SOUTH-EASTERN ASIA	I	273	23/08/00	16:30	CC		6	PS	6
Chani Posse, M. R.	1503	LABORATORY OBSERVATIONS ON THE LIFE HISTORY AND PREDATORY EFFICIENCY OF SEVEN SPECIES OF PHILONTHUS (COLEOPTERA: STAPHYLINIDAE) ON THE HOUSE FLY (DIPTERA: MUSCIDAE)	I	379	21/08/00	16:30	CC		8	PS	8
Chani Posse, M. R.	1504	THE EFFECT OF PREY DENSITY ON THE PREDATORY ABILITY OF THREE SPECIES OF PHILONTHUS (COLEOPTERA: STAPHYLINIDAE) ASSOCIATED WITH CATTLE DUNG	I	379	21/08/00	16:30	CC		8	PS	8
Chani Posse, M. R.	3735	DESCRIPTION OF IMMATURES OF PHILONTHUS QUADRATICEPS BOHEMAN AND P.PAUXILLUS SOLSKY (COLEOPTERA: STAPHYLINIDAE)	II	943	22/08/00	16:30	CC		21	PS	21
Chapman, J. W.	930	VERTICAL-LOOKING RADAR: A POWERFUL NEW TOOL FOR MONITORING INSECT FLIGHT AT ALTITUDE	I	235	21/08/00	16:30	CC		6	PS	6
Chapman, J. W.	1212	SPATIO-TEMPORAL DYNAMICS OF AERIAL INSECT POPULATIONS EXAMINED WITH VERTICAL-LOOKING RADAR	I	305	25/08/00	16:30	CC		6	PS	6
Charernsom, K.	1672	NATURAL ENEMY COMPLEX OF THRIPS PALMI IN THAILAND	I	421	25/08/00	16:30	CC		8	PS	8
Charest, M.	1861	RESISTANCE OF YOUNG AND MATURE BALSAM FIR TREES TO SPRUCE BUDWORM AS AFFECTED BY STAND THINNING : SHORT AND LONG TERM EFFECTS	I	469	24/08/00	14:50	HB	M	10	6	10
Charles, E.	4136	VERTICAL STRATIFICATION OF CHRYSOMELID FAUNAS IN PANAMA	II	1045	25/08/00	17:00	HM	P	24	2	24
Charles, E.	3736	VERTICAL STRATIFICATION OF CHRYSOMELID FAUNAS IN PANAMA	II	943					21		21
Charlwood, D.	2869	THEMATING BEHAVIOUR OF ANOPHELES GAMBIAE - THROUGHTS ON SPECIATION	II	724	21/08/00	10:05	Bol	R	15	1	15
Charmillot, P. J.	2022	GRANULOSIS VIRUS OF CODLING MOTH CYDIA POMONELLA : FROM LABORATORY TO FIELD	I	510	24/08/00	13:30	HM	P	11	7	11
Charmillot, P. J.	2583	MATING DISRUPTION TO CONTROL GRAPE MOTHS: FROM RESEARCH TO FIELD APPLICATION	II	653	24/08/00	11:35	HB	B	14	6	14
Charmillot, P. J.	2550	THE FUTURE OF CODLING MOTH CONTROL WITH CONVENTIONAL INSECTICIDES, INSECT GROWTH REGULATORS AND MICROBIALS	II	644	21/08/00	15:05	HB	B	14	2	14
Charmillot, P. J.	2648	THE FUTURE OF CODLING MOTH CONTROL WITH CONVENTIONAL INSECTICIDES, INSECT GROWTH REGULATORS AND MICROBIALS	II	669	21/08/00	16:30	CC		14	PS	14
Chatzivassiliou, E. K.	3221	THE MEDIAN ACQUISITION AND INOCULATION ACCESS PERIOD OF THRIPS TABACI LINDEMAN MALES AND FEMALES IN THE TRANSMISSION OF TOMATO SPOTTED WILT TOSPOVIRUS	II	813	21/08/00	16:30	CC		17	PS	17
Chatzivassiliou, E. K.	3242	APHID POPULATION FLUCTUATION AND SPREAD OF APHID-BORNE VIRUSES IN TOBACCO CROPS IN GREECE	II	818	23/08/00	16:30	CC		17	PS	17
Chau, L. M.	2649	STUDIES ON THE AGE STRUCTURE OF LIFE CYCLE AND CONTROL METHODS TO YELLOW STEMBORER (SCIRPOPHAGA INCERTULAS STAL) IN MEKONG DELTA, VIETAM	II	669	21/08/00	16:30	CC		14	PS	14
Chaud-Netto, J.	1697	EVALUATION OF THE INTERACTIONS BETWEEN GALLERIA MELLONELLA (LEPIDOPTERA: PYRALIDAE), ACHROIA GRISELLA (LEPIDOPTERA: PYRALIDAE) AND THE PARASITOID APANTELES GALLERIAE (HYMENOPTERA: BRACONIDAE)	I	428	25/08/00	16:30	CC		8	PS	8
Chauvin, R.	2086	DEVELOPMENT OF ENTOMOPATHOGENIC NEMATODES FOR CONTROL OF OVERWINTERING CODLING MOTH LARVAE	I	526	23/08/00	16:30	CC		11	PS	11
Chaves, H.A.	561	RHOPALOCEROS FROM IGUAZU NATIONAL PARK (MISIONES, ARGENTINA)	I	142	25/08/00	16:30	CC		3	PS	3
Chawannapong, M.	2650	INSECTICIDE SPRAYING TECHNIQUES FOR CONTROLLING THE DIAMOND BACK MOTH, PLUTELLA XYLOSTELLA ON CHINESE KALE	II	669	21/08/00	16:30	CC		14	PS	14
Chechik, F.	2922	THE INTERACTION BETWEEN CLIMATIC FACTORS AND BLUETONGUE OUTBREAKS IN ISRAEL, THE EASTERN MEDITERRANEAN AND THE FEASIBILITY OF ESTABLISHING BLUETONGUE-FREE ZONES	II	737	25/08/00	10:05	Bol	R	15	9	15
Chechik, F.	2922	THE INTERACTION BETWEEN CLIMATIC FACTORS AND BLUETONGUE OUTBREAKS IN ISRAEL, THE EASTERN MEDITERRANEAN AND THE FEASIBILITY OF ESTABLISHING BLUETONGUE-FREE ZONES	II	737	25/08/00	10:05	Bol	R	15	9	15
Chen, C. S.	2975	EFFECT OF TEMPERATURE AND GREGARINES INFECTION ON DISTRIBUTION OF AEDES ALBOPICTUS AND AEDES AEGYPTI IN TAIWAN	II	751	22/08/00	16:30	CC		15	PS	15
Chen, G.	3074	DORSOVENTRAL PATTERNING IN TRIBOLIUM CASTANEUM	II	776	24/08/00	14:30	HB	G	16	6	16
Chen, J. M.	145	MOVEMENTS OF PLANTHOPPERS AND THEIR NATURAL ENEMIES BETWEEN HABITATS IN RICE ECOSYSTEM	I	37	25/08/00	13:45	HB	A	2	9	2
Chen, J.-H.	4	ECDYSTEROID SYNTHESIS AND ACTION IN THE IXODID TICKS	I	1	24/08/00	15:05	HB	F	1	1	1
Chen, M. R.	1508	CURRENT STATUS OF THE BIOLOGICAL CONTROL PROGRAM FOR THE MEALYBUG, ORACELLA ACUTA, IN THE PEOPLE'S REPUBLIC OF CHINA	I	380	21/08/00	16:30	CC		8	PS	8
Chen, M. Y.	1216	THE APPLICATION OF CECIDOMYIIDS GALLS ON THE SYSTEMATICS OF THE GENUS MACHILUS (LAURACEAE) IN TAIWAN	I	306	25/08/00	16:30	CC		6	PS	6
Chen, Q.	1432	IN VITRO REARING OF TRICHOGRAMMA OSTRINIAE PANG ET CHENS	I	361	21/08/00	15:05	HM	O	8	2	8
Chen, W. L.	2651	SUSCEPTIBLITY OF LIRIOMYZA SATIVAE (DIPTERA: AGROMYZIDAE) TO GREEN LEGUMOUS LEAF	II	670	21/08/00	16:30	CC		14	PS	14
Chen, X. F.	356	GENETIC VARIATION AND GENE FLOW AMONG POPULATIONS OF THE COTTON BOLLWORM HELICOVERPA ARMIGERA (LEPIDOPTERA: NOCTUIDAE) IN CHINA	I	90	24/08/00	16:30	CC		2	PS	2

Sub-titles: (HB=Hotel Bourbon) - (HM=Hotel Mabu) - (CC=Convention Center) - (Bol=Foz Boulevard) - (PS=Poster Session) - (PL=Plenary Lecturer)

AUTHOR	N°	TITLE	Book	Page	Date	Time	Local	Room	Session	Symp	New Session
Chen, X. F.	3559	KIN RECOGNITION ANALYSIS OF CAMPONOTUS JAPONICUS (HYMENOPTERA: FORMICIDAE) COMBINED WITH AGGRESSIVE BEHAVOUR TEST AND RAPD-PCR METHOD	II	898	25/08/00	16:30	CC		19	PS	19
Chen, X. X.	1505	THE OCCURRENCE OF LEAFMINERS AND THEIR PARASITOIDS ON VEGETABLE CROPS AND WEEDS IN SOUTHEAST CHINA	I	380	21/08/00	16:30	CC		8	PS	8
Cheng, D.	1215	THE CAAS ENTOMOLOGICAL RADAR	I	306	25/08/00	16:30	CC		6	PS	6
Cheng, D. J.	2407	DETERMINATION AND DISTRIBUTION OF FEMALE-SPECIFIC PROTEINS IN THE BROWN PLANTHOPPER, NILAPARVATA LUGENS	II	608	21/08/00	16:30	CC		13	PS	13
Cheng, J.	1572	HOW THE EFFICIENCY OF A PREDATOR VARIES WITH RICE VARIETY: FORAGING BEHAVIOR, POPULATION INCREASE AND FUNCTIONAL RESPONSE +B201	I	396	23/08/00	16:30	CC		8	PS	8
Cheng, J. A.	145	MOVEMENTS OF PLANTHOPPERS AND THEIR NATURAL ENEMIES BETWEEN HABITATS IN RICE ECOSYSTEM	I	37	25/08/00	13:45	HB	A	2	9	2
Cheng, J. A.	2599	AN ECOLOGICAL BASIS FOR SUSTAINABLE PEST MANAGEMENT IN RICE ECOSYSTEM	II	657	25/08/00	13:30	HB	B	14	8	14
Cheng, L.	4174	PHYLOGENY AND PHYLOGEOGRAPHY OF THE MARINE WATER STRIDER HALOBATES (HETEROPTERA, GERRIDAE)	II	1054	23/08/00	10:05	Bol	U	Erratum	1	20
Cheng, L.	2354	THE ROLE OF INNATE IMMUNE PEPTIDES TO REDUCE PARASITE DEVELOPMENT IN AEDES AEGYPTI	II	595	23/08/00	11:05	HB	I	13	4	13
Cheng, W.	3625	WEEVILS AS VECTORS OF PLANT PATHOGENS: A CASE STUDY ON AMARANTH IN SOUTH AFRICA	II	915	21/08/00	15:50	HB	E	21	2	21
Chenus, S.	1550	INOCULATIVE RELEASES OF TRICHOGRAMMA OSTRINIAE FOR EUROPEAN CORN BORER CONTROL	I	391	22/08/00	16:30	CC		8	PS	8
Cheon, H. M.	2491	OOCYTE RECEPTORS FOR THE SPECIFIC ACCUMULATION OF YOLK PROTEINS	II	629	24/08/00	16:30	CC		13	PS	13
Cheon, H. M.	2445	COMPARATIVE ANALYSIS OF STORAGE PROTEIN GENE OF FALL WEBWORM, HYPHANTRIA CUNEA	II	618	22/08/00	16:30	CC		13	PS	13
Cheon, H. M.	3305	OOCYTE RECEPTORS FOR THE SPECIFIC ACCUMULATION OF YOLK PROTEINS	II	835	25/08/00	16:05	HB	K	18	7	18
Chernaki, A. M.	2976	REARING TECHNIQUES OF ALPHITOBIUS DIAPERINUS (COLEOPTERA: TENEBRIONIDAE) USING DIFFERENT TEMPERATURES, DIETS AND HUMIDITIES	II	751	22/08/00	16:30	CC		15	PS	15
Chernikov, A.V.	1444	REDUCTION OF PARAMETRICAL SPACE DIMENSION AS A BASIS OF INSECTS REPRODUCTION AUTOMATIC SYSTEMS CONSTRUCTION	I	364	22/08/00	14:35	HM	O	8	4	8
Chesnut, J. D.	2503	JUVENILE HORMONE ESTERASE BINDING PROTEINS IN MANDUCA SEXTA	II	632	24/08/00	16:30	CC		13	PS	13
Chiappa, E.	651	FLOWER PREFERENCE AND FORAGING BEHAVIOR OF CENTRIS RODOPHTHALMA PEREZ (HYMENOPTERA: ANTHOPHORIDAE)	I	165	22/08/00	16:30	CC		4	PS	4
Chiappa, E.	931	BIOLOGY AND REPRODUCTIVE BEHAVIOR OF CENTRIS RODOPHTHALMA (HYMENOPTERA: ANTHOPHORIDAE)	I	235	21/08/00	16:30	CC		6	PS	6
Chiappa, E.	975	INTERACTIONS BETWEEN FEMALES OF MANUELIA POSTICA (SPINOLA) AND COMPARISONS OF ITS NESTS WITH THE NESTS OF MANUELIA GAYI (SPINOLA) (HYMENOPTERA: ANTHOPHORIDAE)	I	246	21/08/00	16:30	CC		6	PS	6
Chiaradia, L. A.	23	PLAN OF SAMPLING OF DICHOPELMUS NOTUS (ACARI, ERIOPHYIDAE) IN PARAGUAY-TEA ORCHARDS	I	6	21/08/00	16:30	CC		1	PS	1
Chiaradia, L. A.	24	FLUCTUATION OF BREVIPALPUS PHOENICIS (ACARI, TENUIPALPIDAE) IN CITRIC ORCHARD IN CHAPECÓ, SC	I	6	21/08/00	16:30	CC		1	PS	1
Chiaradia, L. A.	2652	PESTICIDE EVALUATION TO CONTROL GYROPSYLLA SPEGAZZINIANA (HEMIPTERA, PSYLLIDAE) IN PARAGUAY-TEA ORCHARD	II	670	22/08/00	16:30	CC		14	PS	14
Chiaradia, L. A.	2653	INSECTICIDE EVALUATION TO CONTROL AGROTIS IPSILON (LEPIDOPTERA, NOCTUIDAE) IN TOBACCO	II	670	21/08/00	16:30	CC		14	PS	14
Chiaradia, L. A.	3222	PESTICIDE EVALUATION TO CONTROL VECTORS INSECTS OF TOBACCO VIRUS DISEASES	II	813	22/08/00	16:30	CC		17	PS	17
Chiaradia, L. A.	288	DAMAGE EVALUATION OF HELICOVERPA ZEA ON THREE CORN HYBRIDS IN DIFFERENT PLANTING TIMES	I	73	23/08/00	16:30	CC		2	PS	2
Chiarotti, F.	3116	FLUCTUATING ASYMMETRY, MATING SUCCESS, BODY SIZE AND HETEROZYGOSITY IN MALES OF COENAGRION SCITULUM (ODONATA: COENAGRIONIDAE)	II	786	21/08/00	16:30	CC		16	PS	16
Chichvarkhin, A.	3820	MOLECULAR SYSTEMATICS AND EVOLUTION OF BUTTERFLIES OF THE GENUS PARNASSIUS, PAPILIONIDAE, BASED ON MITOCHONDRIAL DNA SEQUENCE DATA	II	964	24/08/00	16:30	CC		21	PS	21
Chidichimo, H. O.	3357	ARTIFITIAL INDUCTION OF SEXUALS IN GREENBUG	II	848	24/08/00	16:30	CC		18	PS	18
Chidichimo, H. O.	207	CHARACTERIZATION OF GREENBUG POPULATIONS COLLECTED IN ARGENTINA AND CHILE	I	53	22/08/00	16:30	CC		2	PS	2
Chidichimo, H. O.	921	BIOECOLOGICAL STUDIES OF RUSSIAN WHEAT APHID IN ARGENTINA AND CHILE	I	233	21/08/00	16:30	CC		6	PS	6
Childers, C. C.	2590	ROLE OF PREDATION IN BIOLOGICAL CONTROL OF MITES ON CITRUS	II	654	24/08/00	15:05	HB	B	14	7	14
Chinzei, Y.	2505	CHARACTERIZATION OF A RECOMBINANT INSECT CHITINASE AND A BACULOVIRUS CHITINASE	II	633	24/08/00	16:30	CC		13	PS	13
Chiorantal, A. B.	1627	COLLECTS AND IDENTIFICATION OF RACES OF TRICHOGRAMMA IN COMMERCIAL FIELDS OF TOMATO, IN DIFFERENT ALTITUDE	I	410	24/08/00	16:30	CC		8	PS	8
Chirinos, D. T.	932	BIOLOGY OF THE GUAVA COTTONY SCALE, CAPULINIA SP. NEAR JABOTICABAE (HEMIPTERA: ERIOCOCCIDAE) AND PHYSICAL EFFECT OF BARK EXFOLIATIONS OF GUAVA PLANT	I	235	21/08/00	16:30	CC		6	PS	6
Chirinos, D. T.	3771	BIONOMICS OF THE GUAVA COTTONY SCALE, CAPULINIA SP. NEAR JABOTICABAE (HEMIPTERA: ERIOCOCCIDAE) ON PSIDIUM SPECIES	II	952	22/08/00	16:30	CC		21	PS	21
Chiu, C. S.	2408	A TRANSPORTER-LIKE PROTEIN INEBRIATED, WHICH RESPONDS TO OSMOTIC STIMULI, IS INVOLVED IN POTASSIUM TRANSPORT	II	608	21/08/00	16:30	CC		13	PS	13
Cho, K. H.	2491	OOCYTE RECEPTORS FOR THE SPECIFIC ACCUMULATION OF YOLK PROTEINS	II	629	24/08/00	16:30	CC		13	PS	13
Cho, K. H.	3305	OOCYTE RECEPTORS FOR THE SPECIFIC ACCUMULATION OF YOLK PROTEINS	II	835	25/08/00	16:05	HB	K	18	7	18
Cho, W. L.	2917	ENGINEERING BLOOD MEAL-ACTIVATED SYSTEMIC IMMUNITY USING FAT BODY-SPECIFIC GENES IN THE MOSQUITO VECTOR	II	736	24/08/00	15:05	Bol	R	15	8	15
Cho, Y. H.	933	LIFE HISTORY OF ACRONICTA RUMICIS REARED ON THE NATURALIZED PLANT, RUMEX OBTUSIFOLIUS AS A HOST PLANT	I	236	25/08/00	16:30	CC		6	PS	6
Chocorosqui, V. R.	214	IMPACT OF CULTIVATION SYSTEMS ON DICHELOPS MELACANTHUS (HEMIPTERA: PENTATOMIDAE) ABUNDANCE AND ITS DAMAGE TO WHEAT IN SOUTHERN BRAZIL	I	55	21/08/00	16:30	CC		2	PS	2
Chocorosqui, V. R.	2605	MANAGING HETEROPTERAN OF GRASSLANDS, CORN AND WHEAT IN THE TROPICS	II	658	26/08/00	10:35	HB	B	14	9	14
Chocorosqui, V. R.	1434	PRODUCTION OF PREDATORY BUGS ON ARTIFICIAL AND FACTITIOUS FOODS AND THEIR USE IN GREENHOUSE PEST MANAGEMENT	I	362	21/08/00	15:35	HM	O	8	2	8
Choi, K.	641	TRIALS OF CONTROLLING LEPIDOPTERAN PESTS WITH SEX PHEROMONES IN KOREAN APPLE AND PEAR ORCHARDS	I	162	21/08/00	16:30	CC		4	PS	4
Choi, K.	3872	TRIALS OF CONTROLLING LEPIDOPTERAN PESTS WITH SEX PHEROMONES IN KOREAN APPLE AND PEAR ORCHARDS	II	977	21/08/00	11:05	HB	H	22	1	22
Choi, K. H.	3965	MONITORING OF TWO MAJOR FRUIT MOTHS WITH SEX PHEROMONE TRAPS IN KOREAN APPLE ORCHARDS	II	1001	23/08/00	16:30	CC		22	PS	22
Choi, K.-H.	2269	GRAM-NEGATIVE BACTERIA BINDING PROTEIN, A PATTERN RECOGNITION RECEPTOR FOR LIPOPOLYSACCHARIDE AND b-1,3-GLUCAN, WHICH MEDIATES THE SIGNALING FOR THE INDUCTION OF INNATE IMMUNE GENES IN DROSOPHILA MELANOGASTER CELLS	I	573	22/08/00	16:30	CC		12	PS	12
Chosa, N.	2409	PROCESSING OF DROSOPHILA SPÄTZLE PROTEIN BY A SERINE PROTEASE IN THE PROPHENOLOXIDASE CASCADE OF THE SILKWORM PLASMA	II	609	21/08/00	16:30	CC		13	PS	13

Sub-titles: (HB=Hotel Bourbon) - (HM=Hotel Mabu) - (CC=Convention Center) - (Bol=Foz Boulevard) - (PS=Poster Session) - (PL=Plenary Lecturer)

AUTHOR	N°	TITLE	Book	Page	Date	Time	Local	Room	Session	Symp	New Session
Chow, Y. S.	3198	ANTENNATION AND SEXUALLY DIMORPHIC ANTENNAE OF THE BLISTER BEETLE, EPICAUTA HIRTICONIS	II	807	25/08/00	16:30	CC		16	PS	16
Chowdhury, M. A.	4062	LABORATORY AND FIELD STUDIES ON LARVAL CONTROL OF CULEX QUINQUEFASCIATUS MOSQUITOES INHABITING URBAN AND SUBURBAN DHAKA, BANGLADESH	II	1026	22/08/00	16:30	CC		23	PS	23
Chown, S. L.	50	INTERSPECIFIC PHYSIOLOGICAL DIFFERENTIATION IN MARINE AND TERRESTRIAL HALOZETES SPECIES (ACARI, ORIBATIDA)	I	13	23/08/00	16:30	CC		1	PS	1
Chown, S. L.	3670	THE EVOLUTION OF HABITAT USE AND DIET IN THE SCARABAEOIDEA: A PHYLOGENETIC APPROACH	II	927	24/08/00	14:20	HB	E	21	7	21
Chozhan, K.	2108	COMPARATIVE EFFICACY OF BACILLUS THURINGIENSIS FORMULATIONS FOR CONTROL OF RICE LEAF FOLDER AND THEIR EFFECTS ON BIODIVERSITY IN RICE ECOSYSTEM	I	532	25/08/00	16:30	CC		11	PS	11
Chozhan, K.	2654	AMELIORATIVE EFFECT OF NEEM AND OTHER BOTANICALS ON THE RESURGENCE OF RICE BROWN PLANTHOPPER, NILAPARVATA LUGENS AND ITS SYMBIONTS	II	670	21/08/00	16:30	CC		14	PS	14
Chrispeels, M. J.	2527	DIGESTIVE ALPHA-AMYLASES FROM COFFEE BERRY BORER (HYPOTHENEMUS HAMPEI) AND THEIR INHIBITION BY AMYLASE INHIBITORS FROM PLANTS.	II	638	25/08/00	16:30	CC		13	PS	13
Christensen, T.	579	THE NITRIC OXIDE – SOLUBLE GUANYLYL CYCLASE SIGNALING SYSTEM IS INVOLVED IN THE PROCESSING OF OLFACTORY INFORMATION IN THE HAWKMOTH, MANDUCA SEXTA	I	147	21/08/00	14:15	Bol	S	4	1	4
Christensen, B. M.	2354	THE ROLE OF INNATE IMMUNE PEPTIDES TO REDUCE PARASITE DEVELOPMENT IN AEDES AEGYPTI	II	595	23/08/00	11:05	HB	I	13	4	13
Christiansen, E.	2410	DEFENCE MECHANISMS OF NORWAY SPRUCE AGAINST BARK BEETLE-FUNGUS ATTACKS	II	609	21/08/00	16:30	CC		13	PS	13
Christiansen, E.	2084	INDUCED DISEASE RESISTANCE IN NORWAY SPRUCE AND ITS IMPLICATIONS FOR BARK BEETLE POPULATION DYNAMICS	I	526	22/08/00	16:30	CC		11	PS	11
Christianson, B. A.	121	EVALUATION OF SEASONAL PARTICLE FILM SPRAY PROGRAMS IN A WESTERN APPLE ORCHARD	I	31	23/08/00	16:05	HB	A	2	6	2
Christophides, G.	2237	MOLECULAR STUDIES OF SEX-SPECIFIC GENES IN THE INSECTS C. CAPITATA AND BACTROCERA OLEAE	I	565	21/08/00	16:30	CC		12	PS	12
Chrysanthis, G.	2262	HEAT SHOCK RESPONSE IN THE MEDITERRANEAN FRUIT FLY: GENES, PROMOTERS AND THERMOTOLERANCE	I	571	22/08/00	16:30	CC		12	PS	12
Chrzanowski, G.	215	EFFECT OF THE GRAIN APHID FEEDING ON POLYSACCHARIDE CONTENT IN EARS OF WINTER TRITICALE CULTIVARS	I	55	22/08/00	16:30	CC		2	PS	2
Chrzanowski, G.	216	RESISTANCE TO GRAIN APHID IN WINTER TRITICALE CULTIVARS IN RELATION TO THE CONTENT OF MONO- AND OLIGOSACCHARIDES	I	55	22/08/00	16:30	CC		2	PS	2
Chvála, M.	3661	FENNOSCANDIAN HILARA SPECIES (DIPTERA: EMPIDIDAE) AND THEIR SUPPOSED CIRCUMPOLAR DISTRIBUTION	II	924	24/08/00	10:35	HB	E	21	6	21
Cianficconi, F.	934	EXPERIMENTAL OBSERVATIONS ON THE OUTBREAK OF INFESTATION BY KNEMIDOKOPTES PILAE (ACARINA: KNEMIDOKOPTIDAE) IN PARROTS (MELOPSITTACUS UNDULATUS)	I	236	21/08/00	16:30	CC		6	PS	6
Cianficconi, F.	3737	A NEW SPECIES OF ATHRIPSODES (INSECTA TRICHOPTERA: LEPTOCERIDAE) FROM CENTRAL-SOUTHERN ITALY	II	943	22/08/00	16:30	CC		21	PS	21
Cibrián, J.	650	SEX ATTRACTION OF MALES OF COPITARSIA CONSUETA (LEPIDOPTERA: NOCTUIDAE) UNDER CONDITIONS OF LABORATORY	I	164	22/08/00	16:30	CC		4	PS	4
Cibrián, J.	3118	ANTENNAL SENSILLA OF COPITARSIA CONSUETA (LEPIDOPTERA: NOCTUIDAE)	II	787	21/08/00	16:30	CC		16	PS	16
Cibrián-Tovar, D.	573	BIONOMICS OF PEPPERTREE PSYLLID CALOPHYA RUBRA (HOMOPTERA: PSYLLIDAE) IN MEXICOR	I	145	25/08/00	16:30	CC		3	PS	3
Cibrián-Tovar, D.	574	BIONOMICS OF PEPPERTREE PSYLLID CALOPHYA RUBRA (HOMOPTERA: PSYLLIDAE) IN MEXICO	I	145	21/08/00	16:30	CC		3	PS	3
Cichon, L.	2549	INSECTICIDE RESISTANCE IN CODLING MOTH WORLDWIDE: MONITORING, MECHANISMS AND CROSS-RESISTANCES.	II	644	21/08/00	14:50	HB	B	14	2	14
Cichon, L.	2812	INSECTICIDE RESISTANCE IN CODLING MOTH WORLDWIDE: MONITORING, MECHANISMS AND CROSS-RESISTANCES.	II	710	24/08/00	16:30	CC		14	PS	14
Cichón, L. I.	2655	FRUIT PRODUCTION AND MATING DISRUPTION OF CODLING MOTH IN ARGENTINA	II	671	21/08/00	16:30	CC		14	PS	14
Cichón, L. I.	3869	FRUIT PRODUCTION AND MATING DISRUPTION OF CODLING MOTH IN ARGENTINA	II	977	21/08/00	9:35	HB	H	22	1	22
Cichón, L. I.	2791	INTEGRATED PEST MANAGEMENT OF NECTARINES IN THE RIO NEGRO VALLEY OF ARGENTINA	II	705	24/08/00	16:30	CC		14	PS	14
Cicolani, B.	475	BIODIVERSITY AND ECOLOGICAL IMPORTANCE OF WATER MITES (ACARI, HYDRACHNIDIA) IN ITALIAN SPRINGS	I	120	21/08/00	16:30	CC		3	PS	3
Ciepiela, A. P.	215	EFFECT OF THE GRAIN APHID FEEDING ON POLYSACCHARIDE CONTENT IN EARS OF WINTER TRITICALE CULTIVARS	I	55	22/08/00	16:30	CC		2	PS	2
Ciepiela, A. P.	216	RESISTANCE TO GRAIN APHID IN WINTER TRITICALE CULTIVARS IN RELATION TO THE CONTENT OF MONO- AND OLIGOSACCHARIDES	I	55	22/08/00	16:30	CC		2	PS	2
Ciepiela, A. P.	2411	INTERACTION OF SOME PROTEINS ON BIOLOGY OF GRAIN APHID (SITOBION AVENAE /F.)	II	609	21/08/00	16:30	CC		13	PS	13
Ciglar, I.	2628	SPECIES OF HETEROPTERA IN CROATIAN APPLE ORCHARDS	II	664	21/08/00	16:30	CC		14	PS	14
Cigliano, M. M.	3752	REVISION OF THE GENUS METALEPTEA (ORTHOPTERA; ACRIDIDAE; HYALOPTERYGINI)	II	947	22/08/00	16:30	CC		21	PS	21
Cigliano, M. M.	476	GRASSHOPPER (ORTHOPTERA: ACRIDOIDEA) SPECIES DIVERSITY IN THE PAMPAS, ARGENTINA	I	121	21/08/00	16:30	CC		3	PS	3
Cilla, G.	1752	NEST ARCHITECTURE AND NESTING BEHAVIOR OF ALEPIDOSCELES FILITARSIS (APIDAE, ANTHOPHORINAE)	I	441	21/08/00	16:30	CC		9	PS	9
Cink, J. H.	2677	FIELD TRIALS WITH PREMISE (IMIDACLOPRID) TERMITICIDE FOR CONTROLLING FORMOSAN SUBTERRANEAN TERMITES IN TREES IN NEW ORLEANS, LOUISIANA	II	676	22/08/00	16:30	CC		14	PS	14
Cintra, P.	1309	METANOLIC EXTRACTS FROM DIMORPHANDRA MOLLIS (BARBATIMÃO) AND THEIR ACTIVITY IN WORKERS OF APIS MELLIFERA	I	330	21/08/00	16:30	CC		7	PS	7
Ciochia, V.	1506	BIOLOGYCAL CONTROL OF SOME PHYTOPHAGUE INSECTS WITH TRICHOGRAMMA SPP. (INSECT., HYM.)	I	380	21/08/00	16:30	CC		8	PS	8
Ciochia, V.	1668	THE ENTOMOPHAGUE TRICHOGRAMMA SPP. (INSECTA, HYMENOPTERA) A CHANCE OF BIOLOGICAL CONTROL IN THE TRID MILLENNIUM, IN ROMANIA	I	420	25/08/00	16:30	CC		8	PS	8
Ciociola Jr., A. I.	1507	MOLECULAR KEY TO SOME BRAZILIAN SPECIES OF TRICHOGRAMMA USING ITS2 SEQUENCES AND RESTRICTION ANALYSIS	I	380	21/08/00	16:30	CC		8	PS	8
Ciociola Jr., A. I.	2238	IDENTIFICATION OF TRICHOGRAMMA BASED ON THE SEQUENCE OF THE ITS2 REGION OF THE rDNA, WITH A NEW RECORD FROM BRAZIL	I	565	22/08/00	16:30	CC		12	PS	12
Ciociola Jr., A. I.	1629	CHARACTERIZATION OF THREE SPECIES OF THE GENUS TRICHOGRAMMA	I	411	22/08/00	16:30	CC		8	PS	8
Ciociola, A. I.	3467	SELECTION OF DYES FOR MARKING THE SUBTERRANEAN TERMITE COPTOTERMES HAVILANDI (ISOPTERA: RHINOTERMITIDAE) IN LABORATORY	II	875	21/08/00	16:30	CC		19	PS	19
Ciociola, A. I.	3466	FORAGING BEHAVIOR OF THE SUBTERRANEAN TERMITE COPTOTERMES HAVILANDI (ISOPTERA: RHINOTERMITIDAE) IN RESIDENTIAL AREAS	II	875	21/08/00	16:30	CC		19	PS	19
Ciociola, A. I.	3468	WOOD CONSUMPTION RATE BY THE SUBTERRANEAN TERMITE COPTOTERMES HAVILANDI (ISOPTERA: RHINOTERMITIDAE) IN RESIDENTIAL AREAS	II	875	21/08/00	16:30	CC		19	PS	19
Ciomei, C.	1847	A NEW VIRAL PRODUCT "Inf-Ld" USED IN THE CONTROL OF POPULATIONS DENSITY OF LYMANTRIA DISPAR L. AND EUPROCTIS CHRYSORRHOEA	I	466	23/08/00	15:35	HB	M	10	4	10
Cisneros, F.	2012	AN INTEGRATED APPROACH TO MANAGE THE ANDEAN POTATO WEEVIL, PREMNOTRYPES SPP. (CURCULIONIDAE)	I	508	23/08/00	11:35	HM	P	11	5	11

Sub-titles: (HB=Hotel Bourbon) - (HM=Hotel Mabu) - (CC=Convention Center) - (Bol=Foz Boulevard) - (PS=Poster Session) - (PL=Plenary Lecturer)

AUTHOR	Nº	TITLE	Book	Page	Date	Time	Local	Room	Session	Symp	New Session
Cisneros, J. J.	2695	INFLUENCE OF COTTON NITROGEN FERTILITY ON COTTON APHID, APHIS GOSSYPII, POPULATION DYNAMICS IN CALIFORNIA	II	681	22/08/00	16:30	CC		14	PS	14
Ciuhrii, M.	1847	A NEW VIRAL PRODUCT "Inf-Ld" USED IN THE CONTROL OF POPULATIONS DENSITY OF LYMANTRIA DISPAR L. AND EUPROCTIS CHRYSORRHOEA	I	466	23/08/00	15:35	HB	M	10	4	10
Ciuhrii, M.	2041	THE EXPERIMENTAL TRIALS WITH THE VIRAL PRODUCT "Inf-Hc" FOR DENSITY CONTROL OF PEST POPULATIONS OF HYPHANTRIA CUNEA	I	515	21/08/00	16:30	CC		11	PS	11
Cividanes, F. J.	935	ESTIMATION OF THERMAL THRESHOLD AND DEGREE-DAY MODEL FOR PREDICTING THE OCCURRENCE OF THE CABBAGE APHID (HOMOPTERA: APHIDIDAE)	I	236	21/08/00	16:30	CC		6	PS	6
Cividanes, F. J.	920	INFLUENCE OF PHOSPHATE-POTASSIC FERTILIZATION ON THE OCCURRENCE THE NATURAL ENEMIES ASSOCIATED TO SOYBEAN	I	232	21/08/00	16:30	CC		6	PS	6
Cividanes, F. J.	994	AGE-SPECIFIC LIFE TABLE OF LIPAPHIS ERYSIMI KALT. (HOMOPTERA: APHIDIDAE) UNDER FIELD CONDITIONS	I	251	22/08/00	16:30	CC		6	PS	6
Cividanes, F. J.	995	THERMAL REQUIREMENTS AND PREDICTION OF POPULATION PEAKS OF LIPAPHIS ERYSIMI KALT. (HOMOPTERA: APHIDIDAE)	I	251	22/08/00	16:30	CC		6	PS	6
Cividanes, F.J.	922	INFLUENCE OF PHOSPHATE-POTASSIC FERTILIZATION ON THE OCCURRENCE OF SOYBEAN INSECT PESTS	I	233	21/08/00	16:30	CC		6	PS	6
Cladera, J. L.	366	ASSESSING AREAS OF CLIMATIC STRESS FOR CERATITIS CAPITATA (DIPTERA: TEPHRITIDAE) IN ARGENTINA	I	93	25/08/00	16:30	CC		2	PS	2
Claeys, I.	2259	MOLECULAR CLONING OF NEUROPARSIN PRECURSOR cDNAs IN THE DESERT LOCUST SCHISTOCERCA GREGARIA	I	570	22/08/00	16:30	CC		12	PS	12
Claeys, I.	2321	THE 4-kDa PROTEASE INHIBITOR FAMILY IN THE DESERT LOCUST SCHISTOCERCA GREGARIA: MOLECULAR CLONING AND ANALYSIS OF TISSUE- AND STAGE-DEPENDENT EXPRESSION	I	586	23/08/00	16:30	CC		12	PS	12
Claeys, I.	2447	MOLECULAR CLONING OF NEUROPARSIN PRECURSOR CDNAS IN THE DESERT LOCUST SCHISTOCERCA GREGARIA	II	618	25/08/00	16:30	CC		13	PS	13
Claeys, I.	2509	THE 4-KDA PROTEASE INHIBITOR FAMILY IN THE DESERT LOCUST SCHISTOCERCA GREGARIA: MOLECULAR CLONING AND ANALYSIS OF TISSUE- AND STAGE-DEPENDENT EXPRESSION	II	634	24/08/00	16:30	CC		13	PS	13
Claeys, I.	2528	INSECT G PROTEIN-COUPLED RECEPTORS AND SIGNAL TRANSDUCTION	II	638	25/08/00	16:30	CC		13	PS	13
Claeys, I.	2529	INSECT G PROTEIN-COUPLED RECEPTORS AND SIGNAL TRANSDUCTION	II	639	25/08/00	16:30	CC		13	PS	13
Claeys, I.	3249	MALE-FEMALE DIFFERENCES IN NEUROPEPTIDE PROFILES IN LOCUSTS	II	821	21/08/00	9:35	HB	K	18	1	18
Clancy, K. M.	1852	MECHANISMS OF RESISTANCE IN TREES TO DEFOLIATORS	I	467	24/08/00	10:05	HB	M	10	5	10
Clark, T. L.	953	DEPOSITION OF CORN POLLEN ON MILKWEED AND EXPOSURE RISK TO MONARCH BUTTERFLY LARVAE.	I	241	22/08/00	16:30	CC		6	PS	6
Clark, A. G.	3300	CONTROL OF DROSOPHILA REPRODUCTION BY MALE-DERIVED PROTEINS IN THE SEMINAL FLUID	II	833	25/08/00	13:35	HB	K	18	7	18
Clark, C. E.	1285	INDUSTRIAL APPROACH FOR MANAGING RESISTANCE TO NOVEL INSECTICIDES A GLOBAL RESISTANCE MONITORING PROGRAM	I	324	25/08/00	16:20	HM	N	7	10	7
Clark, J.	3253	MULTIPLE PEPTIDE FAMILIES ARE INVOLVED IN THE NEURAL CONTROL OF REPRODUCTIVE TISSUES OF THE FEMALE LOCUST	II	822	21/08/00	11:05	HB	K	18	1	18
Clark, K. D.	2376	THE ROLE OF PLASMATOCYTE SPREADING PEPTIDE IN REGULATION OF ENCAPSULATION	II	600	24/08/00	16:05	HB	I	13	7	13
Clark, K. D.	2371	THE ROLE OF POLYDNAVIRUSES IN DEFINING PARASITOID HOST RANGES	II	599	24/08/00	13:35	HB	I	13	7	13
Clarke, F. C.	3140	THE EXTERNAL MICROMORPHOLOGY OF THE EAR MITE OTODECTES CYNOTIS (ACARI : PSOROPTIDAE) AS REVEALED BY SCANNING ELECTRON MICROSCOPY	II	792	22/08/00	16:30	CC		16	PS	16
Clarke, S. E.	2964	THE IMPORTANCE OF MOSQUITO LARVAL SURVEYS IN THE MAPPING OF MALARIA TRANSMISSION RISK	II	748	21/08/00	16:30	CC		15	PS	15
Clarke, I. P.	425	INSECTS AS INDICATORS OF SUBTLE CLIMATE-INDUCED HABITAT FRAGMENTATION	I	108	24/08/00	11:20	HB	C	3	5	3
Clarke, J. M.	3470	ANTIMICROBIAL COMPOUNDS FROM ANTS AND OTHER INSECTS AND THEIR ROLE IN THE EVOLUTION OF SOCIALITY	II	876	23/08/00	16:30	CC		19	PS	19
Clarke, S. R.	652	THE SOUTHERN PINE BEETLE INTERNET CONTROL CENTER: AN INTERACTIVE INTEGRATED PEST MANAGEMENT WEB-SITE	I	165	24/08/00	16:30	CC		4	PS	4
Clarke, S. R.	1508	CURRENT STATUS OF THE BIOLOGICAL CONTROL PROGRAM FOR THE MEALY BUG, ORACELLA ACUTA, IN THE PEOPLE'S REPUBLIC OF CHINA	I	380	21/08/00	16:30	CC		8	PS	8
Clarke, S. R.	1908	SUPPRESSION OF SOUTHERN PINE BEETLE INFESTATIONS USING VERBENONE, AN ANTI-AGGREGATION PHEROMONE	I	481	23/08/00	16:30	CC		10	PS	10
Claro, K. Del	3742	INMATURE STAGES OF ZELUS LEUCOGRAMMUS (HETEROPTERA: REDUVIIDAE)	II	945	22/08/00	16:30	CC		21	PS	21
Clavijo, J. A.	3738	THE SPILOMELINI OF VENEZUELA (LEPIDOPTERA:CRAMBIDAE: PYRAUSTINAE)	II	944	21/08/00	16:30	CC		21	PS	21
Clement, S. L.	847	NEOTYPHODIUM DIVERSITY IN GRASSES AND THE ISSUE OF INSECT RESISTANCE	I	214	24/08/00	9:35	HB	D	6	6	6
Clement, S. L.	3887	ENHANCING INSECT RESISTANCE IN GRASSES THROUGH DEPLOYMENT OF FUNGAL ENDOPHYTES	II	981	22/08/00	15:35	HB	H	22	3	22
Clemente, M.	2239	RIBOSOMAL DNA VARIATION IN NATURAL POPULATIONS OF DICHROPLUS ELONGATUS (ORTHOPTERA: ACRIDIDAE)	I	565	21/08/00	16:30	CC		12	PS	12
Clemente, S.	1310	IDENTIFICATION OF A CHEMICAL FRACTION FROM AROMATIC HERBS WITH INSECTICIDAL ACTIVITY AGAINST TRIBOLIUM CASTANEUM (COLEOPTERA, TENEBRIONIDAE)	I	331	21/08/00	16:30	CC		7	PS	7
Clemente, S.	328	BASIL-TOMATO INTERCROPPING EFFECT ON MACROSIPHUM EUPHORBIAE (HEMIPTERA: APHIDIDAE) ABUNDANCE	I	83	24/08/00	16:30	CC		2	PS	2
Clerck-Floate, R. De	2042	LESSONS LEARNED DURING THE DESIGN OF AN ARTHROPOD AND PATHOGEN QUARANTINE FACILITY	I	515	21/08/00	16:30	CC		11	PS	11
Clercq, P. De	1434	PRODUCTION OF PREDATORY BUGS ON ARTIFICIAL AND FACTITIOUS FOODS AND THEIR USE IN GREENHOUSE PEST MANAGEMENT	I	362	21/08/00	15:35	HM	O	8	2	8
Clercq, P. De	1426	ARTIFICIAL DIETS FOR REARING PREDATORS AND PARASITOIDS OF GREENHOUSE PEST INSECTS	I	360	21/08/00	13:35	HM	O	8	2	8
Clery, J.	2944	FORENSIC ENTOMOLOGY IN NEW YORK CITY: LIFE IN THE BOROUGHS	II	743	26/08/00	10:50	Bol	R	15	11	15
Clift, A. D.	936	INTERACTIONS BETWEEN CLIMATE, PASTURE GROWTH AND PARASITES IN DEVELOPMENT OF OUTBREAKS OF AN ACRIDID, PHAULACRIDIUM VITTATUM IN SOUTH-EAST AUSTRALIA	I	236	21/08/00	16:30	CC		6	PS	6
Clift, A. D.	3223	INTERACTIONS BETWEEN INSECT VECTORS OF PLANT DISEASES IN AUSTRALIA	II	814	22/08/00	16:30	CC		17	PS	17
Clift, A. D.	88	USE OF A DATABASE AND GEOGRAPHIC INFORMATION SYSTEM TO MONITOR A FRUIT FLY ERADICATION PROGRAM	I	23	21/08/00	14:35	HB	A	2	2	2
Clúa, A. A.	207	CHARACTERIZATION OF GREENBUG POPULATIONS COLLECTED IN ARGENTINA AND CHILE	I	53	22/08/00	16:30	CC		2	PS	2
Clúa, A. A.	921	BIOECOLOGICAL STUDIES OF RUSSIAN WHEAT APHID IN ARGENTINA AND CHILE	I	233	21/08/00	16:30	CC		6	PS	6
Clúa, A. A.	3357	ARTIFITIAL INDUCTION OF SEXUALS IN GREENBUG	II	848	24/08/00	16:30	CC		18	PS	18
Clynen, E.	3249	MALE-FEMALE DIFFERENCES IN NEUROPEPTIDE PROFILES IN LOCUSTS	II	821	21/08/00	9:35	HB	K	18	1	18
Clynen, E.	3258	NEUROPEPTIDES IN LOCUSTS: PROGRESS IN THE SEARCH FOR FUNCTIONS	II	823	21/08/00	15:00	HB	K	18	1	18
Cnaani, J.	2440	CASTE-SPECIFIC DIFFERENCES IN ECDYSTEROID TITERS IN EARLY LARVAL STAGES OF THE BUMBLE BEE BOMBUS TERRESTRIS	II	616	22/08/00	16:30	CC		13	PS	13
Coast, G. M.	2346	INSECT DIURETIC HORMONES - A DIVERSITY OF MOLECULAR SPECIES ACTING VIA DIFFERENT SECOND MESSENGERS	II	593	21/08/00	15:35	HB	I	13	2	13
Coates, C. J.	2220	MARINER MOBILITY IN AEDES AEGYPTI	I	560	25/08/00	15:05	HB	L	12	10	12
Cobbinah, J. R.	1864	USING RESISTANCE IN TROPICAL PLANTATIONS	I	470	24/08/00	15:35	HB	M	10	6	10

Sub-titles: (HB=Hotel Bourbon) - (HM=Hotel Mabu) - (CC=Convention Center) - (Bol=Foz Boulevard) - (PS=Poster Session) - (PL=Plenary Lecturer)

AUTHOR	Nº	TITLE	Book	Page	Date	Time	Local	Room	Session	Symp	New Session
Cobbinah, J. R.	841	RESPONSE OF PHYTOLYMA LATA (HOMPOTERA: PSYLLIDAE) TO VARYING HOST DENSITY IN GHANA, WEST AFRICA	I	213	23/08/00	15:00	HB	D	6	5	6
Cobbinah, J. R.	1254	CURENT DEVELOPMENTS WITH ETHNOBOTANICAL INSECTICIDES FROM GHANA: REVIVING AND MODERNISING AGE-OLD PRACTICE	I	317	24/08/00	10:20	HM	N	7	7	7
Cobolli, M.	3785	A PHYLOGENETIC STUDY IN THE CAVE CRICKET GENUS TROGLOPHILUS (ORTHOPTERA, RAPHIDOPHORIDAE): COMBINING ALLOZYMIC AND MITOCHONDRIAL DNA SEQUENCE VARIATION DATA	II	955	23/08/00	16:30	CC		21	PS	21
Coca-Abia, M.	3121	MORPHOLOGY OF THE MOUTH PARTS IN ADULTS OF PHYLLOPHAGA (SENSU LATO) HARRIS, 1827	II	787	21/08/00	16:30	CC		16	PS	16
Coca-Abia, M.	3122	HIGH RESOLUTION EXTENDED DEPTH OF FOCUS IMAGES FOR ENTOMOLOGY	II	788	21/08/00	16:30	CC		16	PS	16
Coca-Abia, M.	3667	PHYLOGENETIC TRENDS IN THE TRIBE MELOLONTHINI (COL., SCARABAEIDAE, MELOLONTHINAE) IN THE HOLARCTIC REGION. A BIOGEOGRAPHIC APPROACH	II	926	24/08/00	13:35	HB	E	21	7	21
Coca-Abia, M.	3739	REESTABLISHMENT OF THE GENUS TRICHESTHES ERICHSON, 1847 (COL., SCARABAEIDAE, MELOLONTHINAE), INCLUDING ITS GENITALIA AND EXTERNAL MORPHOLOGY.	II	944	22/08/00	16:30	CC		21	PS	21
Cocuzza, G. E.	3722	AN APPROACH TO EVOLUTIVE TAXONOMY OF THE APHID GENUS ANURAPHIS (RHYNCHOTA APHIDIDAE)	II	940	21/08/00	16:30	CC		21	PS	21
Coelho, S. A. M. P.	217	EFFECT OF PYRIPROXYFEN ON WHITEFLY (BEMISIA ARGENTIFOLII) EGGS, IN THE EGGPLANT (SOLANUM MELOGENA), IN FIELD CONDITIONS	I	55	22/08/00	16:30	CC		2	PS	2
Coelho, S. A. M. P.	2043	EFFECT OF BACILLUS THURINGIENSIS, SUBSP. AIZAWAI FOR THE CONTROL OF PLUTELLA XYLOSTELLA ON CAULIFLOWER, BRASSICA OLERACEA	I	515	21/08/00	16:30	CC		11	PS	11
Coetzee, M.	2264	MOLECULAR IDENTIFICATION OF THE ANOPHELES FUNESTUS GROUP IN SOUTHERN AFRICA	I	571	22/08/00	16:30	CC		12	PS	12
Coghlin, P.	1525	DISPERSAL OF THE FILTH FLY PARASITOID MUSCIDIFURAX RAPTORELLUS (HYMENOPTERA: PTEROMALIDAE) FOLLOWING MASS-RELEASES IN CATTLE CONFINEMENTS	I	385	22/08/00	16:30	CC		8	PS	8
Cogni, R.	1509	INFLUENCE OF PREY SIZE ON PREDATION SUCCESS BY ZELUS LONGIPES (HETEROPTERA: REDUVIIDAE)	I	381	21/08/00	16:30	CC		8	PS	8
Cohen, A. C.	1429	USING BIOCHEMICAL APPROACHES FOR QUALITY CONTROL OF INSECTS REARED ON ARTIFICIAL DIETS	I	361	21/08/00	14:20	HM	O	8	2	8
Cohen, A. C.	1511	USING KNOWLEDGE OF FEEDING BIOLOGY AND BIOCHEMISTRY TO DEVELOP ARTIFICIAL DIETS FOR PREDACEOUS AND PHYTOPHAGOUS INSECTS	I	381	21/08/00	16:30	CC		8	PS	8
Cohen, A. C.	1510	USING BIOCHEMICAL APPROACHES FOR QUALITY CONTROL OF INSECTS REARED ON ARTIFICIAL DIETS	I	381	21/08/00	16:30	CC		8	PS	8
Cohen, H.	2656	MASS TRAPPING STRATEGY TO REDUCE MEDITERRANEAN FRUIT FLY (DIPTERA: TEPHRITIDAE) DAMAGE ON APPLES IN ISRAEL	II	671	21/08/00	16:30	CC		14	PS	14
Cohen, M. B.	2287	MOLECULAR CHARACTERIZATION OF RICE BROWN PLANTHOPPER POPULATION	I	577	24/08/00	16:30	CC		12	PS	12
Cohen, M. B.	3886	MOLECULAR CHARACTERIZATION OF RICE BROWN PLANTHOPPER POPULATION	II	981	22/08/00	15:05	HB	H	22	3	22
Cohen, N. E.	3361	MODULATORS OF EGG MATURATION AND LONGEVITY IN HELIOTHIS VIRESCENS	II	849	24/08/00	16:30	CC		18	PS	18
Cohen, S. A.	495	STRUCTURE AND DIVERSITY OF STREAM INSECT ASSEMBLAGES APPLIED TO ASSESSMENT: THE LULES RIVER (TUCUMAN, ARGENTINA)	I	125	22/08/00	16:30	CC		3	PS	3
Coimbra, J. L. M.	2703	INFLUENCE OF LIBERTY LINK IRRIGATED RICE TECHNOLOGY ON ORYZOPHAGUS ORYZAE (COLEOPTERA: CURCULIONIDAE)	II	683	22/08/00	16:30	CC		14	PS	14
Coimbra, S.	2091	GROWTH OF FUNGI CULTIVATED BY CUTTING ANTS ON MURASHIGE & SKOOG NUTRIENT SOLUTION IN DIFFERENT pH	I	527	24/08/00	16:30	CC		11	PS	11
Coitinho, R. L. B. C.	4096	EFFECT OF VEGETABLE OILS ON THE PREFERENCE FOR OVIPOSITION AND VIABILITY OF IMATURE PHASE OF CALLOSOBRUCHUS MACULATUS (COLEOPTERA: BRUCHIDAE) IN COWPEA GRAINS	II	1034	23/08/00	16:30	CC		23	PS	23
Coitinho, R. L. B. C.	1399	REPELLENCY OF VEGETABLE OILS ON ADULTS OF ZABROTES SUBFASCIATUS (COLEOPTERA: BRUCHIDAE) IN BEAN GRAINS	I	353	25/08/00	16:30	CC		7	PS	7
Cokl, A.	1753	THE LANGUAGE AND DIALECTS OF THE SOUTHERN GREEN STINK BUG NEZARA VIRIDULA, AN INSECT WHICH COMMUNICATES THROUGH PLANTS	I	442	21/08/00	16:30	CC		9	PS	9
Cokl, A.	582	MATE RECOGNITION IN NEZARA VIRIDULA (HETEROPTERA, PENTATOMIDAE): A MATTER OF SONGS AND PHEROMONES	I	147	22/08/00	9:35	Bol	S	4	2	4
Colazza, S.	590	SUBSTRATE-BORNE HOST KAIROMONE FOR THE EGG PARASITOID TRISSOLCUS BASALIS: BEHAVIORAL AND CHEMICAL ECOLOGY ASPECTS	I	149	22/08/00	11:35	Bol	S	4	2	4
Colazza, S.	653	CONTACT CHEMICAL CUES RELEASED BY ADULTS OF NEZARA VIRIDULA HAVE A KAIROMONAL EFFECT ON THE EGG PARASITOID TRISSOLCUS BASALIS: A CHROMATOGRAPHIC INVESTIGATION	I	165	22/08/00	16:30	CC		4	PS	4
Coleman, J.	2916	GENETICALLY-ENGINEERED MOSQUITOES RESISTANT TO THE TRANSMISSION OF MALARIA	II	736	24/08/00	14:35	Bol	R	15	8	15
Coleman, M.	1311	CHARACTERISATION OF AMPLIFIED ALDEHYDE OXIDASES FROM INSECTICIDE RESISTANT CULEX QUINQUEFASCIATUS	I	331	21/08/00	16:30	CC		7	PS	7
Coleman, R. E.	2924	PREVENTION OF SPOROGONY OF PLASMODIUM VIVAX IN ANOPHELES DIRUS MOSQUITOES BY TRANSMISSION-BLOCKING ANTIMALARIALS	II	738	25/08/00	10:35	Bol	R	15	9	15
Coleman, R. E.	3016	USE OF A GEOGRAPHICAL INFORMATION SYSTEM TO EVALUATE THE EFFICACY OF A LETHAL OVITRAP FOR THE CONTROL OF THE MOSQUITO VECTORS OF DENGUE IN THAILAND	II	761	25/08/00	16:30	CC		15	PS	15
Colen, K. G. F.	218	DETERMINATION OF INJURY AND DAMAGE OF THE MEALYBUG DYSMICOCCUS BREVIPES (HEMIPTERA: PSEUDOCOCCIDAE) IN PINEAPPLE	I	56	22/08/00	16:30	CC		2	PS	2
Coletta Filho, H. D.	3203	GENOME AND FUNCIONAL GENOMICS OF XYLELLA FASTIDIOSA	II	809	21/08/00	13:35	Bol	U	17	1	17
Colin, M. E.	3435	TOLERANCE TO THE MITE VARROA JACOBSONI IN AFRICANIZED AND EUROPEAN BEES IN MEXICO	II	867	24/08/00	9:35	HM	Q	19	5	19
Colin, M. E.	4173	HYGIENIC BEHAVIOR AND TOLERANCE TO VARROA JACOBSONI	II	1054	24/08/00	11:35	HM	Q	Erratum	5	19
Colin, M. E.	3412	TOLERANCE TO THE MITE VARROA JACOBSONI IN AFRICANIZED AND EUROPEAN BEES IN MEXICO	II	861	21/08/00	16:30	CC		19	PS	19
Coll, J. T.	1416	COMPARISON OF ROTENONE CONTENT AND INSECT BIOACTIVITY BETWEEN ROOTS AND CALLUS CULTURES OF DERRIS ELLIPTICA	I	357	25/08/00	16:30	CC		7	PS	7
Coll, M.	863	PLANT SPATIAL HETEROGENEITY AND HERBIVORE-ENEMY INTERACTIONS: THE UNDERLYING MECHANISMS WHEN THE ENEMY IS A PLANT-FEEDING OMNIVORE	I	218	25/08/00	14:35	HB	D	6	8	6
Coll, M.	3934	FEEDING ON PLANT TISSUE BY HETEROPTERAN PREDATORS, A REVIEW OF ITS IMPORTANCE FOR POPULATION DYNAMICS AND BIOCONTROL	II	993	24/08/00	15:05	HM	Q	22	9	22
Coll, O. R. de	1909	MORPHOLOGICAL CHARACTERISTICS OF NESTS AND CONTROL OF ATTA SEXDENS RUBROPILOSA WITH GRANULATED BAITS IN A PLANTATION OF PINUS TAEDA, SAFAC, WANDA, MISIONES	I	481	21/08/00	16:30	CC		10	PS	10
Collier, K. F. S.	2044	THE SPECIFICITY OF BEAUVERIA BASSIANA FOR THE CONTROL OF MITE PESTS OF PAPAYA	I	516	21/08/00	16:30	CC		11	PS	11
Collier, R. H.	3598	HOST-PLANT SELECTION BY INSECTS – A THEORY BASED ON "APPROPRIATE/INAPPROPRIATE LANDINGS" BY PEST INSECTS OF CRUCIFEROUS PLANTS	II	908	22/08/00	16:30	CC		20	PS	20
Collin, N. M.	441	THE SIGNIFICANCE OF INSECTS AND OTHER INVERTEBRATES IN MULTILATERAL ENVIRONMENTAL AGREEMENTS	I	112	25/08/00	14:20	HB	C	3	8	3
Collins, D. A.	4023	THE EFFICACY OF THE INSECT GROWTH REGULATOR, FLUFENOXURON, FOR THE CONTROL OF MITE AND INSECT PESTS IN STORED GRAIN	II	1016	22/08/00	14:00	HB	J	23	4	23

Sub-titles: (HB=Hotel Bourbon) - (HM=Hotel Mabu) - (CC=Convention Center) - (Bol=Foz Boulevard) - (PS=Poster Session) - (PL=Plenary Lecturer)

AUTHOR	Nº	TITLE	Book	Page	Date	Time	Local	Room	Session	Symp	New Session
Collins, D. A.	4071	THE EFFICACY OF FOUR INSECT GROWTH REGULATORS AGAINST MITE PESTS IN STORED GRAIN	II	1028	21/08/00	16:30	CC		23	PS	23
Collins, F. H.	2915	MALARIA PARASITE ENCAPSULATION GENES IN ANOPHELES GAMBIAE	II	736	24/08/00	14:05	Bol	R	15	8	15
Collins, F. H.	1387	GENETIC MAPPING OF LOCI AFFECTING RESISTANCE TO INSECTICIDES IN ANOPHELES GAMBIAE	I	350	24/08/00	16:30	CC		7	PS	7
Collucci, E.	3740	CLADISTIC ANALYSIS OF THE GENUS BRACHYPREMNA OSTEN SACKEN 1886 (DIPTERA, TIPULIDAE)	II	944	22/08/00	16:30	CC		21	PS	21
Colmanetti, F. A.	1122	SURVEYS ON BEMISIA ARGENTIFOLII WITH STICK TRAPS IN COTTON CULTIVATIONS IN MIGUELÓPOLIS - S.P - BRAZIL	I	283	24/08/00	16:30	CC		6	PS	6
Colmenárez, Y.	487	SPECIES OF OPHIONINAE (HYMENOPTERA:ICHNEUMONIDAE) FROM THE ANDEAN AND CENTRAL WESTERN REGIONS OF VENEZUELA	I	123	22/08/00	16:30	CC		3	PS	3
Colombo, P. C.	2240	SEXUAL SELECTION ON MORPHOMETRIC AND CHROMOSOME VARIABLES IN LEPTYSMA ARGENTINA (ORTHOPTERA)	I	565	21/08/00	16:30	CC		12	PS	12
Coluzzi, M.	2279	ODYSSEUS, A NOVEL TRANSPOSON INVOLVED IN THE GENERATION OF CHROMOSOMAL INVERSIONS IN THE MALARIA MOSQUITO ANOPHELES ARABIENSIS	I	575	23/08/00	16:30	CC		12	PS	12
Colwell, D. D.	1324	COMPARATIVE LARVICIDAL ACTIVITY OF THE ENDECTOCIDES, DORAMECTIN, EPRINOMECTIN, IVERMECTIN, AND MOXIDECTIN AGAINST THREE SPECIES OF PEST FLIES (DIPTERA: MUSCIDAE) IN DUNG OF TREATED CATTLE	I	334	23/08/00	16:30	CC		7	PS	7
Comas, D.	3302	MOLECULAR ASPECTS OF JUVENILE HORMONE ACTION UPON VITELLOGENIN PRODUCTION IN INSECTS	II	834	25/08/00	14:35	HB	K	18	7	18
Compagnucci, L.	2501	DISTRIBUTION OF FMRF-AMIDE LIKE IMMUNOREACTIVITY IN THE BRAIN OF TRIATOMA INFESTANS.	II	632	24/08/00	16:30	CC		13	PS	13
Conceição, J. C. da	1924	DISTRIBUTION OF EUPHALERUS SP (HEMIPTERA: PSYLLIDAE) IN STATE OF RIO DE JANEIRO, BRAZIL	I	485	22/08/00	16:30	CC		10	PS	10
Confalonieri, V. A.	2241	ORIGIN AND DISPERSAL OF THE COTTON BOLL WEEVIL (COLEOPTERA: CURCULIONIDAE) IN SOUTH AMERICA: A mtDNA PHYLOGEOGRAPHIC STUDY	I	566	21/08/00	16:30	CC		12	PS	12
Conijn, C. G. M.	1567	PREDATOR-PREY INTERACTIONS AT VARIOUS SPATIAL SCALES: BIOLOGICAL CONTROL OF THE BULB MITE, RHIZOGLYPHUS ROBINI, BY THE PREDATORY MITE, HYPOASPIS ACULEIFER, ON LILIES	I	395	22/08/00	16:30	CC		8	PS	8
Conn, J. E.	2214	MOLECULAR EVOLUTION AND GENETICS OF NEOTROPICAL ANOPHELINE MALARIA VECTORS	I	559	24/08/00	9:35	HB	L	12	9	12
Conn, J. E.	2977	EMERGENCE OF A NEW NEOTROPICAL MALARIA VECTOR FACILITATED BY HUMAN MIGRATION AND CHANGES IN LAND USE	II	751	22/08/00	16:30	CC		15	PS	15
Conn, J. E.	2878	THE IMPACT OF DEFORESTATION ON MALARIA: A CASE STUDY FROM THE PERUVIAN AMAZON	II	726	21/08/00	15:05	Bol	R	15	2	15
Conn, J. E.	2313	MITOCHONDRIAL DNA COI SEQUENCES DIFFERENTIATE TWO CLOSELY-RELATED SPECIES, ANOPHELES DUNHAMI AND ANOPHELES NUNEZTOVARI (DIPTERA: CULICIDAE)	I	584	24/08/00	16:30	CC		12	PS	12
Connair, M.	1222	MODE OF ACTION OF INDOXACARB IN PEST INSECTS AND IMPLICATIONS FOR CONTROL	I	309	21/08/00	9:35	HM	N	7	1	7
Conner, W. E.	1742	BATS, MOTHS, AND POETRY: THE EVOLUTION OF ACOUSTIC COMMUNICATION IN TIGER MOTHS (LEPIDOPTERA: ARCTIIDAE)	I	439	23/08/00	11:15	HB	F	9	3	9
Conrad, K. F.	1396	POPULATION DYNAMICS OF ODONATES IN AGRICULTURAL LANDSCAPES:A LARGE-SCALE ECOTOXICOLOGICAL PERSPECTIVE	I	352	22/08/00	9:35	HM	N	7	3	7
Consentino, D. J.	240	ABUNDANCE OF MESO AND MACROFAUNA IN PAMPEAN HAPLUDOLLS AND ARGIUDOLLS: THE INFLUENCE OF TOPSOIL MACROPOROSITY	I	61	22/08/00	16:30	CC		2	PS	2
Cônsoli, F. L.	1458	DIFFERENTIAL HOST EXPLOITATION STRATEGIES BY MORPHOTYPES OF MELITTOBIA DIGITATA (HYMENOPTERA, EULOPHIDAE)	I	368	23/08/00	15:50	HM	O	8	6	8
Cônsoli, F. L.	1512	HOST SELECTION BEHAVIOR OF IN VIVO- AND IN VITRO-REARED TRICHOGRAMMA GALLOI AND T. PRETIOSUM (HYMENOPTERA: TRICHOGRAMMATIDAE)	I	381	21/08/00	16:30	CC		8	PS	8
Cônsoli, F. L.	2375	PHYSIOLOGY OF THE MORPHOTYPE DIFFERENTIATION IN THE PARASITIC WASP MELITTOBIA DIGITATA (HYMENOPTERA, EULOPHIDAE)	II	600	24/08/00	15:35	HB	I	13	7	13
Cônsoli, F. L.	1428	IN VITRO REARING OF PARASITOIDS IN BRAZIL: AN OVERVIEW	I	360	21/08/00	14:05	HM	O	8	2	8
Consolo, V. F.	2045	A NEW FUNGAL ISOLATE FOR THE CONTROL OF DIABROTICA SPECIOSA	I	516	21/08/00	16:30	CC		11	PS	11
Constantineanu, R.	3741	NEW AND INTERESING MORPHOLOGICAL ANOMALIES OF ICHNEUMONIDS IN ROMANIA	II	944	22/08/00	16:30	CC		21	PS	21
Constantino, R.	3474	ANOMALOUS TERMITE DIVERSITY PATTERN IN HISTORICAL FRAGMENTS OF AMAZONIAN SAVANNAS	II	877	22/08/00	16:30	CC		19	PS	19
Constantino, R.	3411	THE PEST TERMITES OF SOUTH AMERICA	II	861	22/08/00	11:20	HM	Q	19	2	19
Conte, C.	2211	ZAM, A RETROVIRUS FROM DROSOPHILA MELANOGASTER	I	558	24/08/00	15:35	HB	L	12	8	12
Conte, F. F.	2242	CHARACTERIZATION OF MOLECULAR MARKERS ON CHRYSOMYA ALBICEPS BY PCR-RFLP OF MITOCHONDRIAL DNA	I	566	21/08/00	16:30	CC		12	PS	12
Conte, F. F.	2270	CHRYSOMYA (CALLIPHORIDAE) MITOCHONDRIAL DNA CONTROL REGION: CHARACTERIZATION OF C. MEGACEPHALA tRNA REPEAT	I	573	22/08/00	16:30	CC		12	PS	12
Conte, H.	2046	INFECTION OF DIATRAEA SACCHARALIS (LEP.; PYRALIDAE) WITH THE MICROSOPORIDIA NOSEMA SP	I	516	21/08/00	16:30	CC		11	PS	11
Conte, H.	2537	CALYX CELLS AND POLYDNAVIRUS (PDV) PRODUCTION IN THE OVARY OF COTESIA FLAVIPES (HYMENOPTERA, BRACONIDAE)	II	641	25/08/00	16:30	CC		13	PS	13
Conte, J.	190	DIFFERENT INSECTICIDES AND DOSES FOR EUSCHISTUS HEROS CONTROL ON SOYBEAN CROP	I	49	21/08/00	16:30	CC		2	PS	2
Conte, J.	191	DIFFERENT INSECTICIDES AND DOSES TO CONTROL GREEN STINKBUG NEZARA VIRIDULA ON SOYBEAN CROP	I	49	21/08/00	16:30	CC		2	PS	2
Conte, Y. Le	3475	ADDITIVE PRIMER AND RELEASER EFFECTS OF BROOD AND QUEEN PHEROMONE ON ADULTS WORKERS IN THE HONEY BEE	II	877	22/08/00	16:30	CC		19	PS	19
Conti, E.	1457	EGG PARASITOIDS ATTACKING HOMOLOGOUS HOSTS: EQUIVALENCES AND DIFFERENCES BETWEEN TWO ALLOPATRIC CABBAGE BUGS	I	368	23/08/00	15:35	HM	O	8	6	8
Conti, E.	1468	CRITICAL ISSUES IN EGG PARASITOIDS	I	370	26/08/00	9:35	HM	O	8	8	8
Contreras, J.	2125	GENETIC VARIABILITY AMONG BEAUVERIA BASSIANA AND PAECILOMYCES FUMOSOROSEUS	I	536	24/08/00	16:30	CC		11	PS	11
Cook, C.	2765	COTTON HOST PLANT RESISTANCE TO THE SILVERLEAF WHITEFLY TRANSMITTED COTTON LEAF CRUMPLE DISEASE	II	698	24/08/00	16:30	CC		14	PS	14
Cook, D. A.	4023	THE EFFICACY OF THE INSECT GROWTH REGULATOR, FLUFENOXURON, FOR THE CONTROL OF MITE AND INSECT PESTS IN STORED GRAIN	II	1016	22/08/00	14:00	HB	J	23	4	23
Cook, D. A.	4071	THE EFFICACY OF FOUR INSECT GROWTH REGULATORS AGAINST MITE PESTS IN STORED GRAIN	II	1028	21/08/00	16:30	CC		23	PS	23
Cook, D. F.	227	AVERMECTINS VS DORAMECTIN: WHATS IN IT FOR DUNG BEETLES	I	58	22/08/00	16:30	CC		2	PS	2
Cook, D. F.	2941	PIGS AND FLIES: A FORENSIC ENTOMOLOGY PERSPECTIVE IN SOUTHWESTERN AUSTRALIA	II	742	26/08/00	10:05	Bol	R	15	11	15
Cook, L.	3638	MOLECULAR EVIDENCE SUPPORTS, FAILS TO REFUTE, OR PROVOKES NEW MORPHOLOGICAL ASSESSMENT IN THE CHIRONOMIDAE (DIPTERA)	II	919	22/08/00	14:00	HB	E	21	4	21
Cooley, L.	3301	ECDYSTEROID-TRIGGERED REGULATORY HIERARCHIES IN INSECT REPRODUCTION	II	834	25/08/00	14:05	HB	K	18	7	18
Coons, L. B.	25	IGG BINDING SITES IN THE SALIVARY GLANDS AND CEMENT CONE OF AN IXODID TICK	I	7	21/08/00	16:30	CC		1	PS	1
Coop, L.	2657	ONLINE APPLICATION SERVER FOR PHENOLOGY MODELS AND MAPS	II	671	21/08/00	16:30	CC		14	PS	14

Sub-titles: (HB=Hotel Bourbon) - (HM=Hotel Mabu) - (CC=Convention Center) - (Bol=Foz Boulevard) - (PS=Poster Session) - (PL=Plenary Lecturer)

AUTHOR	Nº	TITLE	Book	Page	Date	Time	Local	Room	Session	Symp	New Session
Coop, L.	2623	ONLINE DECISION SUPPORT SYSTEM FOR INTEGRATED CODLING MOTH MANAGEMENT	II	663	22/08/00	16:30	CC		14	PS	14
Cooper, S. J. B.	3729	MOLECULAR PHYLOGENY, ECOLOGY AND SOCIAL EVOLUTION IN ALLODAPINE BEES	II	941	21/08/00	16:30	CC		21	PS	21
Cooter, R. J.	136	MIGRATION AND IPM IN DEVELOPING COUNTRIES	I	35	25/08/00	9:35	HB	A	2	9	2
Coppedge, J. R.	162	MANAGEMENT OF MEXICAN CORN ROOTWORM (COLEOPTERA: CHRYSOMELIDAE)	I	42	26/08/00	15:05	HB	A	2	11	2
Coracini, D. L. A.	2047	THE SPECIFICITY OF METARHIZIUM ANISOPLIAE AND BEAUVERIA BASSIANA IN THE INFECTION OF EGGS OF THE BRAZILIAN CHINCH BUG, BLISSUS ANTILLUS	I	516	21/08/00	16:30	CC		11	PS	11
Coracini, M. D. A.	654	SEX PHEROMONE OF THE BRAZILIAN APPLE LEAFROLLER, BONAGOTACRANAODES (LEPIDOPTERA: TORTRICIDAE): EFFECT OF GEOMETRICISOMERS ON MALE ATTRACTION TO (E,Z)-3,5-DODECADIENYL ACETATE	I	165	22/08/00	16:30	CC		4	PS	4
Coracini, M. D. A.	587	EFFECTS OF PHEROMONES IN ARTIFICIAL DIETS FOR PREDATORY BUGS	I	149	22/08/00	9:50	Bol	S	4	2	4
Corallini, C.	3123	GOBLET CELLS IN THE MIDGUT OF TRICHOPTERAN LARVAE	II	788	22/08/00	16:30	CC		16	PS	16
Corchs, M. J.	937	DYNAMICS OF THERMOPREFERENCE IN TRIATOMA SORDIDA	I	237	21/08/00	16:30	CC		6	PS	6
Cordara, M.J.	2804	HARMFUL AND BENEFICAL INSECT SPECIES IN TWO VARIETIES OF LUPINUS SPP. IN ARGENTINA	II	708	25/08/00	16:30	CC		14	PS	14
Cordeiro, L.	1918	RESPONSE OF BRAZILIAN AMBROSIA BEETLES (COLEOPTERA, SCOLYTIDAE) TO KAIROMONES AND PHEROMONES	I	483	22/08/00	16:30	CC		10	PS	10
Cordeiro, L.	1919	SCOLYTIDAE TRAPPINGS IN YOUNG LOBLOLLY PINE (PINUS TAEDA) STANDS	I	484	22/08/00	16:30	CC		10	PS	10
Cordellini, M. H.	1313	A SUSTAINABLE AND ECONOMICAL INSECTICIDAL MANAGEMENT PROGRAM ON COTTON IN BRAZIL	I	331	21/08/00	16:30	CC		7	PS	7
Cordes, R.	3040	GERM LINE AND SOMA DIFFERENTIATION IN BGCN MUTANT DROSOPHILA OVARIES	II	767	21/08/00	14:30	HB	G	16	1	16
Cordo, H.	1663	OCCURRENCE AND REDESCRIPTION OF MEGAMELUS SCUTELLARIS BERG (HEMIPTERA: FULGOROMORPHA: DELPHACIDAE) IN ARGENTINA, A CANDIDATE FOR BIOCONTROL OF WATERHYACINTH	I	419	25/08/00	16:30	CC		8	PS	8
Córdoba Landús, E.	2978	PHLEBOTOMINAE SAND FLIES IN TUCUMAN, ARGENTINA	II	751	22/08/00	16:30	CC		15	PS	15
Córdoba Landús, E.	2988	PHLEBOTOMINAE SAND FLIES AND LEISHMANIASIS IN ARGENTINA	II	754	23/08/00	16:30	CC		15	PS	15
Cordon-Rosales, C.	2981	PARATRANSGENESIS OF REDUVIID VECTORS OF CHAGAS DISEASE	II	752	22/08/00	16:30	CC		15	PS	15
Corrigliano, M. del C.	1095	DIURNAL AND NOCTURNAL DRIFT OF AQUATIC INSECTS	I	276	24/08/00	16:30	CC		6	PS	6
Corigliano, M. del C.	477	AQUATIC INSECT BIODIVERSITY IN STREAMS OF DIFFERENT BASINS AT A REGIONAL SCALE	I	121	21/08/00	16:30	CC		3	PS	3
Corigliano, M. del C.	938	LIFE HISTORIES OF EPHEMEROPTERA IN COMECHINGONES MOUNTAIN STREAMS	I	237	21/08/00	16:30	CC		6	PS	6
Corigliano, M. del C.	1002	RESPONSES OF AQUATIC INSECTS TO AN ENVIRONMENTAL STRESS GRADIENT	I	253	22/08/00	16:30	CC		6	PS	6
Cork, A.	3876	PHEROMONES FOR CONTROL OF YELLOW RICE STEM BORER, SCIRPOPHAGA INCERTULAS (LEPIDOPTERA: PYRALIDAE) IN INDIA	II	978	21/08/00	15:00	HB	H	22	1	22
Cork, A.	667	COPULATION PHEROMONE OF THE VECTOR OF CHAGAS DISEASE, TRIATOMA infestans: IDENTIFICATION AND BIOASSAY	I	169	22/08/00	16:30	CC		4	PS	4
Cork, A.	668	NITROGENOUS COMPOUNDS AS ATTRACTANTS OF TRIATOMA INFESTANS	I	169	22/08/00	16:30	CC		4	PS	4
Corley, J. C.	1935	MAIN INSECT FOREST PESTS AFFECTING PINES IN THE PATAGONIA ARGENTINA	I	488	23/08/00	16:30	CC		10	PS	10
Corley, L.	3068	REGULATION OF CASTE FATE IN POLYEMBRYONIC WASPS	II	774	24/08/00	10:30	HB	G	16	6	16
Corley, L.	2412	REGULATION OF CASTE FATE IN POLYEMBRYONIC WASPS	II	609	21/08/00	16:30	CC		13	PS	13
Cornelissen, T. G.	842	PLANT RESISTANCE AGAINST GALL-FORMING INSECTS: THE ROLE OF PLANT HYPERSENSITIVITY	I	213	23/08/00	15:15	HB	D	6	5	6
Cornelissen, T. G.	1856	MECHANISMS OF RESISTANCE IN TREES TO GALL-FORMING INSECTS	I	468	24/08/00	11:35	HB	M	10	5	10
Cornelissen, T. G.	655	DAMAGE-INDUCED CHANGES ON LEAF QUALITY OF BAUHINIA BREVIPES (LEGUMINOSAE) AND INSECT HERBIVORE ATTACK	I	166	22/08/00	16:30	CC		4	PS	4
Coronado-Blanco, J. M.	478	ADVANCES IN THE KNOWLEDGE OF HYMENOPTERA IN THE BIOSPHERE RESERVE "EL CIELO", MÉXICO	I	121	21/08/00	16:30	CC		3	PS	3
Coronado-Blanco, J. M.	1600	THE ENCARSIA SPECIES - PARASITOIDS OF WHITEFLIES (HOMOPTERA: ALEYRODIDAE) IN MÉXICO	I	403	23/08/00	16:30	CC		8	PS	8
Coronado-Blanco, J. M.	330	PRESENCE OF HYPSIPYLA GRANDELLA IN THE STATE OF TAMAULIPAS, MÉXICO	I	84	24/08/00	16:30	CC		2	PS	2
Coronel, J. M.	3124	MORPHOMETRICS VARIATIONS IN SOLDIERS OF TERMES SALTANS (ISOPTERA, TERMITIDAE, TERMITINAE)	II	788	22/08/00	16:30	CC		16	PS	16
Coronel, J. M.	3512	PRELIMINARY INVENTORY OF ISOPTERA FROM NATURAL PROTECTED AREAS OF NORTHEAST ARGENTINA	II	886	23/08/00	16:30	CC		19	PS	19
Correa, A. G.	3433	GROWTH INHIBITION OF THE SYMBIOTIC FUNGUS OF ATTA SEXDENS, BY NATURAL PRODUCTS AND SYNTHETIC COMPOUNDS	II	867	23/08/00	11:35	HM	Q	19	4	19
Correa, L. E. A.	656	CHEMICAL CONTROL OF THE "LEAF MINER", LEUCOPTERA COFFEELLA (LEPIDOPTERA: LYONETIIDAE), WITH FURY 400 CE AND MARSHAL 400 SC IN COFFEE CROP, COFFEA ARABICA	I	166	22/08/00	16:30	CC		4	PS	4
Correa, L. S.	2851	WHITEFLY (HEMIPTERA: ALEYRODIDAE) OCCURRENCE ON PAPAYA TREE (CARICA PAPAYA) IN PROTECTED ENVIRONMENT	II	720	25/08/00	16:30	CC		14	PS	14
Correa-Ferreira, B. S.	1595	EVALUATION OF THE PARASITISM OF TELENOMUS PODISI ON PIEZODORUS GUILDINII (HETEROPTERA:PENTATOMIDAE) EGGS, IN SOYBEAN CROP IN RORAIMA, BRAZIL	I	402	24/08/00	16:30	CC		8	PS	8
Corrêa-Ferreira, B. S.	219	COMPARISON OF DAMAGES CAUSED TO SOYBEAN BY DIFFERENT SPECIES OF STINK BUGS	I	56	22/08/00	16:30	CC		2	PS	2
Corrêa-Ferreira, B. S.	1477	MULTIPLICATION OF TELENOMUS PODISI AND TRISSOLCUS BASALIS (HYMENOPTERA: SCELIONIDAE) ON EUSCHISTUS HEROS (HEMIPTERA: PENTATOMIDAE) EGGS FOR SOYBEAN STINK BUGS CONTROL	I	373	26/08/00	11:50	HM	O	8	8	8
Corrêa-Ferreira, B. S.	1609	PARASITISM OF HEXACLADIA SMITHII ON THE NEOTROPICAL BROWN STINK BUG EUSCHISTUS HEROS DURING AND AFTER THE SOYBEAN SEASON	I	406	22/08/00	16:30	CC		8	PS	8
Corrêa-Ferreira, B. S.	1610	EFFECT OF PARASITSM BY HEXACLADIA SMITHII ON SURVIVAL AND REPRODUCTIVE CAPACITY OF EUSCHISTUS HEROS FEMALES	I	406	22/08/00	16:30	CC		8	PS	8
Corrêa-Ferreira, B. S.	1623	REARING OF BROWN STINK BUG EUSCHISTUS HEROS AND GREEN STINK BUG NEZARA VIRIDULA AS HOSTS IN THE MULTIPLICATION OF EGG PARASITOIDS	I	409	21/08/00	16:30	CC		8	PS	8
Corrêa-Ferreira, B.S.	2567	ROLE OF NATURAL ENEMIES IN DEVELOPING IPM STRATEGIES	II	649	22/08/00	15:05	HB	B	14	4	14
Corrêa-Marques, M. H.	3439	TECHNIQUES FOR COMPARING DATA ON REPRODUCTION OF VARROA JACOBSONI	II	868	24/08/00	10:35	HM	Q	19	5	19
Correia, M.	220	FILTH IN FRUIT PRODUCTS MARKETED IN SÃO PAULO, BRAZIL	I	56	22/08/00	16:30	CC		2	PS	2
Corró Molas, B.	1570	NEOTROPICAL MYRMECOPHILIC DIAPRIID WASPS ASSOCIATED WITH MYRMICINAE AND FORMICINAE ANTS (HYMENOPTERA, PROCTOTRUPOIDEA, DIAPRIIDAE)	I	396	23/08/00	16:30	CC		8	PS	8
Corseuil, E.	353	POPULACIONAL APPRAISAL OF OWLET MOTHS (LEPIDOPTERA, NOCTUIDAE) AND THEIR NATURAL ENEMIES IN MORNING AND NIGHT COLLECTIONS IN THE RYEGRASS CULTURE, WITH NET SWEEPING	I	89	25/08/00	16:30	CC		2	PS	2
Corseuil, E.	556	OWLET MOTH DIVERSITY (LEPIDOPTERA: NOCTUIDAE) COLLECTED WITH BLACK-LIGHT TRAP, IN SALVADOR DO SUL, RS, BRAZIL	I	141	21/08/00	16:30	CC		3	PS	3
Corseuil, E.	2979	CHARACTERIZATION OF LONOMIA OBLIQUA AND PERIGA CIRCUNSTANS (LEPIDOPTERA, SATURNIIDAE) OCCURING IN RIO GRANDE DO SUL STATE, BRAZIL	II	752	22/08/00	16:30	CC		15	PS	15

Sub-titles: (HB=Hotel Bourbon) - (HM=Hotel Mabu) - (CC=Convention Center) - (Bol=Foz Boulevard) - (PS=Poster Session) - (PL=Plenary Lecturer)

AUTHOR	Nº	TITLE	Book	Page	Date	Time	Local	Room	Session	Symp	New Session
Corseuil, E.	522	DISTRIBUTION OF THE GENUS ADELPHA (LEPIDOPTERA: NYMPHALIDAE: LIMENITINAE) IN THE AMERICAN CONTINENT	I	132	23/08/00	16:30	CC		3	PS	3
Corseuil, E.	1187	POPULATIONAL FLUCTUATION OF PANTHERODES PARDALARIA (LEPIDOPTERA: GEOMETRIDAE) IN RIO GRANDE DO SUL STATE, BRAZIL	I	299	25/08/00	16:30	CC		6	PS	6
Corseuil, E.	3798	PHYLOGENETIC USEFULNESS OF THE ELONGATION FACTOR-1ALPHA (EF-1ALPHA) IN DITRYSIA GROUP (INSECTA: LEPIDOPTERA)	II	959	24/08/00	16:30	CC		21	PS	21
Corseuil, E.	3185	CHARACTERIZATION OF SPODOPTERA SPECIES (LEPIDOPTERA: NOCTUIDAE) OF SOUTHERN BRAZIL	II	803	22/08/00	16:30	CC		16	PS	16
Corseuil, E.	1186	POPULATIONAL FLUCTUATION OF PANTHERODES PARDALARIA (LEPIDOPTERA: GEOMETRIDAE) IN RIO GRANDE DO SUL STATE, BRAZIL	I	299	25/08/00	16:30	CC		6	PS	6
Corso, I. C.	1595	EVALUATION OF THE PARASITISM OF TELENOMUS PODISI ON PIEZODORUS GUILDINII (HETEROPTERA:PENTATOMIDAE) EGGS, IN SOYBEAN CROP IN RORAIMA, BRAZIL	I	402	24/08/00	16:30	CC		8	PS	8
Corso, I. C.	2658	CONTROL OF STERNECHUS SUBSIGNATUS (COL.: CURCULIONIDAE) WITH INSECTICIDES APPLIED ON SOYBEAN PLANTS	II	671	21/08/00	16:30	CC		14	PS	14
Corso, I. C.	2659	INSECTICIDE SELECTIVITY FOR PREDATORS AND PARASITOIDS OF SOYBEAN INSECT PESTS	II	672	21/08/00	16:30	CC		14	PS	14
Corso, I. C.	2682	EXPERIMENTAL VARIABILITY OF SOYBEAN BENEFITIAL INSECTS SAMPLING METHODS	II	677	22/08/00	16:30	CC		14	PS	14
Corso, I. C.	2686	VARIABILITY OF SOYBEAN INSECT SAMPLING METHODS	II	678	23/08/00	16:30	CC		14	PS	14
Cortez, A.	3794	INVESTIGATION OF THE VALIDITY OF SPECIES STATUS OF IXODES DIDELPHIDIS (ACARI: IXODIDAE) USING THE SECOND INTERNAL TRANSCRIBED SPACER (ITS2) OF RIBOSOMAL DNA	II	958	23/08/00	16:30	CC		21	PS	21
Cory, J. S.	2074	PHENOTYPIC VARIATION BETWEEN GENOTYPIC VARIANTS OF A NUCLEOPOLYHEDROVIRUS INFECTING PINE BEAUTY MOTH, PANOLIS FLAMMEA	I	523	23/08/00	16:30	CC		11	PS	11
Cory, J. S.	2414	HERITABILITY OF IMMUNE FUNCTION IN THE CATERPILLAR, SPODOPTERA LITTORALIS	II	610	21/08/00	16:30	CC		13	PS	13
Cosarinsky, M. I.	3476	MICROMORPHOLOGY OF A NEST OF CORNITERMES CUMULANS (ISOPTERA: TERMITIDAE)	II	877	22/08/00	16:30	CC		19	PS	19
Coscarón, M. C.	3823	FIRST SOUTH AMERICAN RECORD OF FOSSIL LYGAEOIDEA (HETEROPTERA)	II	965	24/08/00	16:30	CC		21	PS	21
Coscarón, M. C.	3836	THE SUBFAMILIAL PLACEMENT OF THE INDIAN GENUS LINSHCOSTEUS (HEMIPTERA: REDUVIIDAE: TRIATOMINAE	II	968	25/08/00	16:30	CC		21	PS	21
Coscarón, M. del C.	3742	INMATURE STAGES OF ZELUS LEUCOGRAMMUS (HETEROPTERA: REDUVIIDAE)	II	945	22/08/00	16:30	CC		21	PS	21
Coscarón, M. del C.	3743	BIODIVERSITY OF CIMICOMORPHA AND PENTATOMORPHA (HETEROPTERA) FROM ARGENTINA	II	945	22/08/00	16:30	CC		21	PS	21
Coscarón, M. del C.	3744	INMATURE STAGES OF ZELUS LONGIPES (HETEROPTERA, REDUVIIDAE)	II	945	22/08/00	16:30	CC		21	PS	21
Coscarón, M. del C.	3745	A NEW GENUS OF ACANTHOSOMATIDAE (HETEROPTERA) AND THE INMATURE STAGES	II	945	22/08/00	16:30	CC		21	PS	21
Coscarón, S.	527	A CLADISTIC ANALYSIS OF NEOTROPICAL, ETHIOPIC AND AUSTRALIAN SUBGENERA OF THE GENUS SIMULIUM (DIPTERA:SIMULIIDAE)	I	133	23/08/00	16:30	CC		3	PS	3
Coscarón, S.	3845	TAXONOMY OF SIMULIUM (PSARONIOCOMPSA) (DIPTERA, SIMULIIDAE) IN THE SOURTHERN REGION OF BRAZIL AND ARGENTINA, WITH A NEW SPECIES DESCRIPTION	II	970	25/08/00	16:30	CC		21	PS	21
Cosconea, P.	1847	A NEW VIRAL PRODUCT "Inf-Ld" USED IN THE CONTROL OF POPULATIONS DENSITY OF LYMANTRIA DISPAR L. AND EUPROCTIS CHRYSORRHOEA	I	466	23/08/00	15:35	HB	M	10	4	10
Cosmin, O.	3940	RESULTS REGARDING MAIZE RESISTANCE TO THE EUROPEAN CORN BORER IN ROMANIA	II	994	23/08/00	16:30	CC		22	PS	22
Cossl, A. A.	799	ASPECTS OF THE ECOLOGY OF THE WHEAT STEM SAWFLY (HYMENOPTERA: CEPHIDAE) IN NORTH AMERICA	I	202	21/08/00	10:05	HB	D	6	1	6
Costa Garcia, A.	1303	EVALUATION OF THE STATUS OF RESISTANCE OF AEDES AEGYPTI TOTEMEPHOS IN THE STATE OF RIO DE JANEIRO - BRAZIL	I	329	21/08/00	16:30	CC		7	PS	7
Costa, A. J. S.	3322	NESTMATE RECOGNITION IN SCAPTOTRIGONA BIPUNCTATA (HYMENOPTERA, APIDAE, MELIPONINAE)	II	839	21/08/00	16:30	CC		18	PS	18
Costa, E. C.	221	AGRONOMIC EFFICIENCY THE INSECTICIDES AND DOSES OF CONTROL TO TIBRACA LIMBATIVENTRIS IN IRRIGATED RICE	I	56	22/08/00	16:30	CC		2	PS	2
Costa, E. C.	340	SURVEY OF ARTHROPODS IN TWO SEEDING SYSTEMS OF SORGHUM (SORGHUM BICOLOR)	I	86	25/08/00	16:30	CC		2	PS	2
Costa, E. C.	904	NUTRITIONAL AVALIATION OF PLANTS OF ERVA MATE ATTACKED AND NOT ATTACKED BY "BROCA" HEDYPATHES BETULINUS	I	228	21/08/00	16:30	CC		6	PS	6
Costa, E. C.	1163	SOIL MACROFAUNA AND MESO UNDER DIFFERENT VEGETATION COVERING	I	293	21/08/00	16:30	CC		6	PS	6
Costa, E. C.	1971	SCOLYTIDAE ASSOCIATED EUCALYPTUS SPP. IN A FRAGMENT OF DECIDUAL SEASONAL FOREST	I	497	25/08/00	16:30	CC		10	PS	10
Costa, E. C.	1978	LEPIDOPTEROUS ASSOCIATED TO TWO FOREST COMMUNITIES IN ITAÂRA, RS - BRAZIL	I	498	25/08/00	16:30	CC		10	PS	10
Costa, E. C.	1755	BEHAVIOR OF HEDYPATHES BETULINUS (COL., CERAMBYCIDAE) ON ILEX PARAGUARIENSIS	I	442	21/08/00	16:30	CC		9	PS	9
Costa, F. G.	648	LOCAL DETERRENCE OF MULTIPLE ATTACKS BY THE COFFEE BERRY BORER	I	164	22/08/00	16:30	CC		4	PS	4
Costa, H.	2560	CULTURAL PRACTICES FOR MANAGING WHITEFLIES	II	647	22/08/00	11:35	HB	B	14	3	14
Costa, J. M.	3746	A NEW SPECIES OF CORDULIIDAE FROM RIO DE JANEIRO, BRAZIL AND ITS AFFINITY WITH OTHER SPECIES OF THE SUB-GENUS NEOCORDULIA (ODONATA: ANISOPTERA)	II	946	22/08/00	16:30	CC		21	PS	21
Costa, J. M.	3747	A SYNOPSIS OF THE GENUS STAUROPHLEBIA WITH A REDESCRIPTION OF STAUROPHLEBIA RETICULATA BOSQI NAVÁS, 1927, NEW STATUS (ANISOPTERA: AESHNIDAE)	II	946	22/08/00	16:30	CC		21	PS	21
Costa, J. M.	3748	OCCURRENCE OF TIGRIAGRION AURANTINIGRUM IN PARAGUAY AND BOLIVIA (SOUTH AMERICA) AND NEW SITES IN BRAZIL (ZYGOPTERA: COENAGRIONIDAE)	II	946	22/08/00	16:30	CC		21	PS	21
Costa, M. A. G.	1971	SCOLYTIDAE ASSOCIATED EUCALYPTUS SPP. IN A FRAGMENT OF DECIDUAL SEASONAL FOREST	I	497	25/08/00	16:30	CC		10	PS	10
Costa, M. A. G.	1163	SOIL MACROFAUNA AND MESO UNDER DIFFERENT VEGETATION COVERING	I	293	21/08/00	16:30	CC		6	PS	6
Costa, R. A. C.	2413	ENZYMATIC ANALYSIS OF THE HYPOPHARYNGEAL GLANDS AND LARVAL FOOD OF WORKERS AND MALES OF SCAPTOTRIGONA POSTICA (HYMENOPTERA, APIDAE, MELIPONINAE)	II	610	21/08/00	16:30	CC		13	PS	13
Costa, V. A.	1659	PARASITOIDS OF PHYLLOCNISTIS CITRELLA IN RIO DE JANEIRO STATE, BRASIL	I	418	25/08/00	16:30	CC		8	PS	8
Costa, V. A.	1641	POS-INTRODUCTION OF THE NATURAL ENEMY AGENIAPIS CITRICOLA IN CITRUS GROVES IN JAGUARIÚNA AND AGUAÍ REGIONS, SÃO PAULO STATE, BRAZIL: PRELIMINARY RESULTS	I	414	24/08/00	16:30	CC		8	PS	8
Costa, V. A.	2855	ARMORED SCALES POPULATION DYNAMICS IN SÃO PAULO STATE CITRUS REGION	II	721	21/08/00	16:30	CC		14	PS	14
Costa-Junior, J. S.	2800	EFFECT OF DIFFERENT LEVELS OF NITROGENOUS AND POTASSIC FERTILIZATION ON THE POPULATION OF COCCUS VIRIDIS (HOMOPTERA: COCCIDAE) IN SWEET ORANGE (CITRUS SINENSIS), CULTIVAR "FOLHA MURCHA"	II	707	24/08/00	16:30	CC		14	PS	14
Costa-Leonardo, A. M.	222	THE USE OF ABOVE GROUND HEXAFLUMURON BAITS IN THE ELIMINATION OF A COPTOTERMES HAVILANDI COLONY LOCATED IN RIO CLARO, SP, BRAZIL (ISOPTERA, RHINOTERMITIDAE)	I	57	22/08/00	16:30	CC		2	PS	2
Costa-Leonardo, A. M.	939	GROWTH PATTERNS OF INCIPIENT COLONIES OF COPTOTERMES HAVILANDI (ISOPTERA, RHINOTHERMITIDAE) INITIATED IN THE LABORATORY FROM SWARMING ALATES	I	237	21/08/00	16:30	CC		6	PS	6

Sub-titles: (HB=Hotel Bourbon) - (HM=Hotel Mabu) - (CC=Convention Center) - (Bol=Foz Boulevard) - (PS=Poster Session) - (PL=Plenary Lecturer)

AUTHOR	Nº	TITLE	Book	Page	Date	Time	Local	Room	Session	Symp	New Session
Costa-Leonardo, A. M.	940	FORAGING POPULATION ESTIMATES FOR TWO COLONIES OF COPTOTERMES HAVILANDI (ISOPTERA, RHINOTERMITIDAE) USING MARK-RECAPTURE STUDIES	I	237	21/08/00	16:30	CC		6	PS	6
Costa-Leonardo, A. M.	3459	CASTE POLYMORPHISM IN LABORATORY COLONIES OF COPTOTERMES HAVILANDI (ISOPTERA, RHINOTERMITIDAE)	II	873	21/08/00	16:30	CC		19	PS	19
Costanzo, J. P.	3282	USING ICE NUCLEATING BACTERIA TO REDUCE WINTER SURVIVAL OF COLORADO POTATO BEETLES: DEVELOPING A NOVEL STRATEGY FOR BIOLOGICAL CONTROL	II	829	23/08/00	10:50	HB	K	18	4	18
Costello, M. J.	132	ROLE OF SPIDERS IN GRAPE IPM	I	34	24/08/00	14:20	HB	A	2	8	2
Cottage, E. L. A	1312	RESISTANCE MECHANISM TO BUPROFEZIN IN B-TYPE BEMISIA TABACI (HEMIPTERA: ALEYRODIDAE) IN AUSTRALIA	I	331	21/08/00	16:30	CC		7	PS	7
Cotter, S. C.	2414	HERITABILITY OF IMMUNE FUNCTION IN THE CATERPILLAR, SPODOPTERA LITTORALIS	II	610	21/08/00	16:30	CC		13	PS	13
Coudron, T. A.	3332	INGESTION AND DIGESTION OF GREEN FLUORESCENT PROTEIN BY THE WESTERN TARNISHED PLANT BUG, LYGUS HESPERUS	II	841	22/08/00	16:30	CC		18	PS	18
Coulson, R. N.	941	CORRIDORS FOR MOVEMENT OF BARK BEETLES IN FOREST LANDSCAPE MOSAICS	I	238	21/08/00	16:30	CC		6	PS	6
Coulson, R. N.	4177	SPATIAL AND TEMPORAL PATTERNS OF MITOCHONDRIAL DNA IN FERAL HONEY BEES: IMPACT OF AFRICANIZATION	II	1055	21/08/00	16:30	CC		Erratum	PS	12
Coupland, J. B.	2624	INTEGRATED CONTROL OF MEDITERRANEAN SNAILS IN SOUTHERN AUSTRALIA, INCLUDING THE USE OF PARASITIC SARCOPHAGID FLIES	II	663	21/08/00	16:30	CC		14	PS	14
Coun, M. S.	3664	RECENT ADVANCES ON THE PHYLOGENY AND BIOGEOGRAPHY OF MUSCIDAE (DIPTERA)	II	925	24/08/00	11:20	HB	E	21	6	21
Coun, M. S.	3833	DIIPTERA CALIPTRATA SUCESSION IN A CARCASS OF SUS SCROFA, IN TWO ECOSYSTEMS OF RIO DE JANEIRO, RJ	II	967	24/08/00	16:30	CC		21	PS	21
Couri, M. S.	3659	RECENT ADVANCES ON THE SYSTEMATICS OF THE CROCIDIINAE (DIPTERA, BOMBYLIIDAE)	II	924	24/08/00	10:05	HB	E	21	6	21
Coutinho, A. B.	223	OCCURRENCE AND DAMAGES OF ONCIDERES SAGA (COLEOPTERA, CERAMBYCIDAE) IN MIMOSA CAESALPINAEFOLIA (LEGUMINOSAE, CAESALPINOIDAE)	I	57	22/08/00	16:30	CC		2	PS	2
Coutinho, T. A.	1972	UNDERSTANDING THE INTRODUCTION AND SPREAD OF SIREX NOCTILIO IN THE SOUTHERN HEMISPHERE	I	497	25/08/00	16:30	CC		10	PS	10
Couto, C.	1500	THE ROLE OF CHRYSOPIDS AS NATURAL CONTROL AGENTS IN PORTUGUESE GREENHOUSES	I	378	21/08/00	16:30	CC		8	PS	8
Couto, C.	1586	FIRST APPROACH ON THE POTENTIAL ROLE OF SEVERAL SPECIES (NEUROPTERA: CHHRYSOPIDAE), AS NATURAL CONTROL AGENT IN PORTUGUESE GREENHOUSES	I	400	23/08/00	16:30	CC		8	PS	8
Couto, E. B.	1979	EVALUATION OF THIAMETHOXAM ON COSTALIMAITA FERRUGINEA (COLEOPTERA: CHRYSOMELIDAE) CONTROL IN EUCALYPTUS PLANTATIONS	I	499	25/08/00	16:30	CC		10	PS	10
Couto, J. P. A.	2660	INFLUENCE OF ZINC ON THE WHITEFLY, BEMISIA TABACI, IN BEAN (PHASEOLUS VULGARIS) PLANT	II	672	21/08/00	16:30	CC		14	PS	14
Couto, L.	1938	SPATIAL DISTRIBUTION OF NESTS OF THE LEAF CUTTING ANT ATTA SEXDENS RUBROPILOSA (HYMENOPTERA: FORMICIDAE) IN PLANTATIONS OF EUCALYPTUS UROPHYLLA IN BRAZIL	I	488	23/08/00	16:30	CC		10	PS	10
Couto, L. A. do	3144	DESCRIPTION OF FINAL LARVAL INSTAR AND PUPA OF CURINUS COERULEUS (COLEOPTERA, COCCINELLIDAE, CHILOCORINAE), A PREDATOR OF ALEUROTHRIXUS SP. (HEMIPTERA, ALEYRODIDAE) AND NOTES ON THE ASSOCIATED BIOCOENOSIS	II	793	23/08/00	16:30	CC		16	PS	16
Couturier, G.	484	THE INSECT PESTS OF MYRCIARIA DUBIA (MYRTACEAE) IN PERU : A REVIEW	I	123	22/08/00	16:30	CC		3	PS	3
Couturier, G.	900	ON THE BIOLOGY OF THREE NEW POLLINATING SPECIES (COLEOPTERA: CURCULIONIDAE: DERELOMINI) OF CAIAUÉ ELAEIS OLEIFERA CORTÉS AND OF THE F1 HYBRID (E. GUINEENSIS X E. OLEIFERA) IN THE STATE OF AMAZONAS, BRAZIL	I	227	21/08/00	16:30	CC		6	PS	6
Couturier, G.	901	THREE NEW SPECIES OF COLEOPTERA (CURCULIONIDAE: DERELOMINI) POLLINATORS OF CAIAUÉ Elaeis oleifera (KUNTH) CORTÉS AND OF THE F1 HYBRID (E. guineensis X E. oleifera) IN THE STATE OF AMAZONAS	I	228	21/08/00	16:30	CC		6	PS	6
Coviella, C. E.	942	EFFECT OF ELEVATED CARBON DIOXIDE ON PLANT ALLOCATION TO ANTIHERBIVORY COMPOUNDS	I	238	21/08/00	16:30	CC		6	PS	6
Coyle, D. R.	1859	DEPLOYMENT OF TREE RESISTANCE TO INSECTS IN SHORT- ROTATION BIOMASS PLANTATIONS	I	469	24/08/00	14:05	HB	M	10	6	10
Craig, T. L.	2495	DOWNREGULATION OF ULTRASPIRACLE BUT NOT ECDYSONE RECEPTOR DURING PUPAL DIAPAUSE IN SARCOPHAGA CRASSIPALPIS	II	630	24/08/00	16:30	CC		13	PS	13
Craig, T. L.	3278	DIAPAUSE-SPECIFIC GENE EXPRESSION	II	828	23/08/00	9:50	HB	K	18	4	18
Craig, T. P.	829	SPECIATION IN GALL-INDUCING INSECTS	I	210	23/08/00	10:35	HB	D	6	5	6
Craig, T. P.	4103	IMPACT OF URBANIZATION ON AN INSECT/PLANT INTERACTION: BRUCHID BEETLES ON BLUE PALO VERDE	II	1036	24/08/00	16:30	CC		23	PS	23
Craig, T. P.	832	TEMPORAL VARIATION IN HOST-PLANT PREFERENCE AND OFFSPRING PERFORMANCE: CONSTRAINTS ON HOST-PLANT SPECIALIZATION	I	210	23/08/00	11:20	HB	D	6	5	6
Craik, D. J.	2051	DESIGNING PROTEINASE INHIBITORS FOR THE CONTROL OF HELICOVERPA SPECIES	I	517	21/08/00	16:30	CC		11	PS	11
Crainey, J. L.	2275	THE ORIGIN AND MOLECULAR EVOLUTION OF MOSQUITO NON-LTR RETROTRANSPOSONS BELONGING TO THE CR1 AND JOCKEY CLADES	I	574	23/08/00	16:30	CC		12	PS	12
Crampton, J. M.	2243	THE IDENTIFICATION OF TRANSPOSABLE ELEMENTS IN THE GENOME OF THE MALARIA VECTOR, ANOPHELES GAMBIAE	I	566	21/08/00	16:30	CC		12	PS	12
Crampton, J. M.	3017	VACCINE DELIVERY BY TRANSGENIC HAEMATOPHAGOUS INSECTS - A MODEL SYSTEM	II	761	25/08/00	16:30	CC		15	PS	15
Cranston, P. S.	3638	MOLECULAR EVIDENCE SUPPORTS, FAILS TO REFUTE, OR PROVOKES NEW MORPHOLOGICAL ASSESSMENT IN THE CHIRONOMIDAE (DIPTERA)	II	919	22/08/00	14:00	HB	E	21	4	21
Crauser, D.	3475	ADDITIVE PRIMER AND RELEASER EFFECTS OF BROOD AND QUEEN PHEROMONE ON ADULTS WORKERS IN THE HONEY BEE	II	877	22/08/00	16:30	CC		19	PS	19
Cravedi, P.	1299	RELATIONSHIP BETWEEN EXPRESSION, AMPLIFICATION AND METHYLATION OF FE4 GENE IN MYZUS PERSICAE (HOMOPTERA, APHIDIDAE)	I	328	21/08/00	16:30	CC		7	PS	7
Crawford, B.	3213	BIOLOGY OF CRINIVIRUSES AND WHITEFLY-TRANSMISSION	II	811	22/08/00	14:30	Bol	U	17	2	17
Creamer, R.	2120	THE EFFECT OF CULTURE MEDIA ON VIRULENCE OF PAECILOMYCES AMOENEROSEUS ON SILVERLEAF WHITEFLY BEMISIA ARGENTIFOLII	I	535	25/08/00	16:30	CC		11	PS	11
Creamer, R.	2121	SUSCEPTIBILITY OF DIFFERENT LIFE STAGES OF BEMISIA ARGENTIFOLII TO THE ENTOMOPATHOGENIC FUNGUS PAECILOMYCES AMOENEROSEUS	I	535	25/08/00	16:30	CC		11	PS	11
Creão-Duarte, A. J.	3477	DAMAGES CAUSED BY THE NASUTITERMES SPP. (ISOPTERA : TERMITIDAE) IN ERIOTHECA CRENULATICALYX (BOMBACACEAE) AT THE UNIVERSIDADE FEDERAL DA PARAÍBA, JOÃO PESSOA (PB), BRAZIL	II	878	22/08/00	16:30	CC		19	PS	19
Creffield, J. W.	3386	GLOBAL TRENDS ON WOOD PRESERVATIVES FOR TERMITE MANAGEMENT	II	855	21/08/00	9:50	HM	Q	19	1	19
Crema, R.	1299	RELATIONSHIP BETWEEN EXPRESSION, AMPLIFICATION AND METHYLATION OF FE4 GENE IN MYZUS PERSICAE (HOMOPTERA, APHIDIDAE)	I	328	21/08/00	16:30	CC		7	PS	7
Crema, R.	2276	THE PRESENCE OF THE TRANSPOSABLE ELEMENTS R1 AND R2 IS ASSOCIATED TO MITOTIC CROSSING OVER IN SEVERAL APHID SPECIES	I	574	23/08/00	16:30	CC		12	PS	12
Cremer, S.	1709	FIGHT OR FLIGHT? - ALTERNATIVE REPRODUCTIVE TACTICS IN CARDIOCONDYLA ANTS	I	431	21/08/00	10:55	HB	F	9	1	9
Cremonez, T. M.	3437	QUEEN PRESENCE AFFECTS VARROA INFESTATIONS	II	868	24/08/00	10:05	HM	Q	19	5	19

Sub-titles: (HB=Hotel Bourbon) - (HM=Hotel Mabu) - (CC=Convention Center) - (Bol=Foz Boulevard) - (PS=Poster Session) - (PL=Plenary Lecturer)

AUTHOR	Nº	TITLE	Book	Page	Date	Time	Local	Room	Session	Symp	New Session
Cresoni-Pereira, C.	2415	DIETARY SELF-SELECTION IN ANASTREPHA OBLIQUA WILD FEMALES (DIPTERA, TEPHRITIDAE)	II	610	21/08/00	16:30	CC		13	PS	13
Crespo, A. L. B.	998	EFFECT OF CATERPILLARS AND DEFOLIATION IN OVIPOSICION OF PLUTELLA XYLOSTELLA	I	252	22/08/00	16:30	CC		6	PS	6
Crespo, A. L. B.	673	ECONOMIC INJURY LEVEL AND SEQUENCIAL SAMPLING FOR BEMISIA TABACI IN TOMATO	I	170	23/08/00	16:30	CC		4	PS	4
Crespo, F. A.	3125	DESCRIPTION OF THE PREIMAGINAL INSTARS OF PARAVELIA CORRENTINA (HETEROPTERA: VELIIDAE)	II	788	22/08/00	16:30	CC		16	PS	16
Crespo, R.	2991	CHARACTERIZATION AND CARBON METABOLISM IN FUNGI PATHOGENOUS TO CHAGAS DISEASE VECTORS	II	755	23/08/00	16:30	CC		15	PS	15
Cresswell, I. D.	386	A NEW PROGRAM FOR SYSTEMATICS: THE CONVENTION ON BIOLOGICAL DIVERSITY'S GLOBAL TAXONOMY INITIATIVE (GTI)	I	98	21/08/00	15:15	HB	C	3	1	3
Cresswell, I. D.	440	A NEW PROGRAM FOR SYSTEMATICS: THE CONVENTION ON BIOLOGICAL DIVERSITY'S GLOBAL TAXONOMY INITIATIVE (GTI)	I	112	25/08/00	14:00	HB	C	3	8	3
Creusy, C.	2400	IMMUNOHISTOCHEMICAL CONTRIBUTION TO THE STUDY OF MORPHINE METABOLISM IN CALLIPHORIDAE LARVAE AND IMPLICATIONS IN FORENSIC ENTOMOTOXICOLOGY	II	606	21/08/00	16:30	CC		13	PS	13
Crisanti, A.	2918	STABLE TRANSFORMATION OF ANOPHELINE MOSQUITOES WITH THE MINOS TRANSPOSABLE ELEMENT FROM DROSOPHILA HYDEI	II	736	24/08/00	15:35	Bol	R	15	8	15
Crisósotomo, F. R.	2122	PIPERONYL DERIVATES BASED ON SESAMIN AND THEIR INHIBITION OF THE SYMBIOTIC FUNGUS OF LEAF-CUTTING ANTS	I	535	24/08/00	16:30	CC		11	PS	11
Crisóstomo, F. R.	3433	GROWTH INHIBITION OF THE SYMBIOTIC FUNGUS OF ATTA SEXDENS, BY NATURAL PRODUCTS AND SYNTHETIC COMPOUNDS	II	867	23/08/00	11:35	HM	Q	19	4	19
Cristofani, M.	3203	GENOME AND FUNCIONAL GENOMICS OF XYLELLA FASTIDIOSA	II	809	21/08/00	13:35	Bol	U	17	1	17
Cristofoletti, P.	2490	APIIDS AND APHID PROTEASES AS NON-CONVENTIONAL TARGETS FOR PROTEASE INHIBITOR TRANSGENES USED FOR CONTROLLING PHLOEM-FDEEDING INSECTS	II	629	24/08/00	16:30	CC		13	PS	13
Cristofoletti, P. T.	1754	APOCRINE SECRETION OF AMYLASE AND EXOCYTOSIS OF TRYPSIN ALONG THE MIDGUT OF TENEBRIO MOLITOR LARVAE	I	442	21/08/00	16:30	CC		9	PS	13
Crocker, R. L.	943	INFERRING ACTIVITIES AND POPULATION DENSITY FROM INCIDENTAL SOILBORNE SOUNDS OF WHITE GRUBS	I	238	21/08/00	16:30	CC		6	PS	6
Crocomo, W. B.	944	WHITEFLY TRIALEURODES VAPORARIUM (HEMIPTERA: HOMOPTERA: ALEYRODIADE) COMPARED BIOLOGY IN SOYBEAN AND IN FIVE BEAN CULTIVARS	I	238	21/08/00	16:30	CC		6	PS	6
Crocomo, W. B.	261	USE OF THIAMETHOXAN IN BEAN PEST CONTROL	I	66	23/08/00	16:30	CC		2	PS	2
Crocomo, W. B.	688	JAVA GRASS (CYMBOPOGON WINTWRIANUS JOWITT) ESSENTIAL OIL EFFECTS ON SPODOPTERA FRUGIPERDA BIOLOGY AND BEHAVIOR	I	174	24/08/00	16:30	CC		4	PS	4
Cronin, A. L.	945	PRELIMIARY EVIDENCE OF GEOGRAPHIC VARATION IN SOCIAL BEHAVIOUR OF HALICTINE BEES FROM HOKKAIDO, JAPAN	I	239	22/08/00	16:30	CC		6	PS	6
Cronin, J.	840	PLANT QUALITY AND TROPHIC CASCADES: THE EFFECTS OF PLANT STRESS AND VIGOR ON INSECT ASSEMBLAGES	I	212	23/08/00	14:45	HB	D	6	5	6
Cronin, J. T.	832	TEMPORAL VARIATION IN HOST-PLANT PREFERENCE AND OFFSPRING PERFORMANCE: CONSTRAINTS ON HOST-PLANT SPECIALIZATION	I	210	23/08/00	11:20	HB	D	6	5	6
Cronin, J. T.	1211	PLANT QUALITY AND THE ORGANIZATION OF CYNIPID GALL WASP COMMUNITIES	I	305	25/08/00	16:30	CC		6	PS	6
Cross, J. V.	2018	BIOCONTROL OF LEPIDOPTERAN PESTS OF APPLE AND PEAR WITH MICROBIAL AGENTS AND NEMATODES	I	509	24/08/00	10:05	HM	P	11	7	11
Crozier, R. H.	2181	APPLICATION OF MOLECULAR GENETIC TECHNIQUES FOR A BETTER UNDERSTANDING OF EVOLUTION IN THE SOCIAL INSECTS	I	551	22/08/00	11:35	HB	L	12	3	12
Crozier, R. H.	3505	EXAMINING THE GENETIC CONTROL OF DANCE IN HONEY BEES (APIS MELLIFERA)	II	885	23/08/00	16:30	CC		19	PS	19
Crozier, R. H.	2326	MOLECULAR PHYLOGENETIC INSIGHTS INTO THE ORIGIN OF TERMITE WORKERS	I	587	25/08/00	16:30	CC		12	PS	12
Cruvinel, L. R. O.	236	POPULATIONAL COMPOSITION AND SOIL MOBILITY OF SCAPTOCORIS CASTANEA (HETEROPTERA:CYDNIDAE) IN GOIÁS, BRAZIL	I	60	22/08/00	16:30	CC		2	PS	2
Cruz, I.	1474	PARASITISM RATE AND VIABILITY OF TRICHOGRAMMA MAXACALII (HYM.: TRICHOGRAMMATIDAE) ON EGGS OF THE EUCALYPTUS DEFOLIATOR EUSELASIA APISAON (LEP.: RIODINIDAE)	I	372	26/08/00	11:05	HM	O	8	8	8
Cruz, A. P. da	2865	EFFICIENCY OF MIREX-S MAX (SULFLURAMID 0.3%) BAIT AGAINST ATTA SEXDENS RUBROPILOSA AND ACROMYRMEX OCTOSPINOSUS (HYMENOPTERA: FORMICIDAE)	II	723	24/08/00	16:30	CC		14	PS	14
Cruz, F. Z. da	3222	PESTICIDE EVALUATION TO CONTROL VECTORS INSECTS OF TOBACCO VIRUS DISEASES	II	813	22/08/00	16:30	CC		17	PS	17
Cruz, F. Z. da	2979	CHARACTERIZATION OF LONOMIA OBLIQUA AND PERIGA CIRCUNSTANS (LEPIDOPTERA, SATURNIIDAE) OCCURING IN RIO GRANDE DO SUL STATE, BRAZIL	II	752	22/08/00	16:30	CC		15	PS	15
Cruz, I.	1290	STRATEGIES FOR MANAGEMENT OF RESISTANCE IN BT TRANSGENIC MAIZE IN BRAZIL	I	326	26/08/00	11:15	HM	N	7	11	7
Cruz, I.	1513	EFFECT OF A NUCLEAR POLYHEDROSIS VIRUS ON SPODOPTERA FRUGIPERDA LARVAE, ITS DAMAGE AND YIELD OF MAIZE CROP AT DIFFERENT EGG MASS INFESTATION LEVELS	I	382	21/08/00	16:30	CC		8	PS	8
Cruz, I.	2674	STRATEGY MANAGEMENT OF SPODOPTERA FRUGIPERDA TRHOUGH SELECTIVITY OF INSECTICIDE	II	675	22/08/00	16:30	CC		14	PS	14
Cruz, I.	1412	THE EFFECT OF AQUEOUS EXTRACT OF AZADIRACHTA INDICA LEAVES ON THE CONTROL OF SPODOPTERA FRUGIPERDA FED WITH CORN LEAVES	I	356	25/08/00	16:30	CC		7	PS	7
Cruz, I.	2672	BIOLOGY OF IMMATURE CHRYSOPERLA EXTERNA PREDATOR FED WITH SCHIZAPHIS GRAMINUM APHIDS REARED ON RESISTANT, MODERATELY RESISTANT AND SUSCEPTIBLE SORGHUM GENOTYPES	II	675	22/08/00	16:30	CC		14	PS	14
Cruz-Landim, C.	3031	OVARIAN DIFFERENTIATION IN THE WORKER OF APIS MELLIFERA (HYMENOPTERA, APIDAE)	II	765	21/08/00	10:00	HB	G	16	1	16
Cruz-Landim, C.	2413	ENZYMATIC ANALYSIS OF THE HYPOPHARYNGEAL GLANDS AND LARVAL FOOD OF WORKERS AND MALES OF SCAPTOTRIGONA POSTICA (HYMENOPTERA, APIDAE, MELIPONINAE)	II	610	21/08/00	16:30	CC		13	PS	13
Cruz-Landim, C.	3142	EXOCRINE TEGUMENTARY GLANDS OF BOMBUS MORIO (HYMENOPTERA, APIDAE) FEMALES: A MORPHOLOGICAL STUDY	II	793	22/08/00	16:30	CC		16	PS	16
Cruz-Landim, C.	2046	INFECTION OF DIATRAEA SACCHARALIS (LEP.; PYRALIDAE) WITH THE MICROSOPORIDIA NOSEMA SP	I	516	21/08/00	16:30	CC		11	PS	11
Cuadrado, D.	479	LAKES, PONDS AND WETLANDS AS HABITAT FOR BEETLES (COLEOPTERA, ADEPHAGA AND POLYPHAGA)	I	121	23/08/00	16:30	CC		3	PS	3
Cuadrado, D.	968	A STUDY OF MACROINVERTEBRATES IN RIVES ECOSYSTEMS (NW IBERIAN PENINSULA), AFFECTED BY SMALL HYDROELECTRIC DAMS	I	244	22/08/00	16:30	CC		6	PS	6
Cuda, J.	2064	SAFETY OF GRATIANA BOLIVIANA AS A BIOCONTROL AGENT OF TROPICAL SODA APPLE (SOLANUM VIARUM): IS EGGPLANT A SUITABLE HOST?	I	521	22/08/00	16:30	CC		11	PS	11
Cuda, J. P.	1580	CLASSICAL BIOLOGICAL CONTROL OF SOLANUM VIARUM (SOLANACEAE) IN THE USA	I	398	23/08/00	16:30	CC		8	PS	8
Cuello, N. D.	3743	BIODIVERSITY OF CIMICOMORPHA AND PENTATOMORPHA (HETEROPTERA) FROM ARGENTINA	II	945	22/08/00	16:30	CC		21	PS	21
Cuezzo, F.	480	NEOTROPICAL SPECIES OF THE ANT GENUS DORYMYRMEX (FORMICIDAE: DOLICHODERINAE). I. DORYMYRMEX FLAVESCENS COMPLEX	I	122	21/08/00	16:30	CC		3	PS	3

Sub-titles: (HB=Hotel Bourbon) - (HM=Hotel Mabu) - (CC=Convention Center) - (Bol=Foz Boulevard) - (PS=Poster Session) - (PL=Plenary Lecturer)

AUTHOR	Nº	TITLE	Book	Page	Date	Time	Local	Room	Session	Symp	New Session
Cuezzo, F.	481	THE ARGENTINEAN SPECIES OF THE ANT GENUS LINEPITHEMA (FORMICIDAE: DOLICHODERINAE)	I	122	21/08/00	16:30	CC		3	PS	3
Culbreath, A. K.	2566	SUCCESSES WITH PEANUT IPM IN THE SOUTHEASTERN UNITED STATES THROUGH INTERDISCIPLINARY APPROACHES	II	648	22/08/00	14:50	HB	B	14	4	14
Culbreath, A. K.	2635	DEVELOPMENT OF A METHOD OF RISK ASSESSMENT TO FACILITATE INTEGRATED MANAGEMENT OF SPOTTED WILT DISEASE OF PEANUT IN GEORGIA	II	666	22/08/00	16:30	CC		14	PS	14
Culik, M. P.	482	COLLEMBOLA (ARTHROPODA: HEXAPODA) BIODIVERSITY IN TROPICAL AGRICULTURAL ENVIRONMENTS OF ESPIRITO SANTO, BRAZIL	I	122	21/08/00	16:30	CC		3	PS	3
Cumming, J. M.	3749	THE SPECIES GROUPS OF NEARCTIC PLATYPALPUS MACQUART (DIPTERA: EMPIDOIDEA; TACHYDROMIINAE)	II	946	22/08/00	16:30	CC		21	PS	21
Cumming, J. M.	3660	A NEW PHYLOGENETIC CLASSIFICATION OF THE EMPIDOIDEA (DIPTERA: EREMONEURA)	II	924	24/08/00	10:20	HB	E	21	6	21
Cunha, A. E.,F.,L.	1145	THE STUDY OF ABUNDANCE, BITING BEHAVIOR AND PARITY OF ANOPHELINE IN ENDEMIC MALARIA AREA IN PORTO VELHO – RONDONIA – BRAZIL	I	289	24/08/00	16:30	CC		6	PS	6
Cunha, C. N. da	3605	ARTHROPODS OBTAINED BY CANOPY FOGGING FROM VOCHYSIADIVERGENS (VOCHYSIACEAE) IN PANTANAL OF BRAZIL	II	910	24/08/00	16:30	CC		20	PS	20
Cunha, D. R.	2249	PHYLOGENETIC RELATIONSHIP AMONG STINGLESS BEE SPECIES INFERRED BY MITOCHONDRIAL DNA RESTRICTION FRAGMENT LENGTH POLYMORPHISM	I	568	21/08/00	16:30	CC		12	PS	12
Cunha, U. S. da	2702	STRATEGY OF SEED TREATMENT FOR RATIONALIZATION OF CHEMICAL CONTROL OF ORYZOPHAGUS ORYZAE ON FLOODED RICE	II	682	22/08/00	16:30	CC		14	PS	14
Cunha, U. S. da	2744	FOLIAR SPRAY STRATEGY FOR RATIONAL CHEMICAL CONTROL OF ORYZOPHAGUS ORYZAE ON FLOODED RICE	II	693	23/08/00	16:30	CC		14	PS	14
Cunha, U. S. da	2745	REDUCTION OF CARBOFURAN INSECTICIDE DOSAGE FOR ORYZOPHAGUS ORYZAE LARVAL CONTROLING AND ENVIRONMENTAL IMPACT EVALUATION IN THE FLOODED RICE ECOSYSTEM	II	693	23/08/00	16:30	CC		14	PS	14
Cunningham , M.	17	HOUSE DUST MITE (DERMATOPHAGOIDES PTERONYSSINUS) MORTALITY IN OCCUPIED BEDS AND HEATED AND UNHEATED CARPET	I	5	21/08/00	16:30	CC		1	PS	1
Cure, J. R.	224	SIMULATION OF THE TRI-TROPHIC SYSTEM COFFEE-BROCA-PARASITOIDS: POSSIBLE OUTCOMES FROM TWO DIFFERENT CLIMATIC REGIMES	I	57	22/08/00	16:30	CC		2	PS	2
Cure, J. R.	2172	SIMULATION OF THE TRI-TROPHIC SYSTEM COFFEE-BROCA-PARASITOIDS: POSSIBLE OUTCOMES FROM TWO DIFFERENT CLIMATIC REGIMES	I	548	21/08/00	13:35	HB	L	12	2	12
Curran, J.	2280	IDENTIFICATION OF TEPHRITID FRUIT FLIES USING rRNA GENES	I	575	23/08/00	16:30	CC		12	PS	12
Curran, J.	104	IPM OF BEMISIA TABACI IN AUSTRALASIA	I	27	22/08/00	15:30	HB	A	2	4	2
Curtis, C. F.	1266	ATTEMPTS TO MEET THE THREAT OF PYRETHROID RESISTANCE TO THE CONTINUED SUCCESS OF INSECTICIDE TREATED BEDNETS AGAINST MALARIA VECTORS	I	320	24/08/00	15:35	HM	N	7	8	7
Cymborowski, , B.	3275	INVOLVEMENT OF CIRCADIAN RHYTHMS IN THE REPRODUCTIVE PHYSIOLOGY OF INSECT MALES	II	827	23/08/00	15:50	HB	K	18	3	18
Czepak, C.	225	EFFECT OF THE INSECT GROWTH REGULATOR DIFLUBENZURON ON REPRODUCTION OF EUSCHISTUS HEROS (FABR.) (HETEROPTERA: PENTATOMIDAE)	I	57	22/08/00	16:30	CC		2	PS	2
Czepak, C.	236	POPULATIONAL COMPOSITION AND SOIL MOBILITY OF SCAPTOCORIS CASTANEA (HETEROPTERA:CYDNIDAE) IN GOIÁS, BRAZIL	I	60	22/08/00	16:30	CC		2	PS	2
Czepak, C.	1917	WOOD LOSS IN EUCALYPTUS PLANTATIONS BY COPTOTERMES SP. (ISOPTERA:RHINOTERMITIDAE) IN GOIAS-BRAZIL	I	483	21/08/00	16:30	CC		10	PS	10
Czepak, C.	3483	MONITORING TERMITES IN SUGAR CANE FIELDS IN GOIAS, BRAZIL: A PROFITABLE INVESTIMENT.	II	879	23/08/00	16:30	CC		19	PS	19
D. A. Herms	0	TO BE ANNOUNCED	I	0	24/08/00	9:50	HB	A	1	7	2
D.L. Kline	621	EFFICACY OF NEW ATTRACTANTS AND TRAPS FOR MOSQUITO SURVEILLANCE AND CONTROL	I	157	25/08/00	10:35	Bol	S	4	7	4
d'Almeida, J. M.	2416	POST-EMBRYONIC DEVELOPMENT OF CALYPTRATE FLIES IN ARTIFICIAL DIETS I. CHRYSOMYA MEGACEPHALA (DIPTERA: CALLIPHORIDAE)	II	610	21/08/00	16:30	CC		13	PS	13
D'Amato, F.	2423	PRELIMINARY INVESTIGATION ON INDIVIDUAL RESPIRATION OF ADULTS AND PUPAE OF OSMIA CORNUTA DURING DIAPAUSE BY MEANS OF A CO2 ANALYZER BASED ON AN INFRARED TUNABLE DIODE LASER	II	612	22/08/00	16:30	CC		13	PS	13
Daane, K. M.	131	THE ROLE OF COVER CROPPING IN VINEYARD IPM IN CALIFORNIA	I	34	24/08/00	13:55	HB	A	2	8	2
Daane, K. M.	226	BIO-CONTROL FOR NEW PESTS INVASIONS IN CALIFORNIA VINEYARDS: OBSCURE MEALYBUG AS A CASE EXAMPLE	I	58	22/08/00	16:30	CC		2	PS	2
Daane, K. M.	2048	HOST-HANDLING BEHAVIORS OF BLACK SCALE PARASITOIDS: A CASE FOR ANT MEDIATED EVOLUTION	I	517	21/08/00	16:30	CC		11	PS	11
Daane, K. M.	2661	BIO-CONTROL FOR NEW PESTS INVASIONS IN CALIFORNIA VINEYARDS: OBSCURE MEALYBUG AS A CASE EXAMPLE	II	672	22/08/00	16:30	CC		14	PS	14
Daane, K. M.	132	ROLE OF SPIDERS IN GRAPE IPM	I	34	24/08/00	14:20	HB	A	2	8	2
Dadour, I. R.	227	AVERMECTINS VS DORAMECTIN: WHATS IN IT FOR DUNG BEETLES	I	58	22/08/00	16:30	CC		2	PS	2
Dadour, I. R.	2941	PIGS AND FLIES: A FORENSIC ENTOMOLOGY PERSPECTIVE IN SOUTHWESTERN AUSTRALIA	II	742	26/08/00	10:05	Bol	R	15	11	15
Daffre, S.	2351	GOMESIN, AN ANTIMICROBIAL PEPTIDE OF THE SPIDER HEMOCYTES: SPECTRUM OF ACTIVITY AND cDNA CLONING	II	594	23/08/00	10:05	HB	I	13	4	13
Daffre, S.	4154	GOMESIN, AN ANTIMICROBIAL PEPTIDE OF THE SPIDER HEMOCYTES: SPECTRUM OF ACTIVITY AND cDNA CLONING	II	1049	21/08/00	16:30	CC		Erratum	PS	13
Daffre, S.	2234	PROTEIN PURIFICATION AND cDNA CLONING OF SALIVARY GLANDS COMPONENTS OF ANOPHELES DARLINGI	I	564	21/08/00	16:30	CC		12	PS	12
Daffre, S.	2061	ANTIMICROBIAL PEPTIDES FROM THE CATTLE TICK BOOPHILUS MICROPLUS	I	520	22/08/00	16:30	CC		11	PS	11
Dahlman, D. L.	2373	CHARACTERIZATION AND MODE OF ACTION OF A BIOLOGICALLY ACTIVE PROTEIN SECRETED BY TERATOCYTES	II	599	24/08/00	14:35	HB	I	13	7	13
Dakouo, D.	2662	DEVELOPPING IPM COMPONENTS FOR THE CONTROL OF SORGHUM MAIN PESTS IN BURKINA FASO	II	672	21/08/00	16:30	CC		14	PS	14
Dal Bó, E.	3220	WEEDS AS A SOURCE FOR THRIPS VECTORS AND TSWV IN A TOMATO NURSERY, FOR AN ISOLATED WEEDY AREA IN LA PLATA, ARGENTINE	II	813	21/08/00	16:30	CC		17	PS	17
Dall'Aglio-Holvorcem, C. G.	946	ALLOMETRIC RELATIONSHIPS BETWEEN BIOMASS, VOLUME AND POPULATION SIZE IN COLONIES OF SOLENOPSIS INVICTA(HYMENOPTERA: FORMICIDAE)	I	239	22/08/00	16:30	CC		6	PS	6
Dall'Oglio, O. T.	1816	ENVIRONMENTAL DIVERSITY IN A EUCALYPTUS PLANTATION AFFECTS NUMBERS OF SARSINA VIOLASCENS (LEPIDOPTERA: LYMANTRIIDAE) ADULTS?	I	458	21/08/00	11:50	HB	M	10	1	10
Dall'Oglio, O. T.	1910	FAUNA OF LEPIDOPTERA IN A TRANSECT OF NATIVE VEGETATION- EUCALYPTUS PLANTATION IN IPABA, MINAS GERAIS, BRAZIL	I	481	23/08/00	16:30	CC		10	PS	10
Dalla Pria Jr., W.	2861	EFFICIENCY OF THIAMETHOXAM TO CONTROL ONCOMETOPIA FACIALIS (HEMIPTERA: CICADELLIDAE) IN CITRUS	II	722	25/08/00	16:30	CC		14	PS	14
Dallai, R.	3091	THE CENTRIOLE IN INSECT SPERMATOZOA	II	780	26/08/00	9:35	HB	G	16	9	16
Dallai, R.	3097	ABERRANT SPERMATOGENESIS AND POST ZYGOTIC SEX-DETERMINATION IN COLLEMBOLA	II	781	26/08/00	13:30	HB	G	16	9	16
Dallai, R.	3098	THE GIANT SPERM AXONEME OF THE GALL-MIDGE FLY ASPHONDYLIA RUEBSAAMENI KERTESZ: FINE STRUCTURE AND DEVELOPMENT	II	782	26/08/00	13:45	HB	G	16	9	16
Dallai, R.	3730	THE PHYLOGENY OF BASAL INSECTS: MOLECULAR AND MORPHOLOGICAL DATA COMPARED	II	942	21/08/00	16:30	CC		21	PS	21
Dallwitz, M. J.	774	INTERACTIVE IDENTIFICATION USING THE INTERNET	I	195	24/08/00	11:35	Bol	T	5	5	5
Daloze, D.	4130	CHEMICAL DEFENSE IN NEOTROPICAL LEAF BEETLES	II	1043	25/08/00	14:40	HM	P	24	2	24
Daly, J.	2049	BT COTTON: RELATIONSHIP BETWEEN BIOEFFICACY, GENE EXPRESSION AND PROTEIN	I	517	21/08/00	16:30	CC		11	PS	11

Sub-titles: (HB=Hotel Bourbon) - (HM=Hotel Mabu) - (CC=Convention Center) - (Bol=Foz Boulevard) - (PS=Poster Session) - (PL=Plenary Lecturer)

AUTHOR	Nº	TITLE	Book	Page	Date	Time	Local	Room	Session	Symp	New Session
Daly, J.	3877	LURE AND KILL FOR PEST MANAGEMENT IN ORCHARDS	II	979	21/08/00	15:30	HB	H	22	1	22
Daly, J. C.	1261	NATURE'S SELECTION: GENETICS AND EVOLUTION OF RESISTANCE IN HELICOVERPA ARMIGERA	I	318	24/08/00	14:20	HM	N	7	8	7
Damborsky, M. P.	2962	TRIATOMINES INVOLVED IN DOMESTIC AND WILD TRYPANOSOMA CRUZI TRANSMISSION IN CONCEPCIÓN, CORRIENTES, ARGENTINA	II	747	21/08/00	16:30	CC		15	PS	15
Damen, W. G. M.	3076	PROXIMAL-DISTAL PATTERNING IN TRIBOLIUM CASTANEUM, AN INSECT WITH EMBRYONIC LIMB FORMATION	II	776	24/08/00	15:30	HB	G	16	6	16
Damgaard, J.	3570	MITOCHONDRIAL DNA SEQUENCE VARIATION OF THE WATER STRIDER AQUARIUS REMIGIS (HETEROPTERA, GERRIDAE)	II	901	23/08/00	10:35	Bol	U	20	1	20
Damgaard, J.	3627	PHYLOGENY OF TEMPERATE WATER STRIDERS (GERRIDAE: LIMNOPORUS, AQUARIUS & GERRIS) BASED ON COMBINED ANALYSES OF MOLECULAR AND MORPHOLOGICAL DATA	II	916	22/08/00	9:35	HB	E	21	3	21
Damgaard, J.	4174	PHYLOGENY AND PHYLOGEOGRAPHY OF THE MARINE WATER STRIDER HALOBATES (HETEROPTERA, GERRIDAE)	II	1054	23/08/00	10:05	Bol	U	Erratum	1	20
Damsteegt, V. D.	3224	TRANSMISSION OF CITRUS PATHOGENS FOREIGN TO THE U.S. BY ARTHROPODS ENDEMIC TO THE U.S. CONDUCTED UNDER HIGH QUARANTINE CONTAINMENT	II	814	22/08/00	16:30	CC		17	PS	17
Dan Gerling	XVI	Whiteflies: a revisited frontier	I	LXIV	26/08/00	8:00	HB			PL	
Danet , J.-L.	3215	INSERTIONAL MUTAGENESIS OF SPIROPLASMA CITRI IN RELATION TO PATHOGENICITY	II	812	22/08/00	15:30	Bol	U	17	2	17
Danforth, B. N.	1680	PERISTENUS PARASITISM OF LYGUS LINEOLARIS IN MULTIPLE PLANT HABITATS	I	423	25/08/00	16:30	CC		8	PS	8
Dang, H. T.	2708	COMPARISONS OF INSECTICIDE EFFICACY AGAINST HELICOVERPA ARMIGERA IN CONVENTIONAL VERSUS TRANSGENIC COTTON	II	684	23/08/00	16:30	CC		14	PS	14
Dangerfield, J. M.	483	BIOTRACK: CONCEPTUAL AND INFORMATION TECHNOLOGY SOLUTIONS FOR UNDERSTANDING MORE OF BIODIVERSITY	I	122	22/08/00	16:30	CC		3	PS	3
Daniell, H.	1239	EXPRESSION OF BACILLUS THURINGIENSIS CRY2A PROTEINS IN PLANT CHLOROPLASTS: INCREASING TOXICITY TO SUSCEPTIBLE AND BACILLUS THURINGIENSIS RESISTANT INSECTS	I	313	22/08/00	15:05	HM	N	7	4	7
Dansa-Petretski, M.	2506	OCCURRENCE OF ALPHA-GLUCOSIDASE AS A BIOCHEMICAL MARKER FOR PERIMICROVILLAR MEMBRANES IN HEMIPTERA AND THYSANOPTERA	II	633	24/08/00	16:30	CC		13	PS	13
Dansa-Petretski, M.	2507	HEME GENERATION AND PROCESSING IN THE MIDGUT LUMEN AND ITS STORAGE IN THE EPITHELIAL CELLS OF THE RHODNIUS PROLIXUS (HEMIPTERA: REDUVIIDAE)	II	633	24/08/00	16:30	CC		13	PS	13
Danthanarayana, W.	947	FLIGHT PERIODICITIES IN MIGRANT MOTHS	I	239	24/08/00	11:45	HB	F	6	3	6
Daochao, J.	3750	CLADISTICS AND PHYLOGENY OF SUPERFAMILY RELATIONSHIPS WITHIN HYDRACHNELLAE (ACARI, ACARIFORMES)	II	947	22/08/00	16:30	CC		21	PS	21
Dapoto, G.	1911	ARTHROPODS IN RELATION WITH ARAUCARIA ARAUCANA: AN APPROACH TO ITS BIODIVERSITY IN ARGENTINA	I	482	21/08/00	16:30	CC		10	PS	10
Dapoto, G.	35	MITE POPULATIONS IN RELATION TO CYDIA POMONELLA CONTROL IN THE ALTO VALLE DE RÍO NEGRO Y NEUQUÉN (ARGENTINA)	I	9	22/08/00	16:30	CC		1	PS	1
Darakjian, P.	3460	RELATIVE ABUNDANCE AND EXPLOITATION OF AVAILABLE RESOURCES BY APID BEES (HYMENOPTERA: APOIDEA) IN AN URBANIZED AREA	II	873	21/08/00	16:30	CC		19	PS	19
Daterman, G. E	614	PHEROMONE TECHNOLOGIES FOR MANAGING DOUGLAS-FIR TUSSOCK MOTH IN WESTERN NORTH AMERICA	I	155	24/08/00	14:00	Bol	S	4	6	4
Daugeron, C.	3751	TOWARD A PHYLOGENY OF THE WORLD EMPIDINI (DIPTERA: EMPIDIDAE)	II	947	22/08/00	16:30	CC		21	PS	21
Daves, C.	254	SOYBEAN STEM BORER IN KANSAS: LIFE HISTORY, SAMPLING, AND SEVERITY OF RECENT INFESTATIONS	I	65	23/08/00	16:30	CC		2	PS	2
Davey, K. G.	3325	GLUTATHIONE S-TRANSFERASE FROM THE SPRUCE BUDWORM, CHORISTONEURA FUMIFERANA: IDENTIFICATION, CHARACTER-IZATION, LOCALIZATION, CDNA CLONING, DEVELOPMENTAL EXPRESSION AND INDUCTION BY VARIOUS FACTORS	II	840	21/08/00	16:30	CC		18	PS	18
David Grimaldi	VI	400 million years of terrestrial arthropods, and the mesozoic radiations of the insects	I	XIX	22/08/00	8:00	HB			PL	
Davidson, E. A.	3432	LEAF-CUTTING ANT (ATTA SEXDENS) EFFECTS ON SOIL, ROOT DISTRIBUTION AND TREE GROWTH IN A SECONDARY FOREST OF EASTERN AMAZONIA	II	866	23/08/00	11:20	HM	Q	19	4	19
Davies, B.	1731	THE FUNCTION OF NUPTIAL FEEDING IN THE TETTIGONIID STEROPLEURUS STALI: FIELD EVIDENCE REFUTES THE PATERNAL INVESTMENT HYPOTHESIS	I	436	22/08/00	15:30	HB	F	9	3	9
Davies, K.	3839	MOLECULAR SYSTEMATICS OF FERGUSONINA SPP. (DIPTERA: FERGUSONINIDAE): HOST SPECIFICITY, HOST-USE EVOLUTION, AND IMPLICATIONS FOR BIOCONTROL OF MELALEUCA QUINQUENERVA IN THE FLORIDA EVERGLADES	II	969	25/08/00	16:30	CC		21	PS	21
Davies, N.	2202	IDENTIFYING THE GEOGRAPHIC SOURCE OF INDIVIDUALS THROUGH MULTILOCUS GENOTYPES	I	556	24/08/00	10:05	HB	L	12	7	12
Davies, P. L.	3283	WHEN YOU CAN'T FLY TO BRAZIL: SURVIVING WINTER WITH ANTIFREEZE PROTEIN GENES	II	829	23/08/00	11:05	HB	K	18	4	18
Davies, R. G.	394	PATTERNS OF TERMITE DIVERSITY ACROSS RECENTLY ISOLATED LAND-BRIDGE ISLANDS IN FRENCH GUIANA	I	100	22/08/00	14:05	HB	C	3	2	3
D'Ávila, M.	1755	BEHAVIOR OF HEDYPATHES BETULINUS (COL., CERAMBYCIDAE) ON ILEX PARAGUARIENSIS	I	442	21/08/00	16:30	CC		9	PS	9
Davis, D. R.	1514	BIOLOGY OF THE IMMATURE STAGES OF NORTH AMERICAN PLANT MINING GRACILLARIIDAE (LEPIDOPTERA)	I	382	21/08/00	16:30	CC		8	PS	8
Davis, G. K.	2244	EXPRESSION OF PAIRED GROUP III GENES AND THE EVOLUTION OF SEGMENTATION	I	566	21/08/00	16:30	CC		12	PS	12
Davis, N. T.	2417	NEURONAL CONTROL OF HEART REVERSAL IN THE HAWKMOTH MANDUCA SEXTA	II	611	21/08/00	16:30	CC		13	PS	13
Davis, P. M.	241	ROOTWORM EMERGENCE FROM Cry3Bb HYBRIDS COMPARED TO THAT OBSERVED WITH INSECTICIDE-TREATED MAISE.	I	61	22/08/00	16:30	CC		2	PS	2
Davis, P. M.	1326	EFFECTS OF TRANSGENIC HYBRID MAIZE ON ADULT WESTERN CORN ROOTWORM EMERGENCE AND ROOT RATINGS	I	335	22/08/00	16:30	CC		7	PS	7
Day, W. H.	1680	PERISTENUS PARASITISM OF LYGUS LINEOLARIS IN MULTIPLE PLANT HABITATS	I	423	25/08/00	16:30	CC		8	PS	8
Dean, M.	472	DIVERSITY OF TWO LOWLAND RAINFOREST BEETLE TAXA (HISTERIDAE AND STAPHYLINIDAE: PSELAPHINAE) AT A WESTERN AMAZONIAN LOCALITY	I	120	21/08/00	16:30	CC		3	PS	3
Dean, S. R.	4090	CYTOTOXICITY OF LUFENURON IN UNHATCHED LARVAE OF THE CAT FLEA CTENOCEPHALIDES FELIS	II	1033	23/08/00	16:30	CC		23	PS	23
Deans, N. A.	3132	FUNCTIONAL MORPHOLOGY OF TREE WETA MANDIBULAR WEAPONS	II	790	22/08/00	16:30	CC		16	PS	16
DeBarr, G. L.	1508	CURRENT STATUS OF THE BIOLOGICAL CONTROL PROGRAM FOR THE MEALYBUG, ORACELLA ACUTA, IN THE PEOPLE'S REPUBLIC OF CHINA	I	380	21/08/00	16:30	CC		8	PS	8
Decombel, L.	1403	SIGNIFICANCE OF UPTAKE AND BINDING IN LEPIDOPTERA AND COLEOPTERA ON TOXICITY OF DIBENZOYLHYDRAZINE ECDYSONE AGONISTS	I	354	25/08/00	16:30	CC		7	PS	7
Deepak, S. A.	70	TOXIC AND MUTAGENIC EFFECTS OF A FEW CARBAMATE PESTICIDES ON SILKWORM BOMBYX MORI	I	18	25/08/00	16:30	CC		1	PS	1
Deets, A. J.	981	NEST DYNAMICS OF POLYGYNE COLONIES OF THE SOUTHEASTERN YELLOWJACKET	I	248	23/08/00	16:30	CC		6	PS	6
Defagó, M. T.	657	ANTIFEEDANT EFFECTS OF ARGENTINE MELIA AZEDARACH FRUIT EXTRACT AND ITS ACTIVE COMPOUND MELIARTENIN	I	166	22/08/00	16:30	CC		4	PS	4
Degen, T.	671	VARIATION AND SPECIFICITY OF HERBIVORE-INDUCED PLANT ODORS AS FORAGING CUES FOR PARASITOIDS	I	170	23/08/00	16:30	CC		4	PS	4

Sub-titles: (HB=Hotel Bourbon) - (HM=Hotel Mabu) - (CC=Convention Center) - (Bol=Foz Boulevard) - (PS=Poster Session) - (PL=Plenary Lecturer)

AUTHOR	N°	TITLE	Book	Page	Date	Time	Local	Room	Session	Symp	New Session
Degen, T.	1422	IS IT FEASIBLE TO INCREASE THE ATTRACTIVENESS OF CROP PLANTS TO PARASITOIDS?	I	359	21/08/00	10:50	HM	O	8	1	8
DeGomez, T. E.	948	ARTHROPOD COLONIZATION RATES OF EXOTIC WOODY SPECIES	I	239	22/08/00	16:30	CC		6	PS	6
Degrande, P. E.	1313	A SUSTAINABLE AND ECONOMICAL INSECTICIDAL MANAGEMENT PROGRAM ON COTTON IN BRAZIL	I	331	21/08/00	16:30	CC		7	PS	7
Degrande, P. E.	72	POPULATIONAL FLOTATION OF ACARI EDAPHICS ON TILLAGE AND NO TILLAGE SYSTEMS IN THE AREA OF DOURADOS - MS	I	18	25/08/00	16:30	CC		1	PS	1
Deinert, E. I.	1705	RISK-SENSITIVE FORAGING FOR MATES IN A PUPAL MATING BUTTERFLY, HELICONIUS HEWITSONI	I	430	21/08/00	9:35	HB	F	9	1	9
DeJong, P.	3510	STRUCTURAL ANALYSIS OF THE Z CHROMOSOME IN BOMBYX MORI BY USING THE BAC LIBRARY	II	886	23/08/00	16:30	CC		19	PS	19
Dekeyser, M. A.	1268	BIFENAZATE (D2341), A NOVEL AGENT TO CONTROL SPIDER MITES	I	320	25/08/00	9:35	HM	N	7	9	7
Dekker, T.	2980	L-LACTIC ACID IS AN IMPORTANT HOST STIMULUS FOR THE ANTHROPOPHILIC ANOPHELES GAMBIAE S.S.	II	752	22/08/00	16:30	CC		15	PS	15
Dekker, T.	2871	UNDERSTANDING OF MOSQUITO ATTRACTION THROUGH IDENTIFICATION OF VOLATILE COMPOUNDS EMANATING FROM HUMANS	II	725	21/08/00	10:35	Bol	R	15	1	15
Dekker, Teun	2928	UNDERSTANDING OF MOSQUITO ATTRACTION THROUGH IDENTIFICATION OF VOLATILE COMPOUNDS EMANATING FROM HUMANS	II	739	21/08/00	16:30	CC		15	PS	15
Delabie, J. H. C.	3405	ANTS AS PEST IN HOSPITALS: A COMPARISON BETWEEN NORTHERN AND SOUTHERN HEMISPHERES	II	860	22/08/00	9:50	HM	Q	19	2	19
Delabie, J. H. C.	1723	FUNCTIONAL POLYGYNY IN ECTATOMMA TUBERCULATUM (HYMENOPTERA: FORMICIDAE).	I	434	22/08/00	10:20	HB	F	9	2	9
Delabie, J. H. C.	3515	#N/D	#N/D	#N/D	#N/D	#N/D	#N/D	#N/D	#N/D	#N/D	#N/D
Delalibera Jr., I.	2050	REMARKABLE PHYSIOLOGICAL VARIATION AMONG ISOLATES OF THE MITE PATHOGENIC FUNGUS NEOZYGITES FLORIDANA: NUTRITIONAL REQUIREMENTS AND CRYOPRESERVATION	I	517	21/08/00	16:30	CC		11	PS	11
Del-Claro, K.	805	CONDITIONAL MUTUALISMS IN ANT-PLANT-HERBIVORES INTERACTION IN TROPICAL SAVANNA	I	204	24/08/00	13:35	HB	F	6	2	6
Del-claro, K.	1101	BIOLOGY AND ONTOGENY OF ZELUS LEUCOGRAMMUS, (HEMIPTERA: REDUVIIDAE) IN CERRADO-SAVANNA, BRAZIL: THE IMPORTANCE OF CLIMATIC VARIATIONS	I	278	24/08/00	16:30	CC		6	PS	6
Del-claro, K.	1147	ANT-HERBIVORES INTERACTIONS IN TOCOYENA FORMOSA (RUBIACEAE) IN CERRADO VEGETATION	I	289	24/08/00	16:30	CC		6	PS	6
Del-Claro, K.	1191	MIMETIC ASSEMBLAGES OF LYCID BEETLES IN SOUTHERN BRAZIL	I	300	25/08/00	16:30	CC		6	PS	6
Del-Claro, K.	1192	MIMICRY DYNAMICS OF WASPS AND OTHER INSECTS IN SOUTHERN BRAZIL	I	300	25/08/00	16:30	CC		6	PS	6
Del-claro, K.	1786	THE PREDATORY BEHAVIOR OF ZELUS LEUCOGRAMMUS, (HEMIPTERA: REDUVIIDAE) IN CERRADO-SAVANNA, BRAZIL	I	450	23/08/00	16:30	CC		9	PS	9
Del-Claro, K.	1794	A SILK-NEST WEAVING ANT CAMPONOTUS SENEX (HYMENOPTERA: FORMICINAE) IN A BRAZILIAN SAVANNA	I	452	25/08/00	16:30	CC		9	PS	9
Delfino, M. A.	909	HONEY ANTS ON THREE DIFFERENTS REWARDING ATTRACTANTS	I	230	21/08/00	16:30	CC		6	PS	6
Delfino, M. A.	1836	RECORDS OF CONIFER APHIDS FROM ARGENTINA (HOMOPTERA, APHIDIDAE)	I	463	22/08/00	15:35	HB	M	10	3	10
Delfino, M. A.	565	ESTIMATING INSECT DIVERSITY IN CENTRAL ARGENTINA: A COMPARISON AMONG TAXA AND HABITATS	I	143	25/08/00	16:30	CC		3	PS	3
Delfino, S.	1391	EXTRACTS OF CHRYSANTHEMUM CINERARIAEFOLIUM AND QUASSIA AMARA: EVALUATION OF EFICIENCE AND EFFECT ON SITOPHILUS ORYZAE (COLEOPTERA:CURCULIONIDAE)	I	351	25/08/00	16:30	CC		7	PS	7
Delfino, S.	1135	USE OF NATURAL EXTRACTS OF BASIL, DILL AND FENNEL LIKE ALTERNATIVE MEASURE OF CONTROL OF MACROSIPHOM EUPHORBIAE (HEMIPTERA: APHIDIDAE)	I	286	24/08/00	16:30	CC		6	PS	6
Delfosse, E. S.	3912	HISTORY OF THE RISK ASSESSMENT PROCESS: A NORTH AMERICAN PERSPECTIVE ON RISK ASSESSMENT FOR BIOLOGICAL CONTROL INTRODUCTIONS	II	987	25/08/00	9:45	HB	H	22	7	22
Delfosse, E. S.	1446	TECHNOLOGY TRANSFER IN AUGMENTATIVE BIOLOGICAL CONTROL: AUTOMATION FOR COMMERCIAL PRODUCTION AND APPLICATION OF NATURAL ENEMIES	I	365	22/08/00	15:05	HM	O	8	4	8
Delgado, C.	484	THE INSECT PESTS OF MYRCIARIA DUBIA (MYRTACEAE) IN PERU : A REVIEW	I	123	22/08/00	16:30	CC		3	PS	3
Delgado, F.	246	LIPOLYTIC AND PROTEOLYTIC ACTIVITY OF BEAUVERIA BASSIANA AND METARHIZIUM ANISOPLIAE AND THEIR RELATIONSHIP WITH PATHOGENICITY TO HYPOTHENEMUS HAMPEI	I	63	22/08/00	16:30	CC		2	PS	2
Delgado, F.	26	STUDIES ON INFECTION MECHANISMS OF THE FUNGI BEAUVERIA BASSIANA AND METARHIZIUM ANISOPLIAE ON HYPOTHENEMUS HAMPEI USING FLUORESCENCE MICROSCOPY AND SCANNING ELECTRON MICROSCOPY	I	7	23/08/00	16:30	CC		1	PS	1
Delisle, J.	658	PHYSIOLOGICAL REGULATION OF PHEROMONE PRODUCTION AND ITS INHIBITION FOLLOWING MATING IN CHORISTONEURA FUMIFERANA AND C. ROSACEANA (LEPIDOPTERA:TORTRICIDAE)	I	166	22/08/00	16:30	CC		4	PS	4
Della Lucia, T. M. C.	1720	SEXUAL BEHAVIOR OF LONGHORN BEETLE MIGDOLUS FRYANUS (COLEOPTERA: CERAMBYCIDAE)	I	433	22/08/00	9:35	HB	F	9	2	9
Della Lucia, T. M. C.	180	SUBLETHAL EFFECTS OF ABAMECTIN SUPPRESSING COLONIES OF THE LEAF-CUTTING ANT ACROMYRMEX SUBTERRANEUS SUBTERRANEUS	I	46	21/08/00	16:30	CC		2	PS	2
Della Lucia, T. M. C.	1909	MORPHOLOGICAL CHARACTERISTICS OF NESTS AND CONTROL OF ATTA SEXDENS RUBROPILOSA WITH GRANULATED BAITS IN A PLANTATION OF PINUS TAEDA, SAFAC, WANDA, MISIONES	I	481	21/08/00	16:30	CC		10	PS	10
Della Penna, A. B.	36	EFFECTS OF CHLORPYRIFOS AND TEFLUTHRIN ON LUMBRICUS TERRESTRIS	I	9	22/08/00	16:30	CC		1	PS	1
Dellapé, P. M.	3742	INMATURE STAGES OF ZELUS LEUCOGRAMMUS (HETEROPTERA: REDUVIIDAE)	II	945	22/08/00	16:30	CC		21	PS	21
Dellapé, P. M.	3745	A NEW GENUS OF ACANTHOSOMATIDAE (HETEROPTERA) AND THE INMATURE STAGES	II	945	22/08/00	16:30	CC		21	PS	21
DellaSala, D.	52	THE UNIQUE INSECT BIODIVERSITY OF THE KLAMATH/SISKIYOU MOUNTAIN REGION IN NW USA; CHALLENGES FOR INVENTORY AND CONSERVATION	I	13	24/08/00	16:30	CC		1	PS	3
Delobel, B.	1665	FOOD AND CARCASS ANALYSES OF THE PREDATORY BUG HARMONIA AXYRIDIS (COLEOPTERA: COCCINELLIDAE) AS REFERENCES FOR THE ELABORATION OF ARTIFICIAL DIETS	I	420	25/08/00	16:30	CC		8	PS	8
Deloya, C.	485	SOCIEDAD MEXICANA DE ENTOMOLOGIA, A.C.	I	123	22/08/00	16:30	CC		3	PS	3
Delpuech, J. M.	1557	SUBLETHAL EFFECTS OF INSECTICIDES ON THE BEHAVIOUR OF TWO PARASITOIDS : INFLUENCE OF INDIVIDUAL EXPERIENCE AND GENETIC VARIABILITY	I	393	22/08/00	16:30	CC		8	PS	8
Delrio, G.	3951	POPULATION DYNAMICS OF MEDFLY IN A MEDITERRANEAN AREA (SARDINIA, ITALY)	II	997	22/08/00	16:30	CC		22	PS	22
Delvare, G.	1649	BEMISIA TABACI BIOTYPE B (HEMIPTERA: ALEYRODIDAE) AND ITS PARASITOIDS: GUADELOUPE ISLAND AS A REPRESENTATIVE SITE OF THE CARIBBEAN	I	416	24/08/00	16:30	CC		8	PS	8
Demaestri, M.	1939	APPLICATION OF A GEOGRAPHICAL INFORMATION SYSTEM TO THE STUDY OF SIREX NOCTILIO (HYMENOPTERA-SIRICIDAE) IN CALAMUCHITA VALLEY, CÓRDOBA, ARGENTINA	I	489	23/08/00	16:30	CC		10	PS	10
Demarta, M.	3235	RESOURCE AVAILABILITY AND SPATIAL DISTRIBUTION OF DELPHACODES KUSCHELI (FULGOROMORPHA: DELPHACIDAE)	II	817	23/08/00	16:30	CC		17	PS	17
Denell, R.	3071	MATERNAL VS ZYGOTIC CONTRIBUTIONS TO PATTERNING THE SHORT GERM EMBRYO OF TRIBOLIUM CASTANEUM	II	775	24/08/00	11:30	HB	G	16	6	16
Deng, W.-M.	3319	OOGENESIS IN DROSOPHILA	II	838	22/08/00	16:30	CC		18	PS	18

Sub-titles: (HB=Hotel Bourbon) - (HM=Hotel Mabu) - (CC=Convention Center) - (Bol=Foz Boulevard) - (PS=Poster Session) - (PL=Plenary Lecturer)

AUTHOR	Nº	TITLE	Book	Page	Date	Time	Local	Room	Session	Symp	New Session
Denholm, I.	1284	CHALLENGES WITH MANAGING INSECTICIDE RESISTANCE IN THE APHID, MYZUS PERSICAE	I	324	25/08/00	16:05	HM	N	7	10	7
Denholm, I.	1257	THE UPTAKE OF BOTANICAL INSECTICIDES BY FARMERS: A CASE STUDY OF TOBACCO BASED PRODUCTS IN NIGERIA	I	317	24/08/00	11:20	HM	N	7	7	7
Denholm, I.	1278	COMBATING INSECTICIDE RESISTANCE: ENMARIA AND THE EUROPEAN PERSPECTIVE	I	323	25/08/00	14:35	HM	N	7	10	7
Denholm, I.	1243	INTERACTIONS BETWEEN TRANSGENIC OILSEED RAPE AND PARASITOIDS	I	314	23/08/00	10:20	HM	N	7	5	7
Denlinger, D. L.	2495	DOWNREGULATION OF ULTRASPIRACLE BUT NOT ECDYSONE RECEPTOR DURING PUPAL DIAPAUSE IN SARCOPHAGA CRASSIPALPIS	II	630	24/08/00	16:30	CC		13	PS	13
Denlinger, D. L.	3278	DIAPAUSE-SPECIFIC GENE EXPRESSION	II	828	23/08/00	9:50	HB	K	18	4	18
Dennehy, J.	3025	VARIABLE TIMING OF EGG HATCH AND ITS RELATION TO ANNUAL PRECIPITATION IN POPULATIONS OF AEDES TRISERIATUS	II	763	25/08/00	16:30	CC		15	PS	15
Dennehy, T. J.	1276	SUCCESSES AND FUTURE CHALLENGES OF MANAGING WHITEFLY RESISTANCE IN ARIZONA	I	322	25/08/00	14:05	HM	N	7	10	7
Dennehy, T. J.	1251	PINK BOLLWORM RESISTANCE TO BT COTTON	I	316	23/08/00	15:05	HM	N	7	6	7
Dennehy, T. J.	1367	PRO-ACTIVE MANAGEMENT OF BEET ARMYWORM (SPODOPTERA EXIGUA) RESISTANCE TO THE IGRS, TEBUFENOZIDE AND METHOXYFENOZIDE	I	345	24/08/00	16:30	CC		7	PS	7
Dentener, P.	2554	POSTHARVEST CONTROL OF CODLING MOTH: CHALLENGES AND RECENT ADVANCES	II	645	21/08/00	16:20	HB	B	14	2	14
Dentener, P.	2766	POSTHARVEST CONTROL OF CODLING MOTH: CHALLENGES AND RECENT ADVANCES	II	698	24/08/00	16:30	CC		14	PS	14
Dequech, S. T.	1515	REMARKS ON THE SEXUAL RATIO OF THE CAMPOLETIS FLAVICINCTA IN LABORATORIAL REARING	I	382	21/08/00	16:30	CC		8	PS	8
Deraison, C.	2490	APHIDS AND APHID PROTEASES AS NON-CONVENTIONAL TARGETS FOR PROTEASE INHIBITOR TRANSGENES USED FOR CONTROLLING PHLOEM-FDEEDING INSECTS	II	629	24/08/00	16:30	CC		13	PS	13
Deraison, C.	3952	EXAMINATION OF PROTEINASE AND PROTEINASE INHIBITOR ACTIVITIES IN THE APHID APHIS GOSSYPII	II	997	22/08/00	16:30	CC		22	PS	22
Derrick, K.	1106	FIELD BIOLOGY OF THE GLASSY-WINGED SHARPSHOOTER IN SOUTHERN CALIFORNIA	I	279	24/08/00	16:30	CC		6	PS	6
Derrick, K.	1106	FIELD BIOLOGY OF THE GLASSY-WINGED SHARPSHOOTER IN SOUTHERN CALIFORNIA	I	279	24/08/00	16:30	CC		6	PS	6
Derrick, K.	2592	MANAGEMENT STRATEGIES FOR CITRUS VARIEGATED CHLOROSIS	II	655	24/08/00	15:35	HB	B	14	7	14
Derrick, Ken	3210	MANAGEMENT STRATEGIES FOR CITRUS VARIEGATED CHLOROSIS	II	810	21/08/00	16:30	CC		17	PS	17
Derridj, S.	659	WHY METABOLITES PRESENT ON THE PLANT SURFACE HAVE TO BE CONSIDERED IN HOST SELECTION : APPLICATION TO TWO LEPIDOPTERA OVIPOSITION	I	167	22/08/00	16:30	CC		4	PS	4
Derridj, S.	2738	IDENTIFICATION WITHIN A BLEND OF THE ACTIVITY OF APPLE TREE ORGAN SURFACES METABOLITES ON CYDIA POMONELLA.(LEPIDOPTERA, TORTRICIDAE) OVIPOSITION	II	691	23/08/00	16:30	CC		14	PS	14
Descamps, L. R.	228	EFFECT OF PREVENTIVE INSECTICIDES ON SITOPHILUS SPP (COLEOPTERA: CURCULIONIDAE)	I	58	22/08/00	16:30	CC		2	PS	2
Descamps, L. R.	949	REPRODUCTION OF SITOPHILUS SPP. (COLEOPTERA: CURCULIONIDAE) ON DIFFERENT WHEAT CULTIVARS	I	240	25/08/00	16:30	CC		6	PS	6
Descamps, L. R.	1314	INSECTICIDES TOXICITY TO DIURAPHIS NOXIA (HOMOPTERA:APHIDIDAE)	I	332	21/08/00	16:30	CC		7	PS	7
Descamps, L. R.	1315	TOXICITY OF DELTAMETRIN TO A STRAIN OF TRIBOLIUM CASTANEUM (COLEOPTERA: TENEBRIONIDAE)	I	332	21/08/00	16:30	CC		7	PS	7
Descamps, L. R.	327	IMPACT OF DIURAPHIS NOXIA (HOMOPTERA: APHIDIDAE) ON WHEAT YIELD	I	83	22/08/00	16:30	CC		2	PS	2
Descamps, L. R.	1125	REPRODUCTION OF DIURAPHIS NOXIA (HOMOPTERA: APHIDIDAE) ON DIFFERENT WINTER CEREALS	I	284	25/08/00	16:30	CC		6	PS	6
Desender, K.	421	CHANGES IN CARABID POPULATIONS IN RELATION TO HISTORICAL AND RECENT FOREST ECOLOGY	I	107	24/08/00	10:05	HB	C	3	5	3
Desender, K.	2328	A POPULATION GENETIC COMPARISON OF ISOLATED POPULATIONS OF THE PHYTOPHAGOUS FOREST BEETLE PHYLLOTRETA TETRASTIGMA (COLEOPTERA: CHRYSOMELIDAE)	I	587	25/08/00	16:30	CC		12	PS	12
Desender, K.	4134	GENETIC PATTERNS IN PHYTOPHAGOUS BEETLES OF THE GALÁPAGOS ARCHIPELAGO	II	1044	25/08/00	16:20	HM	P	24	2	24
Desender, K.	1903	FOREST SOIL CLASSIFICATION BASED ON COLLEMBOLA FAUNA	I	480	22/08/00	16:30	CC		10	PS	10
Desender, K.	1813	GROUND BEETLE DIVERSITY AND ASSEMBLAGES FROM FORESTS IN FLANDERS: A BASELINE STUDY	I	457	22/08/00	16:30	CC		10	PS	3
Desender, K.	1813	GROUND BEETLE DIVERSITY AND ASSEMBLAGES FROM FORESTS IN FLANDERS: A BASELINE STUDY	I	457	22/08/00	16:30	CC		10	PS	3
Desender, K.	1880	ARCHAEOLOGICAL GROUND BEETLE ASSEMBLAGES AND RECENT FOREST FAUNA IN FLANDERS: WHAT HAVE WE LOST DURING MEDIEVAL FOREST DEGRADATION AND FRAGMENTATION?	I	474	22/08/00	16:30	CC		10	PS	3
Desender, K.	1912	BEETLES, SPIDERS AND FLIES AS BIO-INDICATORS IN FORESTS: A LARGE SCALE RESEARCH PROJECT IN FLANDERS (BELGIUM)	I	482	21/08/00	16:30	CC		10	PS	10
Desender, K.	1913	CARABID BEETLES AS MODEL ORGANISMS IN POPULATION GENETIC STUDIES ON HIGHLY FRAGMENTED TEMPERATE FORESTS (FLANDERS, BELGIUM)	I	482	21/08/00	16:30	CC		10	PS	10
Desender, K.	567	BEETLE DIVERSITY AND FOREST CHARACTERISTICS IN FLANDERS (BELGIUM)	I	143	25/08/00	16:30	CC		3	PS	3
Desender, K.	1977	DEAD WOOD AND BEETLES: A CASE STUDY IN FLANDERS (BELGIUM)	I	498	25/08/00	16:20	HB	M	10	8	10
Desender, K.	2329	GENETIC PATTERNS IN PHYTOPHAGOUS BEETLES OF THE GALÁPAGOS ARCHIPELAGO	I	588					12		12
Desmier de chenon, R.	716	EFFECT OF ORYCTES RHINOCEROS PHEROMONE (ETHYL 4-METHYLOCTANOATE) DIFFUSION RATE ON THE SIZE OF PEST CATCHES	I	181	24/08/00	16:30	CC		4	PS	4
Desmons, I.	2247	RAPID GENOME SHUFFLING BY TRANSPOSABLE ELEMENTS: WHAT CAN WE LEARN FROM CULEX PIPIENS MOSQUITOES?	I	567	21/08/00	16:30	CC		12	PS	12
Desneux, N.	1557	SUBLETHAL EFFECTS OF INSECTICIDES ON THE BEHAVIOUR OF TWO PARASITOIDS : INFLUENCE OF INDIVIDUAL EXPERIENCE AND GENETIC VARIABILITY	I	393	22/08/00	16:30	CC		8	PS	8
DeSouza, O.	2175	SELF-ORGANIZED TOLERANCE TO STRESS IN TERMITES	I	549	21/08/00	15:05	HB	L	12	2	12
DeSouza, O.	648	LOCAL DETERRENCE OF MULTIPLE ATTACKS BY THE COFFEE BERRY BORER	I	164	22/08/00	16:30	CC		4	PS	4
DeSouza, O.	1632	PREDATORS IMPAIRING PARASITOIDS IN THE NATURAL BIOLOGICAL CONTROL	I	411	24/08/00	16:30	CC		8	PS	8
DeSouza, O.	2668	THE EFECTS OF DEPTH AND DSTRIBUTION OF LQUID INSECTICIDES FOR THE CONTROL OF MOUND TERMITES IN PASTURES (INSECTA: ISOPTERA)	II	674	22/08/00	16:30	CC		14	PS	14
DeSouza, O.	1778	IS ELASMOPALPUS LIGNOSELLUS BEHAVIOR INFLUENCED BY SMOKE OF BURNED SUGAR CANE?	I	448	23/08/00	16:30	CC		9	PS	9
DeSouza, O. F.	3474	ANOMALOUS TERMITE DIVERSITY PATTERN IN HISTORICAL FRAGMENTS OF AMAZONIAN SAVANNAS	II	877	22/08/00	16:30	CC		19	PS	19
Desplan, C.	3073	BICOID AS A PHYLOGENETIC ADDITION TO THE INSECT BODY PLAN	II	775	24/08/00	14:00	HB	G	16	6	16
Desset, S.	2211	ZAM, A RETROVIRUS FROM DROSOPHILA MELANOGASTER	I	558	24/08/00	15:35	HB	L	12	8	12
Desutter-Grandcolas, L.	1737	BEHAVIORAL AND EVOLUTIONARY SIGNIFICANCE OF THE DIVERSITY OF STRIDULUMS AND CALLING SONGS IN CRICKETS	I	438	23/08/00	10:00	HB	F	9	3	9
Desutter-Grandcolas, L.	3587	CLIMATIC RELICT VERSUS ADAPTIVE SHIFT: NO MATTER, THE DIE IS CAST AFTER CAVE COLONIZATION	II	905	25/08/00	10:15	Bol	U	20	3	20
DesVignes, F.	2892	INTERACTION AMONG MULTIPLE IXODES SCAPULARIS-BORNE PATHOGENS AND THEIR HOSTS	II	730	22/08/00	15:35	Bol	R	15	4	15

Sub-titles: (HB=Hotel Bourbon) - (HM=Hotel Mabu) - (CC=Convention Center) - (Bol=Foz Boulevard) - (PS=Poster Session) - (PL=Plenary Lecturer)

AUTHOR	Nº	TITLE	Book	Page	Date	Time	Local	Room	Session	Symp	New Session
Deunff, J.	3331	MULTIPLE PATERNITY, DISPERSAL MODES AND GENETIC STRUCTURE ASSOCIATED WITH DIFFERENT REPRODUCTIVE STRATEGIES IN FORFICULA AURICULARIA (DERMAPTERA)	II	841	22/08/00	16:30	CC		18	PS	18
Deveaux, M.	2401	MORPHINE EXTRACTION IN NECROPHAGOUS INSECTS REMAINS FOR DETERMINING ANTE-MORTEM OPIATE INTOXICATION	II	607	21/08/00	16:30	CC		13	PS	13
Deveson, E. D.	142	LOCUST FORECASTING AND PREVENTIVE CONTROL IN AUSTRALIA	I	37	25/08/00	11:30	HB	A	2	9	2
Devonshire, A. L.	1231	ROLE OF ESTERASES IN RESISTANCE TO PYRETHROIDS IN LEPIDOPTERA	I	311	21/08/00	15:35	HM	N	7	2	7
Devonshire, A. L.	1332	METABOLIC RESISTANCE TO PYRETHROIDS IN AUSTRALIAN HELICOVERPA SPECIES	I	336	22/08/00	16:30	CC		7	PS	7
Devonshire, A. L.	1228	MOLECULAR STUDIES OF INSECT ACETYLCHOLINESTERASE: IS THERE NEW LIFE IN AN OLD TARGET?	I	310	21/08/00	14:05	HM	N	7	2	7
Devorshak, C.	3899	THE EFFECT OF ACCELERATED INTERNATIONAL TRADE ON PROSPECTS FOR IPM	II	984	23/08/00	15:05	HB	H	22	5	22
Devorshak, C.	3921	INTERNATIONAL HARMONIZATION OF PHYTOSANITARY MEASURES	II	990	25/08/00	16:05	HB	H	22	8	22
Devotto, L. O.	2068	USE OF ENTOMOPATHOGENIC FUNGI FOR THE CONTROL OF CALIROA CERASI	I	522	22/08/00	16:30	CC		11	PS	11
DeVries, P. J.	454	SPECIES DIVERSITY OF AMAZON RAINFOREST FRUIT-FEEDING NYMPHALID BUTTERFLIES: EFFECTS OF SPACE, TIME AND DISTURBANCE	I	115	26/08/00	14:05	HB	C	3	10	3
Dewar, A. M.	1245	UK FIELD-SCALE TRIALS OF GM HERBICIDE TOLERANT CROPS TO DETECT THE ENVIRONMENTAL EFFECTS ON INVERTEBRATE ABUNDANCE AND BIODIVERSITY	I	314	23/08/00	10:50	HM	N	7	5	7
Dewar, A. M.	930	VERTICAL-LOOKING RADAR: A POWERFUL NEW TOOL FOR MONITORING INSECT FLIGHT AT ALTITUDE	I	235	21/08/00	16:30	CC		6	PS	6
Dewar, A. M.	1212	SPATIO-TEMPORAL DYNAMICS OF AERIAL INSECT POPULATIONS EXAMINED WITH VERTICAL-LOOKING RADAR	I	305	25/08/00	16:30	CC		6	PS	6
Dewhurst, C.	867	AFRICAN ARMYWORM OUTBREAKS FROM MOZAMBIQUE TO JORDAN	I	219	26/08/00	9:35	HB	D	6	9	6
Deyn, G. de	1118	LINKING MULTITROPHIC INTERACTIONS ABOVE-BELOWGROUND	I	282	24/08/00	16:30	CC		6	PS	6
Dhadialla, T. S.	3289	PHOTOAFFINITY LABELED NON-STEROIDAL ECDYSONE AGONIST AS A TOOL TO STUDY LIGAND-ECDYSONE RECEPTOR COMPLEX INTERACTION	II	831	23/08/00	15:35	HB	K	18	5	18
Dhuyvetter, H.	4134	GENETIC PATTERNS IN PHYTOPHAGOUS BEETLES OF THE GALÁPAGOS ARCHIPELAGO	II	1044	25/08/00	16:20	HM	P	24	2	24
Dhuyvetter, H.	2329	GENETIC PATTERNS IN PHYTOPHAGOUS BEETLES OF THE GALÁPAGOS ARCHIPELAGO	I	588					12		12
Dianmo, L.	660	APHIS GROOSYPII MODEL WITH COMPLEX LIFE HISTORY	I	167	22/08/00	16:30	CC		4	PS	4
Dias Nogueira, M.	3323	BIOLOGICAL INFORMATIONS ABOUT THE DEVELOPMENT OF URBANUS ACAWOIOS (LEPIDOPTERA: HESPERIIDAE)	II	839	21/08/00	16:30	CC		18	PS	18
Dias, A. B.	2418	SURVEY OF MIDGUT ENZYMES AND MIDGUT PH IN INSECTS OF DIFFERENT ORDERS	II	611	21/08/00	16:30	CC		13	PS	13
Dias, B.	442	REGIONAL AND NATIONAL PROJECTS FOR CBD, THE OF SCIENCE	I	112	25/08/00	14:45	HB	C	3	8	3
Dias, B. F. S.	1449	BRAZILIAN LEGISLATION IN THE EXCHANGE BENEFICIAL ORGANISM/CONVENTION ON BIOLOGICAL DIVERSITY	I	366	23/08/00	9:45	HM	O	8	5	8
Dias, B. F. S.	91	THE INTERNATIONAL POLLINATORS INITIATIVE	I	24	22/08/00	9:35	HB	A	2	3	2
Dias, J. M. S. C.	1635	EVALUATION OF BIOLOGICAL CONTROL – BACILLUS SPHAERICUS 2362, EFFECTIVENESS AGAINST MALARIA VECTORS IN AMAZONIA	I	412	24/08/00	16:30	CC		8	PS	8
Dias, R.	4049	APPLICATION OF GASTIGHT STORAGE IN THE TROPICS	II	1022	24/08/00	11:15	HB	J	23	8	23
Dias, S.	299	BIONOMY OF THE BOLL WEVILL REARED ON ARTIFICIAL DIET	I	76	24/08/00	16:30	CC		2	PS	2
Dias, S. C.	2063	EFFECTS IN VITRO AND IN VIVO OF SOYBEAN KUNITZ TRYPSIN INHIBITORS AGAINST THE BOOL WEEVIL ANTHONOMUS GRANDIS	I	520	22/08/00	16:30	CC		11	PS	11
Dias, S. C.	2119	CHARACTERIZATION OF THE PROTEOLYTIC ACTIVITY OF ANTHONOMUS GRANDIS AND ISOLATION OF CDNAS ENCODING SERINE AND CYSTEINE PROTEASES	I	534	24/08/00	16:30	CC		11	PS	11
Dias, T. S.	1489	BEHAVIOR OF TRICHOGRAMMA PRETIOSUM (HYMENOPTERA: TRICHOGRAMMATIDAE) IN SPODOPTERA FRUGIPERDA (LEPIDOPTERA: NOCTUIDAE) EGG-MASSES	I	376	21/08/00	16:30	CC		8	PS	8
Díaz S., J. E.	2768	INTRODUCTION AND REARING OF PHYTOMYZA OROBANCHIA AS PART OF AN INTEGRATED PEST MANAGEMENT PROGRAM ON BROOMRAPE	II	699	24/08/00	16:30	CC		14	PS	14
Díaz, F. A.	486	THE VENEZUELAN SPECIES OF POEMENIINAE, LYCORININAE AND XORIDINAE (HYMENOPTERA: ICHNEUMONIDAE)	I	123	22/08/00	16:30	CC		3	PS	3
Díaz, F. A.	487	SPECIES OF OPHIONINAE (HYMENOPTERA:ICHNEUMONIDAE) FROM THE ANDEAN AND CENTRAL WESTERN REGIONS OF VENEZUELA	I	123	22/08/00	16:30	CC		3	PS	3
Díaz, F. A.	888	SOME BIOLOGICAL AND ECOLOGICAL ASPECTS OF PSEUDODOROS CLAVATUS (DIPTERA:SYRPHIDAE)	I	224	21/08/00	16:30	CC		6	PS	6
Díaz, F. A.	3714	GENERA OF ANOMALONINAE (HYMENOPTERA: ICHNEUMONIDAE) FROM VENEZUELA	II	938	23/	16:30	CC		21	PS	21
Diaz, N.	488	BIODIVERSITY OF CYNIPOIDEA FROM BRAZIL (HYMENOPTERA).	I	124	22/08/00	16:30	CC		3	PS	3
Diaz, N. B.	1571	THE TYPES OF ENCYRTIDAE (HYMENOPTERA, CHALCIDOIDEA) HOUSED IN THE MUSEO DE LA PLATA	I	396	23/08/00	16:30	CC		8	PS	8
Díaz, N. B.	1764	DOES THE FRUIT SIZE INFLUENCE THE PARASITISM OF FRUGIVOROUS LARVAE BY EUCOILINAE SPECIES?	I	444	22/08/00	16:30	CC		9	PS	8
Díaz, N. B.	3444	GEOGRAPHIC RANGE OF THE SPECIES OF BOMBUS LATREILLE (HYMENOPTERA, APIDAE) IN ARGENTINA	II	869	21/08/00	16:30	CC		19	PS	19
Díaz, N. B.	3128	COMPARATIVE STUDY OF MALE'S GENITALS STRUCTURES IN PSEUDOCENTRON SPECIES (HYMENOPTERA: MEGACHILIDAE)	II	789	22/08/00	16:30	CC		16	PS	16
Diaz-Gomez, *	1316	RESPONSE OF PLUTELLA XYLOSTELLA (LEPIDOPTERA: PLUTELLIDAE) TO THE SELECTION WITH BACILLUS THURINGIENSIS	I	332	22/08/00	16:30	CC		7	PS	7
Dicke, M.	1420	PLANTS CRY FOR HELP: DO PLANT BREEDERS AND BIOCONTROL COMPANIES LISTEN?	I	358	21/08/00	10:20	HM	O	8	1	8
Dicke, M.	1516	DIET OF GENERALIST PREDATOR AFFECTS AVOIDANCE BEHAVIOUR OF PREY	I	382	21/08/00	16:30	CC		8	PS	8
Dicke, M.	4138	INSECTS IN WESTERN ART	II	1045	21/08/00	16:30	CC		24	PS	24
Dicke, M.	1209	WHY DO DROSOPHILIDS PRODUCE AGGREGATION PHEROMONES WHEN IT GUIDES PARASITOIDS TO THEIR OFFSPRING?	I	305	25/08/00	16:30	CC		6	PS	6
Dickinson, M. H.	3064	THE AERODYNAMICS AND NEUROBIOLOGY OF FLIGHT CONTROL	II	773	23/08/00	15:35	HB	G	16	5	16
Dickler, E.	2017	FUTURE TRENDS IN CODLING MOTH CONTROL IN INTEGRATED FRUIT PRODUCTION WITH PARTICULAR EMPHASIS ON GRANULOVIRUS	I	509	24/08/00	9:35	HM	P	11	7	11
Didham, R.K.	3578	HOST PHYLOGENETIC TRAITS AS DETERMINANTS OF TEMPORAL VARIATION IN CANOPY ARTHROPOD ASSEMBLAGES	II	903	24/08/00	10:35	Bol	U	20	2	20
Diefenbach, L. M. G.	1024	POPULATION DYNAMICS OF COSMOCLOPIUS NIGROANNULATUS (HEMIPTERA, REDUVIIDAE) IN NICOTIANA TABACUM	I	258	23/08/00	16:30	CC		6	PS	6
Diefenbach, L.M. G.	3176	DESCRIPTION OF INTERNAL REPRODUCTIVE ORGANS OF COSMOCLOPIUS NIGROANNULATUS (HEMIPTERA, REDUVIIDAE)	II	801	24/08/00	16:30	CC		16	PS	16
Diehl, P. A.	2	COLD RECEPTORS ON THE BODY SURFACE OF THE TROPICAL BONT TICK AMBLYOMMA VARIEGATUM	I	1	24/08/00	14:05	HB	F	1	1	1
Diehl-Fleig, E.	2245	ABSENCE OF GENIC VARIABILITY FOR SIX ENZYME SYSTEMS IN MYCETOPHYLAX SP. (HYMENOPTERA, FORMICIDAE)	I	567	21/08/00	16:30	CC		12	PS	12
Diehl-Fleig, E.	3478	EPIGEIC ANT FAUNA OF AREAS WITH HIGH COPPER CONCENTRATION	II	878	22/08/00	16:30	CC		19	PS	19
Diehl-Fleig, Ed.	2245	ABSENCE OF GENIC VARIABILITY FOR SIX ENZYME SYSTEMS IN MYCETOPHYLAX SP. (HYMENOPTERA, FORMICIDAE)	I	567	21/08/00	16:30	CC		12	PS	12
Diehl-Fleig, Ed.	3478	EPIGEIC ANT FAUNA OF AREAS WITH HIGH COPPER CONCENTRATION	II	878	22/08/00	16:30	CC		19	PS	19

Sub-titles: (HB=Hotel Bourbon) - (HM=Hotel Mabu) - (CC=Convention Center) - (Bol=Foz Boulevard) - (PS=Poster Session) - (PL=Plenary Lecturer)

AUTHOR	Nº	TITLE	Book	Page	Date	Time	Local	Room	Session	Symp	New Session
Dietz, F.K.	1225	SPINOSAD: PROPERTIES OF A SUCCESSFUL REDUCED RISK INSECT CONTROL PRODUCT	I	309	21/08/00	11:05	HM	N	7	I	7
Diez, P. A.	1517	PRELIMINARY EVALUATION OF AGENIASPIS CITRICOLA (HYM: ENCYRTIDAE) ATTACKING PHYLLOCNISTIS CITRELLA (CITRUS LEAFMINER) IN ARGENTINA	I	383	21/08/00	16:30	CC		8	PS	8
Diez-Rodríguez, G. I.	1317	INHERITANCE AND FITNESS COST OF RESISTANCE TO LAMBDA-CYHALOTHRIN IN SPODOPTERA FRUGIPERDA (LEPIDOPTERA: NOCTUIDAE)	I	332	22/08/00	16:30	CC		7	PS	7
Digiani, M. C.	4139	FIRST RECORD OF BELOSTOMATIDAE AS INTERMEDIATE HOSTS OF DIGENETIC TREMATODES	II	1045	21/08/00	16:30	CC		24	PS	24
Digilio, M. C.	1427	REARING HYMENOPTEROUS LARVAL PARASITOIDS OF APHIDS ON ARTIFICIAL DIETS	I	360	21/08/00	13:50	HM	O	8	2	8
Dillon, M. L.	146	HELICOVERPA LOCAL MOVEMENT AND RESISTANCE MANAGEMENT STRATEGIES FOR TRANSGENIC COTTON: STUDIES WITH A SPATIALLY EXPLICIT METAPOPULATION MODEL	I	38	25/08/00	14:00	HB	A	2	9	2
Dillon, M. L.	126	CROPPING PATTERNS. A LANDSCAPE PERSPECTIVE OF CULTURAL CONTROL	I	33	24/08/00	10:30	HB	A	2	7	2
Dillon, M. L.	2663	THE ECOLOGY AND MANAGEMENT OF HELICOVERPA ARMIGERA IN SOUTHERN NSW, AUSTRALIA	II	673	22/08/00	16:30	CC		14	PS	14
Dimitrijevic, B.	229	DAMAGE LEVEL EFFECT TO A NUMBER OF GRAINS PER SPIKE AND WEIGHT PER HEAD CAUSED BY CEREAL LEAF BEETLE (CLB) OF WHEAT AND BARLEY	I	58	22/08/00	16:30	CC		2	PS	2
Dimopoulos, G.	2914	MOSQUITO – PARASITE INTERACTIONS: MOLECULAR DISSECTION OF INNATE IMMUNE RESPONSES TO MALARIA INFECTION	II	735	24/08/00	13:35	Bol	R	15	8	15
Dingle, H.	810	A FRAMEWORK FOR INSECT MIGRATION STUDIES – AND SOME RECENT ADVANCES	I	205	24/08/00	9:35	HB	F	6	3	6
Dingle, H.	810	A FRAMEWORK FOR INSECT MIGRATION STUDIES – AND SOME RECENT ADVANCES	I	205	24/08/00	9:35	HB	F	6	3	6
Diniz, I. R.	1878	RICHNESS AND ABUNDANCE OF CATERPILLARS ON CONGENERIC PLANTS IN CERRADO AREAS OF THE DISTRITO FEDERAL	I	473	25/08/00	15:35	HB	M	10	8	10
Diniz, I. R.	1074	CATERPILLARS ASSOCIATED WITH THE REPRODUCTIVE STRUCTURES OF PLANTS IN THE CERRADO	I	271	23/08/00	16:30	CC		6	PS	6
Diniz, I. R.	4166	THE SCARABAEINAE FAUNA (COLEOPTERA: SCARABAEDAE) OF THE CERRADO OF BRASÍLIA, DF, BRAZIL	II	1052	21/08/00	16:30	CC		Erratum	PS	6
Diniz, I. R.	505	COMPARISON OF CARYOCAR BRASILIENSE CATERPILLAR FAUNA IN TWO CERRADO AREAS OF THE DISTRITO FEDERAL, BRAZIL	I	128	22/08/00	16:30	CC		3	PS	3
Diniz, I. R.	950	RICHNESS AND ABUNDANCE OF LEPIDOPTERAN CATERPILLARS ASSOCIATED WITH CERRADO PLANTS	I	240	22/08/00	16:30	CC		6	PS	6
Diniz, I. R.	951	PATTERNS OF INSECT ABUNDANCE IN THE CERRADO OF BRASÍLIA AND THE EFFECT OF CLIMATE	I	240	22/08/00	16:30	CC		6	PS	6
Diodato, L.	1914	VARIATIONS IN THE SPECIES COMPOSITION OF CURCULIONOIDEA IN NATURAL AND PLANTED FORESTS OF CENTRAL SPAIN	I	482	21/08/00	16:30	CC		10	PS	10
Diodato, M. A.	2620	USE OF THIAMETHOXIAM IN THE OF CONTROL PINNASPIS ASPIDISTRAE (HOMOPTERA:STERNORHYNCHA) AND ITS ON THE POPULATION OF NATIVE PARASITOIDES IN CITRUS SPP., IN ARARUAMA CITY, RJ, BRAZIL	II	662	21/08/00	16:30	CC		14	PS	14
Diodato, M. A.	2645	CONTROL OF PHYLLOCNISTIS CITRELLA (LEPIDOPTERA, GRACILLARIIDAE) BY THIAMETHOXAM IN CITRUS IN ARARUAMA CITY–RJ	II	668	21/08/00	16:30	CC		14	PS	14
Diodato, M. A.	2646	USE OF THIAMETHOXAM IN THE CONTROL DE SELENASPIDUS ARTICULATUS (HOMOPTERA:DIASPIDIDAE) AND EFFECT ON THE POPULATION OF THEIR NATIVE PREDATORS IN CITRUS IN SÃO VICENTE DE PAULO (ARARUAMA, RJ), BRAZIL	II	668	21/08/00	16:30	CC		14	PS	14
Diodato, M. A.	2824	EFFECT OF THIAMETHOXAM ON THE POPULATION OF COCCUS VIRIDIS (HOMOPTERA:COCCIDAE) IN CITURS PLANTS IN ARARUAMA CITY, RJ, BRAZIL	II	713	25/08/00	16:30	CC		14	PS	14
Diogo, A. C.	952	PHYLOGEOGRAPHY AND ECOLOGICAL DIVERSIFICATION OF CICINDELA LUSITANICA (CICINDELIDAE: COLEOPTERA)	I	240	22/08/00	16:30	CC		6	PS	6
Diogo, A. C.	2500	NEW STRIDULATORY STRUCTURES IN A TIGER BEETLE (COLEOPTERA, CICINDELIDAE): MORPHOLOGY AND SOUND CHARACTERIZATION	II	631	24/08/00	16:30	CC		13	PS	13
Diogo, A. S.	3479	MAINTENANCE OF SECONDARY NEST OF COPTOTERMES HAVILANDI IN LABORATORY	II	878	22/08/00	16:30	CC		19	PS	19
Diogo, A. S.	3504	ADAPTATION OF THE SUBTERRANEAN TERMITE COPTOTERMES HAVILANDI (ISOPTERA: RHINOTERMITIDAE) TO THE INTERIOR OF BRAZIL	II	884	22/08/00	16:30	CC		19	PS	19
Diogo, A. S.	4113	CONTROL OF NASUTITERMES SP. IN A HISTORICAL PATRIMONY IN THE CONTRYSIDE OF RIO DE JANEIRO	II	1038	24/08/00	16:30	CC		23	PS	23
Diogo, A. S.	4114	CONTROL OF NASUTITERMES SP. ATTACKING A STORE OF FABRICS IN THE COUNTRYSIDE OF RIO DE JANEIRO STATE	II	1039	25/08/00	16:30	CC		23	PS	23
Diogo, A. S.	4089	OCCURRENCE OF RHINOTERMES MARGINALIS(ISOPTERA: RHINOTERMITIDAE) IN URBAN AREAS OF RIO DE JANEIRO CITY	II	1032	24/08/00	16:30	CC		23	PS	23
Dirzo, R.	808	CONSEQUENCES OF MAMMALIAN HERBIVORY ON MULTITHROPHIC INTERACTIONS: INSECTS, PLANTS AND NATURAL ENEMIES	I	204	21/08/00	16:30	CC		6	PS	6
Dively, G. P.	953	DEPOSITION OF CORN POLLEN ON MILKWEED AND EXPOSURE RISK TO MONARCH BUTTERFLY LARVAE.	I	241	22/08/00	16:30	CC		6	PS	6
Dively, G. P.	1354	TIMING INSECTICIDE APPLICATIONS FOR DUSKY SAP BEETLE (COLEOPTERA: NITIDULIDAE) CONTROL IN BT SWEET CORN.	I	342	23/08/00	16:30	CC		7	PS	7
Dixon, A. F.	690	BIOCHEMICAL ADAPTATION OF BIRD CHERRY-OAT APHID TO PLANT PHENOLICS	I	174	23/08/00	16:30	CC		4	PS	4
Dixon, A. F. G.	2716	DEVELOPMENTAL RATE ISOMORPHY IN INSECTS AND MITES	II	686	23/08/00	16:30	CC		14	PS	14
Dixon, A.F.G.	858	WHEN AND WHY TOP-DOWN REGULATION FAILS	I	217	25/08/00	11:05	HB	D	6	7	6
Doberlet, M.V.	582	MATE RECOGNITION IN NEZARA VIRIDULA (HETEROPTERA, PENTATOMIDAE): A MATTER OF SONGS AND PHEROMONES	I	147	22/08/00	9:35	Bol	S	4	2	4
Dockx, C.	954	MIGRATION OF NORTH AMERICA MONARCHS, DANAUS PLEXIPPUS, TO CUBA	I	241	22/08/00	16:30	CC		6	PS	6
Dodo, S.	1841	TEBUFENOZIDE: AN EFFECTIVE AND SELECTIVE CONTROL AGENT FOR CATERPILLAR PESTS IN FORESTRY	I	464	23/08/00	11:05	HB	M	10	4	10
Doerr, M.	120	SELECTIVE USE OF PARTICLE FILM TECHNOLOGY IN WASHINGTON POME FRUIT PEST MANAGEMENT	I	31	23/08/00	15:50	HB	A	2	6	2
Doetzer, A K.	1518	DEVELOPMENT, SURVIVAL AND REPRODUCTION OF TRISSOLCUS BASALIS AND TELENOMUS PODISI (HYMENOPTERA: SCELIONIDAE) REARED IN GREENHOUSE IN SOUTHERN PARANÁ STATE, BRAZIL	I	383	21/08/00	16:30	CC		8	PS	8
Doetzer, A K.	1519	COLD STORAGE OF IMMATURE STAGES OF TRISSOLCUS BASALIS AND TELENOMUS PODISI (HYMENOPTERA: SCELIONIDAE): EFFECT ON DEVELOPMENT, ADULT LONGEVITY AND REPRODUCTION	I	383	21/08/00	16:30	CC		8	PS	8
Dolch, R.	3596	COMMUNITIES OF POD-INHABITING INSECTS IN MADAGASCAR: PATTERNS OF SPECIES RICHNESS, SPATIAL RESOURCE FRAGMENTATION, AND TROPICAL-TEMPERATE COMPARISONS.	II	907	22/08/00	16:30	CC		20	PS	20
Dolci, M.	4065	THE HISTORY OF THE INSECTICIDE FENOXYCARB IN ITALY	II	1026	21/08/00	16:30	CC		23	PS	23
Dolder, H.	2462	APYRENE AND EUPYRENE SPERMATOZOA IN THE SEMINAL VESICLE OF EUPTOIETA HEGESIA (LEPIDOPTERA: NYMPHALIDAE)	II	622	23/08/00	16:30	CC		13	PS	13
Dolder, H.	3093	ORGANELLE MODIFICATION DURING INSECT SPERMIOGENESIS.	II	780	26/08/00	10:25	HB	G	16	9	16
Dolder, H.	3153	STRUCTURAL AND ULTRASTRUCTURAL OBSERVATIONS OF SPERM OF TWO SPECIES OF PARASITOIDS (HYMENOPTERA: EULOPHIDAE)	II	795	23/08/00	16:30	CC		16	PS	16
Dolder, M. A. H.	3201	CHARACTERISTICS OF SPERMATOZOA OF A STINGLESS BEE MELIPONA MARGINATA (HYMENOPTERA: APIDAE: MELLIPONINI)	II	807	25/08/00	16:30	CC		16	PS	16

Sub-titles: (HB=Hotel Bourbon) - (HM=Hotel Mabu) - (CC=Convention Center) - (Bol=Foz Boulevard) - (PS=Poster Session) - (PL=Plenary Lecturer)

AUTHOR	Nº	TITLE	Book	Page	Date	Time	Local	Room	Session	Symp	New Session
Domenico, M. Di	3116	FLUCTUATING ASYMMETRY, MATING SUCCESS, BODY SIZE AND HETEROZYGOSITY IN MALES OF COENAGRION SCITULUM (ODONATA: COENAGRIONIDAE)	II	786	21/08/00	16:30	CC		16	PS	16
Domínguez, E.	495	STRUCTURE AND DIVERSITY OF STREAM INSECT ASSEMBLAGES APPLIED TO ASSESSMENT: THE LULES RIVER (TUCUMAN, ARGENTINA)	I	125	22/08/00	16:30	CC		3	PS	3
Dominguez, M. C.	3603	VARIATIONS IN GROUND-DWELLING ARTHROPOD COMMUNITIES IN GRAZED AND PROTECTED AREAS IN THE DESERT OF MENDOZA (ARGENTINA)	II	909	23/08/00	16:30	CC		20	PS	20
Dominiak, B.	2337	TRACKING AUSTRALIAN FRUIT FLIES USING MICROSATELLITES	I	590	25/08/00	16:30	CC		12	PS	12
Donahaye, E.	4049	APPLICATION OF GASTIGHT STORAGE IN THE TROPICS	II	1022	24/08/00	11:15	HB	J	23	8	23
Donato, M.	3752	REVISION OF THE GENUS METALEPTEA (ORTHOPTERA; ACRIDIDAE; HYALOPTERYGINI)	II	947	22/08/00	16:30	CC		21	PS	21
Donato, M.	489	HISTORICAL BIOGEOGRAPHY OF THE SOUTH AMERICAN RHYTIRRHININI (COLEOPTERA; CURCULIONIDAE)	I	124	22/08/00	16:30	CC		3	PS	3
Donato, M.	526	A COMPARISON BETWEEN RECONCILIATED TREES, DISPERSE-VICARIANCE AND PARALOGY FREE BIOGEOGRAPHIC SCHEMES	I	133	23/08/00	16:30	CC		3	PS	3
Donato, M.	3825	TAXONOMIC DISTINCTNESS, ENDEMICITY, AND COMPLEMENTARITY: NEW CLUES TO DEFINE PRIORITIES FOR CONSERVATION IN SOUTHERN SOUTH AMERICA	II	965	24/08/00	16:30	CC		21	PS	21
Donatti, L.	3139	COMPARATIVE MORPHOLOGY OF IMMATURE STAGES OF NOCTILIOSTREBLA AITKENI AND PARADYSCHIRIA FUSCA (DIPTERA: STREBLIDAE)	II	792	22/08/00	16:30	CC		16	PS	16
Dong, K.	1229	SODIUM CHANNEL MUTATIONS AND PYRETHROID RESISTANCE	I	310	21/08/00	14:35	HM	N	7	2	7
Dong, Y.	4048	THE INFORMATION OF URBAN MEDICAL INSECTS MANAGEMENT SYSTEM	II	1022	24/08/00	11:00	HB	J	23	8	23
Dong, Y.	2921	STUDIES ON THE POSSIBILITY OF TRANSMISSION OF DENGUE VIRUS BY CULEX PIPIENS QUINQUEFASCIATUS IN LABORATORY	II	737	25/08/00	9:50	Bol	R	15	9	15
Dong, Y.	2920	STUDIES OF WOLBACHIA IN CULEX PIPIENS COMPLEX IN CHINA	II	737	25/08/00	9:35	Bol	R	15	9	15
Donini, A.	3253	MULTIPLE PEPTIDE FAMILIES ARE INVOLVED IN THE NEURAL CONTROL OF REPRODUCTIVE TISSUES OF THE FEMALE LOCUST	II	822	21/08/00	11:05	HB	K	18	1	18
Donkai, N.	3503	CHEMICAL STRUCTURE AND PROPERTIES OF SILK PROTEINS PRODUCED BY THE SILKWORMS REARED UNDER ARTIFICIAL DIET/ASEPTIC CONDITIONS	II	884	23/08/00	16:30	CC		19	PS	19
Donly, C.	2461	A HIGH-AFFINITY OCTOPAMINE/TYRAMINE TRANSPORTER CLONED FROM THE INSECT CENTRAL NERVOUS SYSTEM	II	622	23/08/00	16:30	CC		13	PS	13
Donnellan, S. C.	2942	IDENTIFICATION OF FORENSICALLY-IMPORTANT AUSTRALIAN BLOWFLIES	II	742	26/08/00	10:20	Bol	R	15	11	15
Donnelly, C. A.	3995	INSECT POPULATION CONTROL USING A DOMINANT, REPRESSIBLE, LETHAL GENETIC SYSTEM	II	1008	25/08/00	16:30	CC		22	PS	22
Donnelly-Doman, M.	2390	THE MOSQUITO PERITROPHIC MATRIX	II	604	26/08/00	11:05	HB	I	13	10	13
Doodeman, G. T. A	1118	LINKING MULTITROPHIC INTERACTIONS ABOVE-BELOWGROUND	I	282	24/08/00	16:30	CC		6	PS	6
Dorado, F. R.	3997	AN EXPERIMENTAL COURSE ON INSECTS IN A MEDITERRANEAN SECONDARY SCHOOL	II	1009	25/08/00	16:30	CC		22	PS	22
Dória, H. O. S.	2419	EVALUATION OF VELVETBEEN CATERPILLAR SUSCEPTIBILITY TO ETANOLIC EXTRACTS ISOLATED FROM SEEDS OF CRYPTOCARIA MOSCHATA	II	611	21/08/00	16:30	CC		13	PS	13
Dória, H. O. S.	955	GREEN LACEWINGS OCCURENCE ON WEEDS IN CROP CORN	I	241	22/08/00	16:30	CC		6	PS	6
Dória, H. O. S.	1479	HOST SPECIES AND AGE SELECTION BY TRICHOGRAMMA PRETIOSUM IN GREEN LACEWING SPECIES	I	373	21/08/00	16:30	CC		8	PS	8
Dória, H. O. S.	2426	TROUBLES ABOUT THE USAGE OF ANGOUMOIS GRAIN MOTH EGGS TO FEEDING CHRYSOPID LARVAE	II	613	22/08/00	16:30	CC		13	PS	13
Dória, H. O. S.	1524	ACARICIDES SELETIVITY EVALUATION ON CHRYSOPERLA EXTERNA (NEUROPTERA: CHRYSOPIDAE)	I	384	23/08/00	16:30	CC		8	PS	8
Dorn, A.	2444	PSEUDOTUMORS IN THE STICK INSECT (CARAUSIUS MOROSUS) - A MODEL SYSTEM TO STUDY REGULATION OF THE MAINTENANCE OF TISSUE DIFFERENTIATION	II	617	22/08/00	16:30	CC		13	PS	13
Dorn, A.	3092	TESTIS DIFFERENTIATION - ROLE OF APICAL COMPLEX	II	780	26/08/00	10:00	HB	G	16	9	16
Dorn, S.	2547	CODLING MOTH BEHAVIOR AND ECOLOGY: RECENT FINDINGS	II	644	21/08/00	14:20	HB	B	14	2	14
Dorn, S.	1542	CONSEQUENCES OF INBREEDING AND HYBRIDIZATION IN THE GREGARIOUS PARASITOID COTESIA GLOMERATA	I	389	22/08/00	16:30	CC		8	PS	8
Dornelles, S. H. B.	1755	BEHAVIOR OF HEDYPATHES BETULINUS (COL., CERAMBYCIDAE) ON ILEX PARAGUARIENSIS	I	442	21/08/00	16:30	CC		9	PS	9
Dorosh, S.	750	SIMULATION OF INSECT MOVEMENT WITH RESPECT TO PLANT ARCHITECTURE AND MORPHOGENESIS	I	189	21/08/00	13:50	Bol	T	5	1	5
Dossou, C.	3855	NOT ALL SCIOMYZIDAE KILL MOLLUSKS : SEPEDONELLA NANA EATS WORMS	II	973	25/08/00	16:30	CC		21	PS	21
Dotson, E. M.	2895	BACTERIAL SYMBIONTS AND THE CONTROL OF CHAGAS DISEASE	II	731	23/08/00	9:35	Bol	R	15	5	15
Doucet, D.	3283	WHEN YOU CAN'T FLY TO BRAZIL: SURVIVING WINTER WITH ANTIFREEZE PROTEIN GENES	II	829	23/08/00	11:05	HB	K	18	4	18
Douglas, A. E.	902	IMPACT OF THE GENOTYPE OF A SYMBIOTIC BACTERIA ON THE FITNESS OF A PHYTOPHAGOUS INSECT	I	228	21/08/00	16:30	CC		6	PS	6
Doukas, D.	2613	THE EFFECTS OF CITRUS LEAF MINER INFESTATIONS IN CITRUS GROVES	II	660	21/08/00	16:30	CC		14	PS	14
Douroupi, T.	3656	HISTOCHEMICAL AND MOLECULAR EVIDENCE OF PEROXIDASE ACTIVITY IN SEGESTIDEA NOVAGUINEAE (ORTHOPTERA) AND STICHOTREMA DALLATORREANUM (STREPSIPTERA)	II	923	23/08/00	16:20	HB	E	21	5	21
Dow, J. T.	2379	MIDGUT SYSTEM: TRANSPORT MECHANISMS	II	601	25/08/00	10:35	HB	I	13	8	13
Dowell, F. E.	4020	NEAR-INFRARED SPECTROSCOPY APPLIED TO DETECTING PARASITOIDS AND HIDDEN INSECT LARVAE, IDENTIFYING COLEOPTERA, AND CHRONOLOGICAL AGE-GRADING	II	1015	22/08/00	11:00	HB	J	23	3	23
Downard, P.	1272	A GLOBAL PERSPECTIVE ON THE BIOLOGY AND FIELD PERFORMANCE OF SPINOSAD	I	321	25/08/00	11:05	HM	N	7	9	7
Drake, V. A.	744	AUTOMATICALLY OPERATING RADARS FOR MONITORING INSECT PEST MIGRATIONS	I	188	21/08/00	9:55	Bol	T	5	1	5
Drake, V. A.	784	INVESTIGATING THE WINGBEAT SIGNALS OF MIGRATING INSECTS USING AN INSECT MONITORING RADAR	I	198	21/08/00	16:30	CC		5	PS	5
Drake, V. A.	794	REPRESENTATION AND DISSEMINATION OF MIGRATION DATA FROM AUTOMATIC INSECT MONITORING RADARS	I	200	21/08/00	16:30	CC		5	PS	5
Drake, V. A.	813	INSECT MIGRATION AND POPULATION PROCESSES IN INLAND AUSTRALIA OBSERVED WITH MONITORING RADARS	I	206	24/08/00	10:25	HB	F	6	3	6
Drake, V. A.	813	INSECT MIGRATION AND POPULATION PROCESSES IN INLAND AUSTRALIA OBSERVED WITH MONITORING RADARS	I	206	24/08/00	10:25	HB	F	6	3	6
Dransfield, L.	2280	IDENTIFICATION OF TEPHRITID FRUIT FLIES USING rRNA GENES	I	575	23/08/00	16:30	CC		12	PS	12
Drew, R. A. I.	230	ANNIHILATION OF FOUR FRUIT FLY PEST SPECIES ON THE PACIFIC ISLAND OF NAURU USING FIPRONIL IN PASSIVE BAITING SYSTEMS	I	59	22/08/00	16:30	CC		2	PS	2
Drinkwater, T. W.	1318	BIOASSAY TO COMPARE THE SYSTEMIC ACTIVITY OF THREE NEONICOTINOIDS FOR CONTROL OF HETERONYCHUS ARATOR (COLEOPTERA: SCARABAEIDAE), IN MAIZE	I	333	22/08/00	16:30	CC		7	PS	7
Driver, F.	2157	PHYLOGENY OF PAECILOMYCES SPECIES REVEALED BY ANALYSIS OF RIBOSOMAL RNA ITS SEQUENCES	I	544	25/08/00	16:30	CC		11	PS	11
Driver, F.	2280	IDENTIFICATION OF TEPHRITID FRUIT FLIES USING rRNA GENES	I	575	23/08/00	16:30	CC		12	PS	12
Driver, F.	104	IPM OF BEMISIA TABACI IN AUSTRALASIA	I	27	22/08/00	15:30	HB	A	2	4	2
Driver, F.	2156	PHYLOGENY OF PAECILOMYCES SPECIES REVEALED BY ANALYSIS OF RIBOSOMAL RNA ITS SEQUENCES	I	544	25/08/00	16:30	CC		11	PS	11
Drugmand, , D.	567	BEETLE DIVERSITY AND FOREST CHARACTERISTICS IN FLANDERS (BELGIUM)	I	143	25/08/00	16:30	CC		3	PS	3

Sub-titles: (HB=Hotel Bourbon) - (HM=Hotel Mabu) - (CC=Convention Center) - (Bol=Foz Boulevard) - (PS=Poster Session) - (PL=Plenary Lecturer)

AUTHOR	Nº	TITLE	Book	Page	Date	Time	Local	Room	Session	Symp	New Session
Drummond, F. A.	2640	SELECTIVITY OF INSECTICIDES USED IN CHRYSANTEMUS PEST CONTROL TO ORIUS INSIDIOSUS	II	667	21/08/00	16:30	CC		14	PS	14
Du, J. W.	2651	SUSCEPTIBILITY OF LIRIOMYZA SATIVAE (DIPTERA: AGROMYZIDAE) TO GREEN LEGUMOUS LEAF	II	670	21/08/00	16:30	CC		14	PS	14
Du, M.	1572	HOW THE EFFICIENCY OF A PREDATOR VARIES WITH RICE VARIETY: FORAGING BEHAVIOR, POPULATION INCREASE AND FUNCTIONAL RESPONSE +B201	I	396	23/08/00	16:30	CC		8	PS	8
Duarte Aguilar, J. A.	956	BIOLOGICAL ASPECTS, POPULATION DENSITY, DAMAGE RATE AND BEHAVIOR OF THE FRUIT-BORER, CONOTRACHELUS SP. (COLEOPTERA: CURCULIONIDAE) ON CUPUAÇU TREE (THEOBROMA GRANDIFLORUM SCHUM.) IN AMAZONIAN REGION, BRAZIL	I	241	22/08/00	16:30	CC		6	PS	6
Duarte Aguilar, J. A.	3324	REPRODUCTIVE CAPACITY OF DIACHASMIMORPHA LONGICAUDATA (HYMENOPTERA: BRACONIDAE) BY FACULTATIVE ARRHENOTOKY PARTHENOGESIS REARED ON PRE-PUPAE OF CERATITIS CAPITATA (DIPTERA: TEPHRITIDAE)	II	839	21/08/00	16:30	CC		18	PS	18
Duarte, M.	3126	LIFE HISTORY AND MORPHOLOGY OF THE IMMATURE STAGES OF THE HAIRSTREAK BUTTERFLY "THECLA" CISSUSA (LEPIDOPTERA, LYCAENIDAE, THECLINAE)	II	789	22/08/00	16:30	CC		16	PS	16
Dubrovsky, A.	2075	DIFFERENTIAL TRANSMISSION OF ZUCCHINI YELLOW MOSAIC VIRUS AND TURNIP MOSAIC MOSAIC VIRUS BY MYZUS PERISCAE AND BREVICORYNE BRASSICAE	I	523	22/08/00	16:30	CC		11	PS	11
Duckett, C. N.	4124	PHYLOGENIES OF THE OEDIONYCHINA	II	1042	25/08/00	11:00	HM	P	24	2	24
Dudley, R.	3060	THE BIOMECHANICS AND FUNCTIONAL DIVERSITY OF FLIGHT	II	772	23/08/00	13:35	HB	G	16	5	16
Dudley, R.	814	INVESTIGATING OPTIMAL MIGRATION STRATEGIES IN BUTTERFLIES: THE USE OF LOCAL AND CELESTIAL CUES TO ADJUST COURSE AND FLIGHT SPEED	I	206	24/08/00	10:45	HB	F	6	3	6
Dudley, R.	814	INVESTIGATING OPTIMAL MIGRATION STRATEGIES IN BUTTERFLIES: THE USE OF LOCAL AND CELESTIAL CUES TO ADJUST COURSE AND FLIGHT SPEED	I	206	24/08/00	10:45	HB	F	6	3	6
Dudley, R.	3062	FLIGHT RESPIRATION AND ENERGETICS	II	773	23/08/00	14:35	HB	G	16	5	16
Dufault, R. J.	350	WHITEFLIES (HOMOPTERA: ALEYRODIDAE) ON SPECIES OF MEDICINAL HERBAL PLANTS	I	89	25/08/00	16:30	CC		2	PS	2
Duffels, J. P.	467	CICADA BIOGEOGRAPHY AND WALLACE'S LINE, DO CICADAS SING A DIFFERENT SONG?	I	118	21/08/00	16:30	CC		3	PS	3
Duffield, S. J.	2663	THE ECOLOGY AND MANAGEMENT OF HELICOVERPA ARMIGERA IN SOUTHERN NSW, AUSTRALIA	II	673	22/08/00	16:30	CC		14	PS	14
Dufrêne, M.	490	EVALUATION OF ECOLOGICAL NETWORK QUALITY FOR BUTTERFLY INDICATOR SPECIES BY COMPARISON OF OBSERVED POPULATION DENSITY AND PREDICTED DENSITY FROM BOTANICAL RELEVÉS	I	124	22/08/00	16:30	CC		3	PS	3
Dughetti, A. C.	231	EVALUATION OF THE DAMAGE PRODUCED BY CLOVER SEED CHALCID BRUCHOPHAGUS GIBBUS (HYMENOPTERA: EURYTOMIDAE) IN RED CLOVER, IN THE COLORADO RIVER BONAERENSE VALLEY	I	59	22/08/00	16:30	CC		2	PS	2
Dughetti, A. C.	232	SUSCEPTIBILITY OF DIFFERENT ONION HYBRIDS AND VARIETIES TO THE ATTACK OF ONION MAGGOT DELIA ANTIQUA (DIPTERA: ANTHOMYIIDAE)	I	59	22/08/00	16:30	CC		2	PS	2
Dughetti, A. C.	957	STUDY OF THE PEST OF AN ORGANIC ONION CROP: THEIR POPULATION'S FLUCTUATION, THEIR SPATIAL DISPERSAL AND THEIR NATURAL ENEMIES	I	242	23/08/00	16:30	CC		6	PS	6
Dughetti, A. C.	1319	DIFFERENT DOSAGES OF IMIDACLOPRID 60 FS (GAUCHO 60 FS•) IN ONION SEED TREATMENT ON THE GERMINATION AND THE EMERGED PLANTS	I	333	24/08/00	16:30	CC		7	PS	7
Dulcis, D.	2417	NEURONAL CONTROL OF HEART REVERSAL IN THE HAWKMOTH MANDUCA SEXTA	II	611	21/08/00	16:30	CC		13	PS	13
Dunaevsky, Y. E.	2420	PROTEINASE INHIBITORS IN THE MIDGUT OF THE COCKROACH	II	611	21/08/00	16:30	CC		13	PS	13
Duncan, F. D.	3127	DUNG BEETLE SPIRACLES: DIFFERENT APPROACHES TO THE SAME PROBLEM	II	789	22/08/00	16:30	CC		16	PS	16
Duncan, L. W.	1579	PARASITISM AND PERSISTENCE IN THE FIELD OF ENTOMOPATHOGENIC NEMATODES AND OTHER NATURAL ENEMIES OF THE LARVAE DIAPREPES ABBREVIATUS (COLEOPTERA: CURCULIONIDAE).	I	398	23/08/00	16:30	CC		8	PS	8
Dunley, J. E.	2542	RESISTANCE MANAGEMENT ON AN AREAWIDE BASIS IN ANNUAL VERSUS PERENNIAL CROPPING SYSTEMS	II	642	21/08/00	11:05	HB	B	14	1	14
Dunley, J. E.	120	SELECTIVE USE OF PARTICLE FILM TECHNOLOGY IN WASHINGTON POME FRUIT PEST MANAGEMENT	I	31	23/08/00	15:50	HB	A	2	6	2
Dunley, J. E.	2539	AREAWIDE MANAGEMENT OF LEPIDOPTEROUS PESTS IN PERENNIAL CROPPING SYSTEMS: OPPORTUNITIES AND CONSTRAINTS	II	642	21/08/00	9:35	HB	B	14	1	14
Dunse, K. M.	2051	DESIGNING PROTEINASE INHIBITORS FOR THE CONTROL OF HELICOVERPA SPECIES	I	517	21/08/00	16:30	CC		11	PS	11
Duport, G.	1404	INSECTICIDAL ACTIVITY AND MOLECULAR TARGETS OF LEGUME LECTINS ON THE PEA APHID, ACYRTHOSIPHON PISUM	I	354	25/08/00	16:30	CC		7	PS	7
Dupuriets, L.	2490	APHIDS AND APHID PROTEASES AS NON-CONVENTIONAL TARGETS FOR PROTEASE INHIBITOR TRANSGENES USED FOR CONTROLLING PHLOEM-FDEEDING INSECTS	II	629	24/08/00	16:30	CC		13	PS	13
Dupuriets, L.	3952	EXAMINATION OF PROTEINASE AND PROTEINASE INHIBITOR ACTIVITIES IN THE APHID APHIS GOSSYPII	II	997	22/08/00	16:30	CC		22	PS	22
Duque, P.	1981	PRELIMINAR OBSERVATIONS OF CULICIDS (DIPTERA:CULICIDAE) ASSOCIATED TO PHYTOTELMATA IN A VERY HYMUD TROPICAL FOREST (bmh-T) IN CHOCO-COLOMBIA	I	499	21/08/00	16:30	CC		10	PS	10
Durahman, L.	3993	CORRELATION OF TERMINALIA LENGTH BETWEEN MALES AND FEMALES OF BACTROCERA CARAMBOLAE (DIPTERA: TEPHRITIDAE) FROM WESTJAVA, INDONESIA	II	1008	25/08/00	16:30	CC		22	PS	22
Durán-Estrada, L.	330	PRESENCE OF HYPSIPYLA GRANDELLA IN THE STATE OF TAMAULIPAS, MÉXICO	I	84	24/08/00	16:30	CC		2	PS	2
Durante, S. P.	3128	COMPARATIVE STUDY OF MALE'S GENITALS STRUCTURES IN PSEUDOCENTRON SPECIES (HYMENOPTERA: MEGACHILIDAE)	II	789	22/08/00	16:30	CC		16	PS	16
Durante, S. P.	3753	SYSTEMATIC STUDY OF THE ARGENTINEAN SPECIES OF THE GENUS PSEUDOCENTRON (HYMENOPTERA: MEGACHILIDAE)	II	947	23/08/00	16:30	CC		21	PS	21
Duranton, J.-F.	958	SPREAD OF A MIGRATORY LOCUST PLAGUE IN MADAGASCAR	I	242	22/08/00	16:30	CC		6	PS	6
Dureja, P.	1667	SYNOMONAL EFFECT OF CHICKPEA VARIETIES ON THE EGG PARASITOID TRICHOGRAMMA CHILONIS (TRICHOGRAMMATIDAE: HYMENOPTERA)	I	420	24/08/00	16:30	CC		8	PS	8
Durigan, A. C.	4095	EVALUATION OF INSECTICIDES IN THE CONTROL OF RICE WEEVIL AND LESSER GRAIN BORER ON STORED BARLEY	II	1034	25/08/00	16:30	CC		23	PS	23
Durigan, A. C.	2769	DEVELOPMENT AND DAMAGE OF THE RICE WEEVIL ON TRITICALE AND WHEAT CULTIVARS	II	699	21/08/00	16:30	CC		14	PS	23
Durvasula, R. V.	2896	EXPRESSION OF SINGLE CHAIN ANTIBODIES BY INSECT SYMBIONTS	II	731	23/08/00	9:50	Bol	R	15	5	15
Durvasula, R. V.	2981	PARATRANSGENESIS OF REDUVIID VECTORS OF CHAGAS DISEASE	II	752	22/08/00	16:30	CC		15	PS	15
Durvasula, R. V.	2895	BACTERIAL SYMBIONTS AND THE CONTROL OF CHAGAS DISEASE	II	731	23/08/00	9:35	Bol	R	15	5	15
Duso, C.	135	PHYTOSEIID-POLLEN RELATIONSHIPS IN ITALIAN VINEYARDS	I	35	24/08/00	15:35	HB	A	2	8	2
Duso, C.	2580	ORGANOPHOSPHATE RESISTANCE IN GRAPE LEAFHOPPERS AND IPM STRATEGIES	II	652	24/08/00	10:05	HB	B	14	6	14
Dutary-Thatcher, B.	3019	ANOPHELES DARLINGI AND MALARIA IN AREAS OF SETTLEMENT IN AMAZÔNIA - MUNICÍPIO DE NOVO AIRÃO (AM)	II	762	25/08/00	16:30	CC		15	PS	15
Dutton, M. F.	850	INTERACTIONS BETWEEN ABOVE- AND BELOW-GROUND FUNGAL ENDOPHYTES: EFFECTS ON A LEPIDOPTERAN HERBIVORE	I	215	24/08/00	11:05	HB	D	6	6	6
Dutton, R.	1283	DEVELOPMENT OF A RESISTANCE MANAGEMENT STRATEGY FOR COLORADO BEETLE IN POLAND: A SUCCESSFUL IRAC-SPONSORED PROJECT	I	324	25/08/00	15:50	HM	N	7	10	7

Sub-titles: (HB=Hotel Bourbon) - (HM=Hotel Mabu) - (CC=Convention Center) - (Bol=Foz Boulevard) - (PS=Poster Session) - (PL=Plenary Lecturer)

AUTHOR	Nº	TITLE	Book	Page	Date	Time	Local	Room	Session	Symp	New Session
Dutton, R.	1272	A GLOBAL PERSPECTIVE ON THE BIOLOGY AND FIELD PERFORMANCE OF SPINOSAD	I	321	25/08/00	11:05	HM	N	7	9	7
Dutzler, G.	627	IDENTIFICATION OF FEMALE AND MALE SEX PHEROMONES IN THE SOLITARY BEE OSMIA RUFA (HYMENOPTERA: MEGACHILIDAE)	I	159	21/08/00	16:30	CC		4	PS	4
Duyts, H.	1118	LINKING MULTITROPHIC INTERACTIONS ABOVE-BELOWGROUND	I	282	24/08/00	16:30	CC		6	PS	6
Dymbrowski, K. A.	2915	MALARIA PARASITE ENCAPSULATION GENES IN ANOPHELES GAMBIAE	II	736	24/08/00	14:05	Bol	R	15	8	15
D*ol*, D.	2711	ECB (OSTRINIA NUBILALIS) AND WCR (DIABROTICA VIRGIFERA VIRGIFERA) IN EAST SLAVONIA (CROATIA)	II	685	22/08/00	16:30	CC		14	PS	14
E Ferreira	661	DETERMINING THE SUSCEPTIBILITY OF LESSER CORNTALK BORER IN RICE ELASMOPALPUS LIGNOSELLUS TO INSECTICIDES	I	167	22/08/00	16:30	CC		4	PS	4
E. D. Quintela	959	POPULATION DYNAMICS OF BEMISIA SPP. IN WILD HOSTS IN AGRICULTURAL SYSTEM	I	242	22/08/00	16:30	CC		6	PS	6
E.G. Virla	3225	EPIDEMIOLOGY OF "MAL DE RÍO CUARTO" DISEASE AND THE RELATION WITH ITS VECTORS IN ARGENTINA	II	814	22/08/00	16:30	CC		17	PS	17
Easwaramoorthy, S.	2052	STUDIES ON ENTOMOPATHOGENIC FUNGI AGAINST WHITE GRUB HOLOTRICHIA SERRATA (COLEOPTERA : SCARABAEIDAE) IN SUGARCANE	I	518	21/08/00	16:30	CC		11	PS	11
Eaton, T.	714	HABITUATION OF JAPANESE BEETLES (COLEOPTERA: SCARABAEIDAE) TO AZADIRACHTIN APPLIED AS A FEEDING DETERRENT	I	180	24/08/00	16:30	CC		4	PS	4
Ebbinghaus, D.	1793	VARIABILITY IN THE BEHAVIOURAL RESPONSE OF THE ONION FLY TO N-DIPROPYL DISULFIDE	I	452	24/08/00	16:30	CC		9	PS	9
Eben, A.	960	SEEDLINGS AS EPHEMERAL UNDERSTORY IN MANGROVES : IMPACT OF HERBIVORES AND WATER LEVEL ON SEEDLING SURVIVAL	I	242	22/08/00	16:30	CC		6	PS	6
Eben, A.	2246	THE EVOLUTION OF HOST PLANT BREADTH IN DIABROTICITES (COLEOPTERA : CHRYSOMELIDAE)	I	567	21/08/00	16:30	CC		12	PS	12
Eberhard, W. G.	3055	FUNCTIONAL MORPHOLOGY OF SPECIES-SPECIFIC GRASPING STRUCTURES IN MALE SEPSID FLIES, AND THE EVOLUTION OF ANIMAL GENITALIA	II	771	23/08/00	10:20	HB	G	16	4	16
Eckert, M.	3257	TOPOCHEMICAL LOCALIZATION OF PERIVISCEROKININS AND PYROKININS IN THE CEPHALIC NERVOUS SYSTEM OF THE AMERICAN COCKROACH	II	823	21/08/00	14:30	HB	K	18	1	18
Eckert, M.	2488	MASS SPECTROMETRIC MORPHOLOGY - DISTRIBUTION OF FXPRLAMIDES IN NERVES AND NEUROHAEMAL ORGANS OF THE AMERICAN COCKROACH	II	628	24/08/00	16:30	CC		13	PS	13
Ecole, C.C.	976	EFFECT OF TEMPERATURE ON THE SEX RATIO AND WEIGHT OF CHRYSOPERLA EXTERNA ADULTS OBTAINED FROM LARVAE FED ON SCHIZAPHIS GRAMINUM	I	246	22/08/00	16:30	CC		6	PS	6
Ecole, C.C.	1529	FUNCTIONAL RESPONSE OF CHRYSOPERLA EXTERNA FED ON SCHIZAPHIS GRAMINUM	I	386	22/08/00	16:30	CC		8	PS	8
Economopoulos, A. P.	3978	CERATITIS CAPITATA OVERWINTERING IN MEDITERRANEAN CLIMATE	II	1004	24/08/00	16:30	CC		22	PS	22
Edelstein, J. D.	316	SAMPLING DISTRIBUTION PATTERNS OF RACHIPLUSIA NU (LEPIDOPTERA: NOCTUIDAE) AND DESIGN OF SAMPLE PLANS	I	80	24/08/00	16:30	CC		2	PS	2
Edgar, K.	2477	REGULATION OF JH LEVELS IN MOSQUITOES	II	626	23/08/00	16:30	CC		13	PS	13
Edgar, K.	2294	A MOLECULAR VIEW OF TRYPSIN SYNTHESIS IN AEDES AEGYPTI.	I	579	24/08/00	16:30	CC		12	PS	12
Edman, J. D.	2888	FITNESS ADVANTAGE FOR YELLOW FEVER MOSQUITOES (AEDES AEGYPTI) THAT FEED ON HUMAN BLOOD	II	729	22/08/00	14:05	Bol	R	15	4	15
Edomwande, E. O.	233	OVO-LARVICIDAL EFFECTS OF LUFENURON TO POTATO TUBER MOTH, PHTHORIMAEA OPERCULELLA (ZELLER) (LEPIDOPTERA: GELECHIIDAE)	I	59	22/08/00	16:30	CC		2	PS	2
Edwards, C. R.	166	GLOBAL PERSPECTIVE OF DIABROTICA MANAGEMENT	I	43	26/08/00	16:20	HB	A	2	11	2
Edwards, C.R.	163	MANAGEMENT OF WESTERN CORN ROOTWORM IN EUROPE	I	42	26/08/00	15:20	HB	A	2	11	2
Edwards, M.	3001	TOWARD INTERRUPTING MALARIA TRANSMISSION BY GENETIC MANIPULATION OF THE MOSQUITO VECTOR	II	757	23/08/00	16:30	CC		15	PS	15
Edwards, M. J.	2390	THE MOSQUITO PERITROPHIC MATRIX	II	604	26/08/00	11:05	HB	I	13	10	13
Edwards, O. R.	2664	INTERCLONAL VARIABILITY IN THE PERFORMANCE OF THREE APHIDS ON GRAIN LEGUME HOSTS IN WESTERN AUSTRALIA	II	673	22/08/00	16:30	CC		14	PS	14
Edwards, O. R.	2575	APPLICATIONS OF MOLECULAR ECOLOGY TO IPM – WHAT IMPACT?	II	651	23/08/00	14:00	HB	B	14	5	14
Edwards, R.	1447	DEVELOPMENT AND IMPLEMENTATION OF AN AUTOMATED SYSTEM FOR MASS REARING PINK BOLLWORM (PECTINOPHORA GOSSYPIELLA)	I	365	22/08/00	15:20	HM	O	8	4	8
Egger, J.	4094	ARTIFICIAL FEEDING OF MOSQUITOS VIA A MEMBRANELESS SYTSTEM	II	1034	24/08/00	16:30	CC		23	PS	23
Eggleton, P.	382	SOIL BIODIVERSITY: THE NEED FOR A GLOBAL INITIATIVE	I	97	21/08/00	13:30	HB	C	3	1	3
Eggleton, P.	420	TERMITE DIVERSITY AND LAND USE CHANGES: LESSONS FOR FUTURE GENERAL BIODIVERSITY STUDIES	I	107	24/08/00	9:35	HB	C	3	5	3
Eggleton, P.	436	DICTYOPTERA	I	111	25/08/00	11:05	HB	C	3	7	3
Eggleton, P.	491	TERMITE DIVERSITY AND LAND USE CHANGES: LESSONS FOR FUTURE GENERAL BIODIVERSITY STUDIES	I	124	22/08/00	16:30	CC		3	PS	3
Eggleton, P.	416	EVALUATING PRACTICAL METHODS FOR SAMPLING INVERTEBRATE BIOINDICATORS	I	106	23/08/00	15:05	HB	C	3	4	3
Eggleton, P.	394	PATTERNS OF TERMITE DIVERSITY ACROSS RECENTLY ISOLATED LAND-BRIDGE ISLANDS IN FRENCH GUIANA	I	100	22/08/00	14:05	HB	C	3	2	3
Eguileor, M. de	1427	REARING HYMENOPTEROUS LARVAL PARASITOIDS OF APHIDS ON ARTIFICIAL DIETS	I	360	21/08/00	13:50	HM	O	8	2	8
Eikerat, N.	2924	PREVENTION OF SPOROGONY OF PLASMODIUM VIVAX IN ANOPHELES DIRUS MOSQUITOES BY TRANSMISSION-BLOCKING ANTIMALARIALS	II	738	25/08/00	10:35	Bol	R	15	9	15
Eiras, A E.	622	THE ROLE OF GRASS INFUSIONS AS OVIPOSITION ATTRACTANTS AND OVIPOSITION STIMULANTS FOR AEDES AEGYPTI MOSQUITOES	I	157	25/08/00	11:05	Bol	S	4	7	4
Eiras, A.	693	MANAGING TEMPERATE FRUIT PESTS IN BRAZIL USING SEMIOCHEMICALS	I	175	23/08/00	16:30	CC		4	PS	4
Eiras, A. E.	1970	USE OF ATTRACTANTS FOR SURVEYING DIPTERAN POPULATIONS IN A RAINFOREST AREA IN NORTHEASTERN BRAZIL	I	496	24/08/00	16:30	CC		10	PS	10
Eiras, A. E.	654	SEX PHEROMONE OF THE BRAZILIAN APPLE LEAFROLLER, BONAGOTACRANAODES (LEPIDOPTERA: TORTRICIDAE): EFFECT OF GEOMETRICISOMERS ON MALE ATTRACTION TO (E,Z)-3,5-DODECADIENYL ACETATE	I	165	22/08/00	16:30	CC		4	PS	4
Eiras, Dr A.	1035	THE ROLE OF LEARNING AND MEMORY IN LEAF-CUTTING ANT FORAGING ECOLOGY.	I	261	23/08/00	16:30	CC		6	PS	6
Ek-Amnuay, J.	2650	INSECTICIDE SPRAYING TECHNIQUES FOR CONTROLLING THE DIAMOND BACK MOTH, PLUTELLA XYLOSTELLA ON CHINESE KALE	II	669	21/08/00	16:30	CC		14	PS	14
Ekbom, B.	1614	THE ROLE OF LANDSCAPE STRUCTURE AND FARMING PRACTICE ON PREDATION OF APHID	I	407	24/08/00	16:30	CC		8	PS	8
El-Banhawy, E. M.	1520	RESPONSE OF THE PREDACIOUS MITE, AMBLYSEIUS CYDNODACTYLON TO INCREASING PREY DENSITY OF THE TWO SPOTTED SPIDER MITE, TETRANYCHUS URTICAE IN ABSENCE OR PRESENCE OF NYMPHS OF TOBACCO WHITE FLY, BEMESIA TABACI (ACARI: PHYTOSEIIDAE)	I	383	21/08/00	16:30	CC		8	PS	8
Elbert, A.	1230	INVESTIGATIONS ON NEONICOTINOID RESISTANCE IN BEMISIA TABACI FROM ALMERIA/SPAIN	I	311	21/08/00	15:05	HM	N	7	2	7
Ele ková, E.	2893	TICK-HOST INTERACTIONS IN THE CO-FEEDING TRANSMISSION OF TICK-BORNE ENCEPHALITIS VIRUS: CELL INVOLVEMENT	II	730	22/08/00	15:50	Bol	R	15	4	15
Elek, J. A.	1840	THE ROLE OF BACILLUS THURINGIENSIS IN FOREST PEST MANAGEMENT: ITS CURRENT STATUS AND FUTURE PROSPECTS	I	464	23/08/00	10:35	HB	M	10	4	10
Elek, J. A.	2639	INTEGRATED PEST MANAGEMENT OF A LEAF BEETLE IN EUCALYPT PLANTATIONS IN TASMANIA, AUSTRALIA	II	667	21/08/00	16:30	CC		14	PS	14
Elek, Z.	1915	EFFECTS OF NON-NATIVE SPRUCE PLANTATION ON CARABID BEETLES	I	483	21/08/00	16:30	CC		10	PS	10
Eleotério, E. S. R.	4072	SURVEY AND IDENTIFICATION OF TERMITES (INSECTA: ISOPTERA) IN AN URBAN AREA OF PIRACICABA, STATE OF SÃO PAULO, BRAZIL	II	1028	22/08/00	16:30	CC		23	PS	23

Sub-titles: (HB=Hotel Bourbon) - (HM=Hotel Mabu) - (CC=Convention Center) - (Bol=Foz Boulevard) - (PS=Poster Session) - (PL=Plenary Lecturer)

AUTHOR	N°	TITLE	Book	Page	Date	Time	Local	Room	Session	Symp	New Session
El-Heneidy, A. H.	2665	WHEAT CROP PROTECTION BASED ON PLANT RESISTANCE AND BIOLOGICAL CONTROL IN EGYPT	II	673	22/08/00	16:30	CC		14	PS	14
Eliahu, M.	1415	INFLUENCE OF SPINOSAD ON SOME HYMENOPTEROUS NATURAL ENEMIES OF AVOCADO, CITRUS AND OTHER ORCHARD PESTS	I	357	25/08/00	16:30	CC		7	PS	7
El-Ibrashy, M. T.	2666	A JUVENOID- ORIENTED LEISA STRATEGY FOR PEST MANAGEMENT	II	673	22/08/00	16:30	CC		14	PS	14
Elizabeth Bernays	III	Plant/insect interactions - a synthesis	I	VIII	21/08/00	8:00	HM			PL	
Elliot, N. C.	500	MANAGING THE DIVERSITY OF CARABIDAE IN AGRICULTURAL LANDSCAPES	I	127	22/08/00	16:30	CC		3	PS	3
Elliot, S. L.	961	CAN PLANTS USE ENTOMOPATHOGENS AS BODYGUARDS?	I	243	22/08/00	16:30	CC		6	PS	6
Ellis, D. J.	2020	THE ROLE OF FORMULATION ADDITIVES IN INCREASING THE POTENCY OF CYDIA POMONELLA GRANULOVIRUS FOR CODLING MOTH LARVAE	I	510	24/08/00	11:05	HM	P	11	7	11
El-Lissy, O.	2541	REGIONAL MAMANGEMENT AND ERADICATION OF INSECT PESTS IN ANNUAL SYSTEMS	II	642	21/08/00	10:35	HB	B	14	1	14
Ellsworth, P. C.	105	IMPLEMENTATION AND ADOPTION OF IPM SYSTEMS	I	27	22/08/00	16:00	HB	A	2	4	2
Ellsworth, P. C.	2671	INTRODUCTION-PART 1: CHALLENGES AND OPPORTUNITIES FOR PEST MANAGEMENT OF BEMISIA IN THE NEW CENTURY	II	675	22/08/00	16:30	CC		14	PS	14
Ellsworth, P. C.	2775	INTRODUCTION-PART 2: CHALLENGES AND OPPORTUNITIES FOR PEST MANAGEMENT OF BEMISIA IN THE NEW CENTURY	II	701	25/08/00	16:30	CC		14	PS	14
Ellsworth, P.C.	101	ECOLOGICAL CONSIDERATIONS FOR MANAGEMENT OF A MULTIPLE-CROP PEST	I	26	22/08/00	14:00	HB	A	2	4	2
Ellwood, M. D. F.	1756	HOW WELL DOES FOGGING SAMPLE A HIGH CANOPY EPIPHYTE?	I	442	21/08/00	16:30	CC		9	PS	9
Ellwood, M. D. F.	3579	HOW WELL DOES FOGGING SAMPLE A HIGH CANOPY EPIPHYTE?	II	903	24/08/00	11:05	Bol	U	20	2	20
Elnagar, S.	492	WHITE FLIES FAUNA OF WILD PLANTS AND THEIR ABUNDANCE IN EGYPT	I	125	22/08/00	16:30	CC		3	PS	3
Elpidina, E. N.	2420	PROTEINASE INHIBITORS IN THE MIDGUT OF THE COCKROACH	II	611	21/08/00	16:30	CC		13	PS	13
El-Saadany, G. B.	885	LIFE HISTORY AND LIFE TABLES OF CITRUS LEAF MINERPHYLLOCNISTIS CITRELLA (LEPIDOPTERA:GRACILLARIIDAE)	I	224	21/08/00	16:30	CC		6	PS	6
El-Sayed, A. M.	646	BARK BEETLE RESPONSE TO AGGREGATION PHEROMONE INHIBITED BY MONOTERPENES RELEASED BY A PIEZOELECTRIC SPRAYER	I	163	21/08/00	16:30	CC		4	PS	4
Elsner, N.	1774	DEGRADATION OF TEMPORAL PARAMETERS OF A GRASSHOPPER SONG IN THE FIELD	I	447	23/08/00	16:30	CC		9	PS	9
Embrey, M.	1354	TIMING INSECTICIDE APPLICATIONS FOR DUSKY SAP BEETLE (COLEOPTERA: NITIDULIDAE) CONTROL IN BT SWEET CORN.	I	342	23/08/00	16:30	CC		7	PS	7
Emiliani, C. L.	2845	SCREENING FORAGE GRASSES OF THE GENUS BRACHIARIA FOR RESISTANCE TO THE SPITTLEBUGS (HOMOPTERA: CERCOPIDAE)	II	718	25/08/00	16:30	CC		14	PS	14
Emlen, D. J.	1710	SCALING RELATIONSHIPS AS 'REACTION NORMS': INSIGHTS FOR THE EVOLUTION OF BEETLE HORNS	I	431	21/08/00	11:15	HB	F	9	1	9
Emlen, D. J.	3294	EVOLUTION OF A DEVELOPMENTAL THRESHOLD IN ONTHOPHAGUS DUNG BEETLES (COLEOPTERA: SCARABAEIDAE)	II	832	24/08/00	11:35	HB	K	18	6	18
Endo, K.	3566	PHOTOPERIODIC AND NEUROENDOCRINE REGULATION OF THE SEASONAL MORPH DEVELOPMENT IN A BIVOLTINE RACE (DAIZO) OF THE SILKMOTH, BOMBYX MORI	II	900	25/08/00	16:30	CC		19	PS	19
Engelke, M. C.	63	HOST RESISTANCE TO INSECTS AND MITES IN ZOYSIA SPP. FOR URBAN LANDSCAPES	I	16	24/08/00	16:30	CC		1	PS	1
Engels, W.	398	HOW FAR NORTH AND SOUTH DOES THE APIFAUNA OF AMAZONIA REACH, ESPECIALLY THE BEE SPECIES VISITING MASS-FLOWERING TREES	I	101	22/08/00	15:05	HB	C	3	2	3
Engels, W.	1036	BEE-PLANT-RELATIONS OF MASS-FLOWERING TREES IN A SOUTH BRAZILIAN ARAUCARIA FOREST OF THE MATA ATLÂNTICA	I	261	23/08/00	16:30	CC		6	PS	6
Engels, W.	1821	LITTER ANT COMMUNITY IN SUBTROPICAL ARAUCARIA AND COASTAL ESCARPMENT FORESTS IN SOUTHERN BRAZIL	I	459	21/08/00	16:05	HB	M	10	1	10
Engels, W.	1944	NEW RECORDS OF COLEOPTERA AND HYMENOPTERA FROM ARAUCARIA ANGUSTIFOLIA TREES IN THE SOUTH OF BRAZIL	I	490	23/08/00	16:30	CC		10	PS	10
Engels, W.	3337	COLONY DEVELOPMENT OF ATTA LEAFCUTTING ANTS UNDER LABORATORY AND FIELD CONDITIONS	II	843	22/08/00	16:30	CC		18	PS	18
Engels, W.	3509	LEAFCUTTING ANTS AS PESTS IN ARAUCARIA CULTURES: DIET PREFERENCE BIO-ASSAY UNDER LABORATORY CONDITIONS	II	886	23/08/00	16:30	CC		19	PS	19
Engels, W.	3607	EXTRAORDINARY NEST SITE OF AUGOCHLOROPSIS CAERULANS (HYMENOPTERA; HALICTINAE) IN A WET PASTURE HOLLOW	II	910	25/08/00	16:30	CC		20	PS	20
Engels, W.	3159	THE WEEVIL GENUS ARAUCARIUS (CURCULIONIDAE, COSSONINAE) - NEW INVESTIGATION OF AN UNUSUAL TIBIAL STRUCTURE	II	797	24/08/00	16:30	CC		16	PS	16
Enghoff, H.	550	PATTERNS OF ANIMAL DISPERSAL, VICARIANCE AND DIVERSIFICATON IN THE HOLARCTIC	I	139	24/08/00	16:30	CC		3	PS	3
English-Loeb, G.	2581	INTERACTIONS BETWEEN MITES AND PLANT PATHOGENS AND IMPLICATIONS FOR BIOLOGICAL CONTROL IN GRAPES	II	652	24/08/00	10:35	HB	B	14	6	14
Enkegaard, A.	824	INTERSPECIFIC INTERACTIONS AMONG ENTOMOPHAGOUS INSECTS IN PROTECTED CULTURES	I	208	22/08/00	16:05	HB	D	6	4	6
Epperlein, K.	1208	INVESTIGATIONS INTO CARABIDES AT TYPICAL HABITATS OF THE NATURE RESERVE AND WINE GROWING REGION „SÜßER SEE", SACHSEN-ANHALT, GERMANY	I	304	25/08/00	16:30	CC		6	PS	6
Epperlein, K.	3597	INVESTIGATIONS OF THE BUTTERFLY FAUNA (LEPIDOPTERA, RHOPALOCERA, ZYGAENOIDAE) AROUND A DISUSED BROWN COAL MINE NEAR GRÄFENHAINICHEN (GERMANY, SACHSEN-ANHALT)	II	908	22/08/00	16:30	CC		20	PS	20
Epsky, N. D.	613	FIELD EVALUATION OF FEMALE TARGETED TRAPPING SYSTEMS FOR DETECTION AND USE IN POPULATION SUPPRESSION/ERADICATION OF CERATITIS CAPITATA (DIPTERA: TEPHRITIDAE)	I	155	24/08/00	13:30	Bol	S	4	6	4
Era, D. J.	2588	CITRUS IPM IN AUSTRALIA AND EAST AND SOUTHEAST ASIA	II	654	24/08/00	14:35	HB	B	14	7	14
Eremina, O. Yu.	2421	ENZYME ACTIVITIES IN ARTHROPODA COLLECTED FROM HEAVY METAL POLLUTED SITES	II	612	22/08/00	16:30	CC		13	PS	13
Eremina, O. Yu.	2422	IMPACT OF HEAVY METALS ON INSECT ENZYME ACTIVITIES	II	612	22/08/00	16:30	CC		13	PS	13
Eremina, O.Yu.	1349	INSECT ANTIESTERASE ACTIVITY OF NOVEL ORGANO-PHOSPHORUS COMPOUNDS AND CHANGES OF ENZYME LEVEL IN FIELD RESISTANT POPULATIONS MUSCA DOMESTICA	I	340	23/08/00	16:30	CC		7	PS	7
Eriksen, K.	2340	REVERSED PHARMACOLOGY IN INSECTS: FINDING NOVEL ORPHAN G PROTEIN-COUPLED RECEPTORS AND THEIR LIGANDS	II	591	21/08/00	10:55	HB	I	13	1	13
Erthal Jr., M.	2065	SCREENING FOR NEW INSECTICIDAL COMPOUNDS PRODUCED BY ENTOMOPATHOGENIC FUNGI	I	521	22/08/00	16:30	CC		11	PS	11
Erwin, T. L.	387	CANOPY ARTHROPODS OF THE WESTERN AMAZON BASIN	I	98	22/08/00	9:50	HB	C	3	2	3
Esaki, K.	2080	THE POTENTIAL IMPACT OF GROBAL WARMING ON DECIDUOUS OAK DIEBACK CAUSED BY AMBROSIA FUNGUS CARRIED BY AMBROSIA BEETLE IN JAPAN	I	525	22/08/00	16:30	CC		11	PS	11
Esbjerg, P.	2667	TRAPPING OF TURNIP MOTH AND CARROT FLY FOR FORECASTING IN CARROT IPM	II	674	22/08/00	16:30	CC		14	PS	14
Escobar, S. G.	2768	INTRODUCTION AND REARING OF PHYTOMYZA OROBANCHIA AS PART OF AN INTEGRATED PEST MANAGEMENT PROGRAM ON BROOMRAPE	II	699	24/08/00	16:30	CC		14	PS	14
Escorza, C. M.	880	SPACE-SEASONAL DISTRIBUTION OF CERATITIS CAPITATA (DIPTERA: TEPHRITIDAE) IN A MASS TRAPPING EXPERIENCE IN A CITRUS ORCHARD IN MALLORCA (SPAIN)	I	222	21/08/00	16:30	CC		6	PS	6
Escoto, H. C.	1916	NATURAL RESISTANCE OF TEN CUBAN FOREST SPECIES AGAINST TERMITE ATTACK	I	483	22/08/00	16:30	CC		10	PS	10
Espinosa de los Monteros, A.	2246	THE EVOLUTION OF HOST PLANT BREADTH IN DIABROTICITES (COLEOPTERA : CHRYSOMELIDAE)	I	567	21/08/00	16:30	CC		12	PS	12

Sub-titles: (HB=Hotel Bourbon) - (HM=Hotel Mabu) - (CC=Convention Center) - (Bol=Foz Boulevard) - (PS=Poster Session) - (PL=Plenary Lecturer)

AUTHOR	Nº	TITLE	Book	Page	Date	Time	Local	Room	Session	Symp	New Session
Espinosa, B.	2139	OBSERVATIONS ON THE VICE-LIKE STRUCTURES IN PUPAE OF PLUSIINAE (LEPIDOPTERA, NOCTUIDAE)	I	539	24/08/00	16:30	CC		11	PS	11
Espinoza, S.	1996	USE OF PATHOGENIC NEMATODES AND THEIR SYMBIOTIC BACTERIA FOR THE CONTROL OF SLUG PEST	I	504	21/08/00	15:05	HM	P	11	2	11
Espirito Santo, M. M.	1856	MECHANISMS OF RESISTANCE IN TREES TO GALL-FORMING INSECTS	I	468	24/08/00	11:35	HB	M	10	5	10
Espírito-Santo, M. M.	853	ENDOPHYTES, TANNINS, AND HERBIVORES: THE INTERFACE IN A WOODY SHRUB	I	216	24/08/00	14:30	HB	D	6	6	6
Espírito-Santo, M. M.	833	CONSEQUENCES OF HOST PLANT RESISTANCE AND SENESCENCE TO THE SURVIVORSHIP AND DEVELOPMENT OF A NEOTROPICAL GALLING INSECT	I	211	23/08/00	11:35	HB	D	6	5	6
Esposito, M. C.	524	FLIES AS A BIOINDICATOR FOR BIODIVERSITY LOSS IN AGRICULTURAL LANDING USE SYSTEMS	I	133	23/08/00	16:30	CC		3	PS	3
Ester, A.	3953	CONTROLLING ONION THRIPS, ONION FLY AND LEEK MOTH IN LEEK BY FILMCOATING SEEDS WITH FIPRONIL	II	998	22/08/00	16:30	CC		22	PS	22
Estrada, J.	1256	USE AND PERSPECTIVES OF BOTANICAL PESTICIDES IN CUBA	I	317	24/08/00	11:05	HM	N	7	7	7
Estrela, J. L. V.	494	DIVERSITY OF DIURNAL INSECTS SPECIES IN PLANTS OF AN AGROFORESTRY SYSTEM IN ACRE	I	125	22/08/00	16:30	CC		3	PS	3
Etebari, K.	234	FIRST REPORT ON THE PRESENCE OF MULBERRY THRIPS PSEUDODENDROTHRIPS MORI (THYS., THRIPIDAE) AS A NEW SPECIES FOR INSECT FAUNA OF MULBERRY FIELD OF NORTH OF IRAN	I	60	22/08/00	16:30	CC		2	PS	2
Etebari, K.	962	INVESTIGATION ON HOST PREFERENCE OF PSUEDODENDROTHRIPS MORI (THYS: THRIPIDAE) ON FOUR VARIETIES OF MULBERRY IN THE FIELD AND LABORATORY	I	243	23/08/00	16:30	CC		6	PS	6
Etebari, K.	2715	THE EFFICACY OF CERTAIN AQUEOUS PLANT EXTRACTS FROM GUILAN PROVINCE AGAINST ELM LEAF BEETLE XANTHOGALEAROCELLA LUTEOLA (COL; CHRYSOMELLIDAE)	II	686	23/08/00	16:30	CC		14	PS	14
Etges, W. J.	2200	CLINES, LEAPS, GAPS AND REVERSES IN INVERSION POLYMORPHISM	I	555	23/08/00	15:35	HB	L	12	6	12
Etiennot, A.	1830	PLATYPUS SULCATUS: A RATIONAL APPROACH TO ITS CONTROL IN POPULUS SPP. IN ARGENTINA	I	461	22/08/00	11:35	HB	M	10	2	10
Etiennot, A. E.	245	INCIDENCE OF THE DAMAGE OF PLATYPUS SULCATUS CHAPUIS (COLEOPTERA, PLATYPODIDAE) IN THE QUALITY OF POPULUS DELTOIDES WOODS	I	62	23/08/00	16:30	CC		2	PS	2
Eubanks, M. D.	866	COMPLEXITY BEGETS STABILITY REVISITED: THE IMPORTANCE OF VARIATION IN TROPHIC INTERACTIONS TO THE MAINTENANCE OF BIODIVERSITY	I	219	25/08/00	16:05	HB	D	6	8	6
Eubanks, M. D.	3935	THE ECOLOGICAL CONSEQUENCES OF OMNIVORY BY PLANT-FEEDING "PREDATORS"	II	993	24/08/00	15:35	HM	Q	22	9	22
Evangelista Junior, W. S.	1681	QUANTITATIVE MASS PRODUCTION OF THE STINKBUG PREDATOR PODISUS NIGRISPINUS (HETEROPTERA: PENTATOMIDAE)	I	424	25/08/00	16:30	CC		8	PS	8
Evangelista Junior, W. S.	2713	CAN THIAMETHOXAM BE ASSOCIATED TO STINKBUG PREDATOR PODISUS NIGRISPINUS NYMPHS IN A COTTON PEST MANAGEMENT PROGRAM ?	II	685	22/08/00	16:30	CC		14	PS	14
Evans, H. F.	1867	ECOLOGY AND MANAGEMENT OF DEFOLIATING PESTS OF CONIFERS IN NORTHERN BRITAIN	I	471	25/08/00	9:35	HB	M	10	7	10
Evans, H.	3245	INSECT TRANSMISSION OF A VASCULAR WILT OF A TROPICAL HARDWOOD IN THE SEYCHELLES	II	819	25/08/00	16:30	CC		17	PS	17
Evans, J. D.	2333	GENE EXPRESSION AND THE EVOLUTION OF INSECT POLYPHENISMS: INTRODUCTION	I	589	25/08/00	16:30	CC		12	PS	12
Evans, J. D.	2183	GENOMICS AND LARVAL DEVELOPMENT IN HONEY BEES	I	551	22/08/00	13:55	HB	L	12	4	12
Evans, T. A.	3480	ESTIMATING RELATIVE DECLINE IN POPULATIONS OF SUBTERRANEAN TERMITES (ISOPTERA: RHINOTERMITIDAE) DUE TO BAITING	II	878	22/08/00	16:30	CC		19	PS	19
Evans, T. A.	3481	SEASONAL AND DAILY FORAGING ACTIVITY OF SUBTERRANEAN, WOOD-EATING TERMITES (ISOPTERA: RHINOTERMITIDAE AND TERMITIDAE)	II	879	22/08/00	16:30	CC		19	PS	19
Evenhuis, N. L.	777	BIOSYSTEMATIC DATABASE OF WORLD DIPTERA: THE FIRST GLOBAL MASTER SPECIES DATABASE IN ENTOMOLOGY	I	196	24/08/00	14:15	Bol	T	5	5	5
Evenhuis, N. L.	793	BIOSYSTEMATIC DATABASE OF WORLD DIPTERA NAMES: KEYS TO INFORMATION	I	200	24/08/00	16:30	CC		5	PS	5
Evenhuis, N. L.	3659	RECENT ADVANCES ON THE SYSTEMATICS OF THE CROCIDIINAE (DIPTERA, BOMBYLIIDAE)	II	924	24/08/00	10:05	HB	E	21	6	21
Eystathioy, T.	3304	GENE REGULATION DURING OVARIAN DEVELOPMENT IN THE SILKMOTH	II	834	25/08/00	15:35	HB	K	18	7	18
Eythimiou, K.	3242	APHID POPULATION FLUCTUATION AND SPREAD OF APHID-BORNE VIRUSES IN TOBACCO CROPS IN GREECE	II	818	23/08/00	16:30	CC		17	PS	17
F.Cianficconi,	2982	EXPERIMENTAL OBSERVATIONS ON THE OUTBREAK OF INFESTATION BY KNEMIDOKOPTES PILAE (ACARINA: KNEMIDOKOPTIDAE) IN PARROTS (MELOPSITTACUS UNDULATUS)	II	752	22/08/00	16:30	CC		15	PS	15
Fábio-A-Suinaga, F. B.	3129	ULTRAMORPHOLOGY OF THE HYPOPHARYNGEAL GLANDS OF POLISTES VERSICOLOR (HYMENOPTERA; VESPIDAE)	II	789	22/08/00	16:30	CC		16	PS	16
Fabretti, J.	2805	AVENTIS CONTRIBUTION TO INTEGRATED CROP MANAGEMENT (ICM)	II	708	24/08/00	16:30	CC		14	PS	14
Facanali, R.	2855	ARMORED SCALES POPULATION DYNAMICS IN SÃO PAULO STATE CITRUS REGION	II	721	21/08/00	16:30	CC		14	PS	14
Faccini, J. L. H.	27	EAR MITES OF GOATS IN BRAZIL	I	7	22/08/00	16:30	CC		1	PS	1
Fadini, M. A. M.	2668	THE EFECTS OF DEPTH AND DSTRIBUTION OF LQUID INSECTICIDES FOR THE CONTROL OF MOUND TERMITES IN PASTURES (INSECTA: ISOPTERA)	II	674	22/08/00	16:30	CC		14	PS	14
Faeth, S. H.	851	ENDOPHYTES IN WOODY PLANTS AND GRASSES: DEFENDERS AGAINST, OR CONSPIRATORS WITH, INSECT HERBIVORES?	I	215	23/08/00	13:30	HB	D	6	6	6
Faeth, S. H.	963	MUTUALISM GONE AWRY? LACK OF HERBIVORE RESISTANCE IN NEOTYPHODIUM INFECTED GRASSES	I	243	22/08/00	16:30	CC		6	PS	6
Fagua, G.	493	LATITUDINAL AND ALTITUDINAL VARIATION OF THE RICHNESS, DIVERSITY AND COMPOSITION OF THE BUTTERFLY COMMUNITY IN THE "CORDILLERA ORIENTAL" (COLOMBIA)	I	125	22/08/00	16:30	CC		3	PS	3
Fagua, G.	626	DIVERSITY OF DUNG BEETLES (COLEOPTERA: SCARABAEIDAE) IN BORDER-INNER TRANSECTS IN A FOREST OF THE COLOMBIAN ANDES	I	158	21/08/00	16:30	CC		4	PS	4
Fagundes, G. G.	3954	TOLERANCE OF BRACON HEBETOR (HYMENOPTERA: BRACONIDAE) TO MICROWAVE RADIATION (2450 MHz).	II	998	22/08/00	16:30	CC		22	PS	22
Fagundes, G. G.	916	EFFECT OF LARVAL DIETS ON THE SENSIVITY OF ANAGASTA KUEHNIELLA (LEPIDOPTERA, PYRALIDAE) TO MICROWAVES RADIATION (2.450 MHz)	I	231	21/08/00	16:30	CC		6	PS	6
Fagundes, M.	853	ENDOPHYTES, TANNINS, AND HERBIVORES: THE INTERFACE IN A WOODY SHRUB	I	216	24/08/00	14:30	HB	D	6	6	6
Fagundes, M.	1090	GALLING HERBIVORY MEDIATED BY MUTUALISTIC INTERACTIONS BETWEEN ANTS AND APHIDS IN BACCHARIS DRACUNCULIFOLIA (ASTERACEAE)	I	275	24/08/00	16:30	CC		6	PS	6
Fagundes, M.	964	PLANT QUALITY AND GALLING HERBIVORE POPULATION ECOLOGY ON BACCHARIS DRACUNCULIFOLIA	I	243	22/08/00	16:30	CC		6	PS	6
Fairbairn, J. P.	2053	ENTOMOPATHOGENIC NEMATODES AS BIOLOGICAL CONTROL AGENTS OF INSECT PESTS: A CLEARER UNDERSTANDING	I	518	21/08/00	16:30	CC		11	PS	11
Fairbairn, J. P.	2054	MODELS OF ENTOMOPATHOGENIC NEMATODES FOR BIOLOGICAL CONTROL	I	518	21/08/00	16:30	CC		11	PS	11
Falabella, P.	2372	EXPRESSION OF CARDIOCHILES NIGRICEPS POLYDNAVIRUS IN PARASITIZED HELIOTHIS VIRESCENS LARVAE AND INDUCED HOST FUNCTIONAL ALTERATIONS	II	599	24/08/00	14:05	HB	I	13	7	13
Falk, B. W.	3213	BIOLOGY OF CRINIVIRUSES AND WHITEFLY-TRANSMISSION	II	811	22/08/00	14:30	Bol	U	17	2	17
Fallas, M.	612	PHEROMONE-BASED MASS TRAPPING OF THE BANANA WEEVIL, COSMOPOLITES SORDIDUS & THE WEST INDIAN SUGARCANE WEEVIL, METAMASIUS HEMIPTERUS IN BANANA & PLANTAIN	I	155	24/08/00	11:05	Bol	S	4	6	4

Sub-titles: (HB=Hotel Bourbon) - (HM=Hotel Mabu) - (CC=Convention Center) - (Bol=Foz Boulevard) - (PS=Poster Session) - (PL=Plenary Lecturer)

AUTHOR	Nº	TITLE	Book	Page	Date	Time	Local	Room	Session	Symp	New Session
Falleni, A.	3037	OVARIAN FOLLICLE DIFFERENTIATION IN INSECT OVARIOLES	II	766	21/08/00	11:30	HB	G	16	1	16
Falqueto, S. A.	365	SCARABAEIDAE S. STR. (COLEOPTERA: SCARABAEOIDEA) FROM VIÇOSA, MINAS GERAIS STATE, BRAZIL	I	92	25/08/00	16:30	CC		2	PS	2
Famiani, F.	886	IMPROVEMENT OF HONEY-BEE POLLINATION IN ACTINIDIA DELICIOSA	I	224	21/08/00	16:30	CC		6	PS	6
Fan, R. J.	3130	THE SUBOESOPHAGEAL GANGLION MODULATES THE OUTPUT INFORMATION IN THE MOTHS OLFACTORY CONDITIONIG	II	790	22/08/00	16:30	CC		16	PS	4
Fan, Y.	600	SYNTHESIS OF HYDROCARBONS AND SEX PHEROMONES AND THEIR TRANSPORT THROUGH THE HEMOLYMPH IN INSECTS	I	152	23/08/00	10:50	Bol	S	4	4	4
Fanciulli, P. P.	3097	ABERRANT SPERMATOGENESIS AND POST ZYGOTIC SEX-DETERMINATION IN COLLEMBOLA	II	781	26/08/00	13:30	HB	G	16	9	16
Fanti, P.	1427	REARING HYMENOPTEROUS LARVAL PARASITOIDS OF APHIDS ON ARTIFICIAL DIETS	I	360	21/08/00	13:50	HM	O	8	2	8
Fanton, C. J.	2668	THE EFECTS OF DEPTH AND DSTRIBUTION OF LQUID INSECTICIDES FOR THE CONTROL OF MOUND TERMITES IN PASTURES (INSECTA: ISOPTERA)	II	674	22/08/00	16:30	CC		14	PS	14
Faraji, F.	662	PHYSIOLOGICAL STATE AND ASSOCIATIVE LEARNING DETERMINE RESPONSE OF PREDATORY MITE TO FOOD-RELATED AND OVIPOSITION-RELATED VOLATILES	I	167	22/08/00	16:30	CC		4	PS	4
Fard, P. A.	1091	A FAUNAL INVESTIGATION ON THE LONG-HORNED GRASSHOPPERS (ORTHOPTERA-TETTIGONIIDAE) OF GAZVIN TO DAMAVAND DISTINCT	I	275	24/08/00	16:30	CC		6	PS	6
Fard, P. A.	235	THE BIOLOGICAL STUDY OF WHEAT LEAF MINER SYRINGOPAIS TEMPERATELLA (LEPIDOPTERA ELACHISTIDAE) IN KHUZESTAN PROVINCE	I	60	23/08/00	16:30	CC		2	PS	2
Fard, P. A.	1521	STUDIES ON WALNUT APHIDS AND THEIR NATURAL ENEMIES IN KARAJ	I	384	21/08/00	16:30	CC		8	PS	8
Fard, P. A.	2669	LOSS EVALUATION OF WHEAT LEAF MINER SYRINGOPAIS TEMPERATELLA IN KHUZESTAN PROVINCE	II	674	22/08/00	16:30	CC		14	PS	14
Fardin, A. E.	1917	WOOD LOSS IN EUCALYPTUS PLANTATIONS BY COPTOTERMES SP. (ISOPTERA: RHINOTERMITIDAE) IN GOIAS–BRAZIL	I	483	21/08/00	16:30	CC		10	PS	10
Faria, C. A.	1522	TUTA ABSOLUTA PARASITISM BY TRICHOGRAMMA PRETIOSUM WITH NOTES ON HOST SITE	I	384	21/08/00	16:30	CC		8	PS	8
Faria, C. A.	648	LOCAL DETERRENCE OF MULTIPLE ATTACKS BY THE COFFEE BERRY BORER	I	164	22/08/00	16:30	CC		4	PS	4
Faria, M.	2559	BIOLOGICAL CONTROL WITH FUNGI	II	647	22/08/00	11:20	HB	B	14	3	14
Faria, M. L.	853	ENDOPHYTES, TANNINS, AND HERBIVORES: THE INTERFACE IN A WOODY SHRUB	I	216	24/08/00	14:30	HB	D	6	6	6
Faria, M. L.	964	PLANT QUALITY AND GALLING HERBIVORE POPULATION ECOLOGY ON BACCHARIS DRACUNCULIFOLIA	I	243	22/08/00	16:30	CC		6	PS	6
Faria, M. L.	1856	MECHANISMS OF RESISTANCE IN TREES TO GALL-FORMING INSECTS	I	468	24/08/00	11:35	HB	M	10	5	10
Faria, M. R. de	2093	FIELD TRIAL WITH THE ENTOMOPATHOGENIC FUNGUS METARHIZIUM ANISOPLIAE VAR. ACRIDUM AGAINST BANDS OF THE GRASSHOPPER RHAMMATOCERUS SCHISTOCERCOIDES IN BRAZIL	I	528	23/08/00	16:30	CC		11	PS	11
Farias, A. M. I.	1522	TUTA ABSOLUTA PARASITISM BY TRICHOGRAMMA PRETIOSUM WITH NOTES ON HOST SITE	I	384	21/08/00	16:30	CC		8	PS	8
Farina, W. M.	3494	RECRUITMENT IN HONEYBEES: HOW DO FORAGERS AND HIVEMATES INTERACT ACCORDING TO THE FOOD SOURCE PROFITABILITY?	II	882	23/08/00	16:30	CC		19	PS	19
Farina, W. M.	3534	NECTAR COLLECTING IN HONEY BEES: HOW DO CHANGES IN THE RELATIVE FOOD SOURCE PROFITABILITY EXPLOITED BY INDIVIDUAL BEES AFFECT THE SOCIAL FORAGING ACTIVITY?	II	892	24/08/00	16:30	CC		19	PS	19
Farina, W. M.	3564	HONEYBEES ARE ABLE TO REPRESENT DURING TROPHALLAXIS INSTANTANEOUS CHANGES IN FLOW OF SOLUTION	II	899	25/08/00	16:30	CC		19	PS	19
Farina, W. M.	3482	SUGAR SOLUTION LOADING AND UNLOADING IN THE ANT CAMPONOTUS MUS IN RELATION TO WORKER SIZE	II	879	22/08/00	16:30	CC		19	PS	19
Farina, W. M.	3531	BEHAVIOURAL RESPONSES OF THE HONEYBEE TO ALARM-SCENTS AT THE FOOD SOURCE	II	891	24/08/00	16:30	CC		19	PS	19
Farkas, R.	1551	HYDROTAEA AENESCENS, A LARVAL PREDATOR OF THE HOUSE FLY: A SUMMARY OF RECENT RESERCH	I	391	22/08/00	16:30	CC		8	PS	8
Farneti, R.	1427	REARING HYMENOPTEROUS LARVAL PARASITOIDS OF APHIDS ON ARTIFICIAL DIETS	I	360	21/08/00	13:50	HM	O	8	2	8
Farnham, L.	1035	THE ROLE OF LEARNING AND MEMORY IN LEAF-CUTTING ANT FORAGING ECOLOGY	I	261	23/08/00	16:30	CC		6	PS	6
Faro, M. S.	2753	EVALUATION OF THE EFFICIENCY OF THE FARM CHEMICAL FASTANE I P (ALPHACYPERMETHRIN) TO CONTROL THE ANTS FROM THE GENUS ACROMYRMEX (HYMENOPTERA: FORMICIDAE)	II	695	23/08/00	16:30	CC		14	PS	14
Faroni, L. R. D'A.	4073	MODIFIED ATMOSPHERE IN BRAZILIAN GRAIN STORAGE	II	1028	22/08/00	16:30	CC		23	PS	23
Faroni, L. R. D'A.	4079	EFFECT OF THE SPRAYING TEMPERATURE ON THE DEGRADATION AND BIOLOGICAL EFFECTIVENESS OF PIRIMIPHOS-METHYL ON STORED GRAINS	II	1030	22/08/00	16:30	CC		23	PS	23
Faroni, L. R. D'A.	4108	MODELLING POPULATION GROWTH OF RHYZOPERTHA DOMINICA (COLEOPTERA: BOSTRICHIDAE) ON STORED WHEAT	II	1037	25/08/00	16:30	CC		23	PS	23
Faroni, L. R. D'A.	4021	TRICHOGRAMMA AND PARASITIC MITE AS POTENTIAL AGENTS FOR STORED GRAIN INSECT CONTROL IN BRAZIL	II	1015	22/08/00	11:30	HB	J	23	3	23
Farquhar, J.	3720	MOLECULAR PHYLOGENY OF BEMISIA TABACI (HOMOPTERA; ALEYRODIDAE) USING A MITOCHONDRIAL MARKER, THE 16S RIBOSOMAL SUBUNIT GENE	II	939	21/08/00	16:30	CC		21	PS	21
Farrell, B. D.	3623	HIGHER PHYLOGENY OF THE CURCULIONIDAE: EVIDENCE FROM A MOLECULAR AND MORPHOLOGICAL STUDY	II	915	21/08/00	15:20	HB	E	21	2	21
Farrell, B. D.	3841	THE PHYLOGENESIS OF CONIFER/ ANGIOSPERM HOST SHIFT AND DIVERSIFICATION IN GONDWANAN BARK BEETLES	II	969	25/08/00	16:30	CC		21	PS	21
Farrell, B. D.	2260	EVOLUTION OF LARVIFORM MALES IN THE INBREEDING BARK BEETLE OZOPEMON: FIERCE FIGHTERS OR JUST WEIRD?	I	570	22/08/00	16:30	CC		12	PS	12
Farrell, J. P.	2222	INSECT TRANSGENESIS: BACULOVIRUSES MEET TRANSPOSONS FOR BENEFICIAL INVASIONS	I	561	25/08/00	16:05	HB	L	12	10	12
Fashing, N. J.	28	THE FOOD WEBS OF ARTHROPOD COMMUNITIES IN NEPENTHES PITCHERS: WHERE DO HISTIOSTOMATID MITES FIT IN?	I	7	22/08/00	16:30	CC		1	PS	1
Fashing, N. J.	29	SETAL POLYMORPHISM WITHIN AND BETWEEN STASES IN AN ALGOPHAGID MITE INHABITANT OF WATER-FILLED TREEHOLES	I	8	22/08/00	16:30	CC		1	PS	1
Fattori, A. C.	2028	SETTING UP AN ENTOMOPATHOGENIC MICROORGANISMS COLLECTION AT THE CENTRO EXPERIMENTAL DO INSTITUTO BIOLOGICO/LABORATORIO DE CONTROLE BIOLOGICO, BRAZIL	I	512	21/08/00	16:30	CC		11	PS	11
Faulkes, Z.	1725	NEUROPHYSIOLOGICAL ANALYSIS OF ACOUSTIC SIGNALS IN CRICKETS: TEMPORAL PATTERN AND SOUND LOCALIZATION	I	435	22/08/00	14:00	HB	F	9	3	9
Fausto, A. M.	2467	CELL DIFFERENTIATION OF THE FOLLICULAR EPITHELIUM IN STICK INSECT OVARIOLES	II	623	23/08/00	16:30	CC		13	PS	13
Fausto, A. M.	3037	OVARIAN FOLLICLE DIFFERENTIATION IN INSECT OVARIOLES	II	766	21/08/00	11:30	HB	G	16	1	16
Fausto, A. M.	3136	BIOLOGY AND FUNCTIONAL MORPHOLOGY OF PACHYTELES LARVAE (COLEOPTERA: CARABIDAE: PAUSSINAE	II	791	22/08/00	16:30	CC		16	PS	16
Fausto, A.M.	3102	COMPARATIVE SPERMATOLOGY IN PLECOPTERA	II	783	26/08/00	15:45	HB	G	16	9	16
Fava, F.	321	EGG DEVELOPMENT IN DIATRAEA SACCHARALIS (LEPIDOPTERA: PYRALIDAE) UNDER DIFFERENT TEMPERATURE REGIMES	I	81	24/08/00	16:30	CC		2	PS	2
Fava, F.	361	ARMADILLIDIUM VULGARE (CRUSTACEA: ISOPODA): NEW PEST TO SOYBEANS IN ARGENTINA?	I	91	25/08/00	16:30	CC		2	PS	2
Favre, P.	3482	SUGAR SOLUTION LOADING AND UNLOADING IN THE ANT CAMPONOTUS MUS IN RELATION TO WORKER SIZE	II	879	22/08/00	16:30	CC		19	PS	19

Sub-titles: (HB=Hotel Bourbon) - (HM=Hotel Mabu) - (CC=Convention Center) - (Bol=Foz Boulevard) - (PS=Poster Session) - (PL=Plenary Lecturer)

AUTHOR	N°	TITLE	Book	Page	Date	Time	Local	Room	Session	Symp	New Session
Fay, H. A. C.	663	AN INTUITIVE APPROACH TO SELECTING UTILIZABLE ATTRACTANTS FOR A GENERAL FRUIT-FEEDING PEST: THE FRUITPIERCING MOTH EXPERIENCE	I	168	22/08/00	16:30	CC		4	PS	4
Fazolin, M.	494	DIVERSITY OF DIURNAL INSECTS SPECIES IN PLANTS OF AN AGROFORESTRY SYSTEM IN ACRE	I	125	22/08/00	16:30	CC		3	PS	3
Febles, J. C.	1547	POSSIBILITIES FOR THE USE OF ENCARSIA HISPIDA DE SANTIS (HYMENOPTERA: APHELINIDAE) IN THE BIOLOGICAL CONTROL OF THE SPIRALLING WHITEFLIES ALEURODICUS DISPERSUS RUSSELL AND LECANOIDEUS FLOCCISSIMUS MARTIN ET AL. (HEMIPTERA: ALEYRODIDAE)	I	390	23/08/00	16:30	CC		8	PS	8
Febvay, G.	1536	DEVELOPMENT OF TRICHOGRAMMA PRETIOSUM (HYMENOPTERA: TRICHOGRAMMATIDAE) IN ARTIFICIAL DIET, FOCUSING ON PROTEIN UTILIZATION	I	387	22/08/00	16:30	CC		8	PS	8
Febvay, G.	1665	FOOD AND CARCASS ANALYSES OF THE PREDATORY BUG HARMONIA AXYRIDIS (COLEOPTERA: COCCINELLIDAE) AS REFERENCES FOR THE ELABORATION OF ARTIFICIAL DIETS	I	420	25/08/00	16:30	CC		8	PS	8
Federici, B.	1240	MOSQUITO ACTIVES	I	313	22/08/00	15:35	HM	N	7	4	7
Federici, I.	1989	BACTERIA - ADVANCEMENTS AND RESEARCH NEEDS	I	502	21/08/00	10:05	HM	P	11	1	11
Feener Jr., D. H.	1206	FACTORS LIMITING THE RED IMPORTED FIRE ANT (SOLENOPSIS WAGNERI) IN ITS NATIVE RANGE IN BRAZIL	I	304	25/08/00	16:30	CC		6	PS	6
Feldmann, U.	2223	THE INTEGRATED AREA-WIDE APPROACH TO INSECT PEST MANAGEMENT, PROSPECTS FOR ITS APPLICATION TO TSETSE	I	561	25/08/00	9:35	HB	L	12	11	12
Felgenhauer, B. E.	2441	MEMBRANE DYNAMICS OF RAPID FLUID TRANSPORT IN THE MALPIGHIAN TUBULES OF THE HOUSE CRICKET, ACHETA DOMESTICUS	II	617	22/08/00	16:30	CC		13	PS	13
Felicioli, A.	965	THE AGONY OF A HONEYBEE COLONY PARASITIZED BY THE SARCOPHAGID FLY SENOTAINIA TRICUSPIS (MEIGEN): TEMPERATURE AND HUMIDITY VARIATIONS	I	244	22/08/00	16:30	CC		6	PS	6
Felicioli, A.	2423	PRELIMINARY INVESTIGATION ON INDIVIDUAL RESPIRATION OF ADULTS AND PUPAE OF OSMIA CORNUTA DURING DIAPAUSE BY MEANS OF A CO2 ANALYZER BASED ON AN INFRARED TUNABLE DIODE LASER	II	612	22/08/00	16:30	CC		13	PS	13
Felipe, M. A.	3435	TOLERANCE TO THE MITE VARROA JACOBSONI IN AFRICANIZED AND EUROPEAN BEES IN MEXICO	II	867	24/08/00	9:35	HM	Q	19	5	19
Felipe, M. A.	4173	HYGIENIC BEHAVIOR AND TOLERANCE TO VARROA JACOBSONI	II	1054	24/08/00	11:35	HM	Q	Erratum	5	19
Felipe, M. A.	3412	TOLERANCE TO THE MITE VARROA JACOBSONI IN AFRICANIZED AND EUROPEAN BEES IN MEXICO	II	861	21/08/00	16:30	CC		19	PS	19
Felippe, J. M.	3974	ACTIVITY OF THE INSECTICIDE/MITICIDE, PYRIDABEN, IN THE CONTROL OF SILVERLEAF WHITEFLY COMPLEX (BEMISIA TABACI - BIOTYPES "A" AND "B") IN SOME MAIN BRAZILIAN CROPS	II	1003	23/08/00	16:30	CC		22	PS	22
Felippe, M. R.	2861	EFFICIENCY OF THIAMETHOXAM TO CONTROL ONCOMETOPIA FACIALIS (HEMIPTERA: CICADELLIDAE) IN CITRUS	II	722	25/08/00	16:30	CC		14	PS	14
Felix, M.	3848	A NEW GENUS OF CICADELLINI (HEMIPTERA: CICADELLIDAE) FROM SOUTHEASTERN BRAZIL.	II	971	25/08/00	16:30	CC		21	PS	21
Fell, D.	680	OLFACTORY RESPONSES TO ISOAMYL ACETATE AND ADULTS OF THE LARGE MILKWEED BUGS (ONCOPELTUS FASCIATUS, HETEROPTERA:LYGAEIDAE) IN MALE AND FEMALE ANTENNAE OF THE SAME SPECIES	I	172	23/08/00	16:30	CC		4	PS	4
Feng, Q. L.	1320	AN RNA HELICASE OF THE "DEAD BOX" FAMILY CLONED FROM A LEPIDOPTERAN SPECIES, THE SPRUCE BUDWORM (CHORISTONEURA FUMIFERANA)	I	333	22/08/00	16:30	CC		7	PS	7
Feng, Q. L.	3325	GLUTATHIONE S-TRANSFERASE FROM THE SPRUCE BUDWORM, CHORISTONEURA FUMIFERANA: IDENTIFICATION, CHARACTER-IZATION, LOCALIZATION, CDNA CLONING, DEVELOPMENTAL EXPRESSION AND INDUCTION BY VARIOUS FACTORS	II	840	21/08/00	16:30	CC		18	PS	18
Feng, Q. L.	1845	BIOLOGICAL CONTROL OF FOREST PESTS USING INSECT SPECIFIC VIRUSES	I	465	23/08/00	14:35	HB	M	10	4	10
Feng, Q. L.	3280	MOLECULAR ANALYSIS OF THE OVERWINTERING DIAPAUSE IN THE SPRUCE BUDWORM, CHORISTONEURA FUMIFERANA	II	828	23/08/00	10:20	HB	K	18	4	18
Feng, Q.-L.	1838	AN OVERVIEW OF BIOTECHNOLOGICAL APPROACHES TO BIOLOGICAL AND BIORATIONAL CONTROL OF FOREST INSECT PESTS	I	463	23/08/00	9:35	HB	M	10	4	10
Feng, Q.-L.	2382	HORMONAL REGULATION OF CUTICLE FORMATION AND CHITIN SYNTHESIS	II	602	25/08/00	13:35	HB	I	13	9	13
Fenton, A. C.	2054	MODELS OF ENTOMOPATHOGENIC NEMATODES FOR BIOLOGICAL CONTROL	I	518	21/08/00	16:30	CC		11	PS	11
Fenton, A. C.	2053	ENTOMOPATHOGENIC NEMATODES AS BIOLOGICAL CONTROL AGENTS OF INSECT PESTS: A CLEARER UNDERSTANDING	I	518	21/08/00	16:30	CC		11	PS	11
Fereres, A.	127	PLANT VIRUS EPIDEMICS: CAN CULTURAL PRACTICES HELP CURB THIS LOOMING THREAT TO MODERN AGRICULTURE?	I	33	24/08/00	10:50	HB	A	2	7	2
Ferguson, J. S.	1321	PEPPER WEEVIL CONTROL WITH ACTARA 25WG	I	333	22/08/00	16:30	CC		7	PS	7
Ferkovich, S. M.	1435	LABORATORY PRODUCTION AND FIELD EVALUATION OF HYMEMOPTEROUS ECTOPARASITOIDS REARED ON ARTIFICIAL DIETS	I	362	21/08/00	15:50	HM	O	8	2	8
Ferla, N. J.	30	SPACIAL AND TEMPORAL DISTRIBUTION OF CALACARUS HEVEAE ON RUBBER TREES IN BRAZIL	I	8	22/08/00	16:30	CC		1	PS	1
Fernades, W. D.	72	POPULATIONAL FLOTATION OF ACARI EDAPHICS ON TILLAGE AND NO TILLAGE SYSTEMS IN THE AREA OF DOURADOS - MS	I	18	25/08/00	16:30	CC		1	PS	1
Fernande, P. M.	225	EFFECT OF THE INSECT GROWTH REGULATOR DIFLUBENZURON ON REPRODUCTION OF EUSCHISTUS HEROS (FABR.) (HETEROPTERA: PENTATOMIDAE)	I	57	22/08/00	16:30	CC		2	PS	2
Fernandes, A. M. V.	1522	TUTA ABSOLUTA PARASITISM BY TRICHOGRAMMA PRETIOSUM WITH NOTES ON HOST SITE	I	384	21/08/00	16:30	CC		8	PS	8
Fernandes, A.P.	3131	DETECTION OF CALCIUM AND CALMODULIN DURING SPERMIOGENESIS IN PHYTOPHAGOUS BUGS (HEMIPTERA: PENTATOMIDAE)	II	790	22/08/00	16:30	CC		16	PS	16
Fernandes, E. R.	2774	INTEGRATED METHODS TO CONTROL BEMISIA TABACI BIOTYPE B, IN MELONS	II	700	25/08/00	16:30	CC		14	PS	14
Fernandes, G. W.	664	PLANT HYPERSENSITIVE RESPONSE TO GALL INDUCTION ACROSS HOST TAXA	I	168	22/08/00	16:30	CC		4	PS	4
Fernandes, G. W.	504	BIODIVERSITY OF GALLING INSECTS: HISTORICAL, COMMUNITY AND HABITAT EFFECTS IN THE NEOTROPICAL SAVANNAS	I	128	22/08/00	16:30	CC		3	PS	3
Fernandes, G. W.	534	BUTTERFLY DIVERSITY IN SERRA DO CIPÓ, BRAZIL: A RELIMINARY SURVEY	I	135	24/08/00	16:30	CC		3	PS	3
Fernandes, G. W.	655	DAMAGE-INDUCED CHANGES ON LEAF QUALITY OF BAUHINIA BREVIPES (LEGUMINOSAE) AND INSECT HERBIVORE ATTACK	I	166	22/08/00	16:30	CC		4	PS	4
Fernandes, G. W.	833	CONSEQUENCES OF HOST PLANT RESISTANCE AND SENESCENCE TO THE SURVIVORSHIP AND DEVELOPMENT OF A NEOTROPICAL GALLING INSECT	I	211	23/08/00	11:35	HB	D	6	5	6
Fernandes, G. W.	1370	BUTTERFLY DIVERSITY IN SERRA DO CIPÓ, BRAZIL: A PRELIMINARY SURVEY	I	346	25/08/00	16:30	CC		7	PS	7
Fernandes, G. W.	2494	INFLUENCE OF WATER AND NUTRITIONAL STATUS OF BACCHARIS DRACUNCULIFOLIA ON THE ABUNDANCE AND RICHNESS OF ENDOPHYTES	II	630	24/08/00	16:30	CC		13	PS	13
Fernandes, G. W.	836	RESOURCE ALLOCATION VERSUS SEASONAL VARIATIONS AND THE COMMUNITY OF GALLING-INSECTS ON THE TROPICAL DIOECIOUS SHRUB BACCHARIS CONCINNA (ASTERACEAE)	I	211	23/08/00	13:45	HB	D	6	5	6
Fernandes, G. W.	842	PLANT RESISTANCE AGAINST GALL-FORMING INSECTS: THE ROLE OF PLANT HYPERSENSITIVITY	I	213	23/08/00	15:15	HB	D	6	5	6
Fernandes, G. W.	964	PLANT QUALITY AND GALLING HERBIVORE POPULATION ECOLOGY ON BACCHARIS DRACUNCULIFOLIA	I	243	22/08/00	16:30	CC		6	PS	6
Fernandes, G. W.	1090	GALLING HERBIVORY MEDIATED BY MUTUALISTIC INTERACTIONS BETWEEN ANTS AND APHIDS IN BACCHARIS DRACUNCULIFOLIA (ASTERACEAE)	I	275	24/08/00	16:30	CC		6	PS	6
Fernandes, G. W.	1722	HYPERSENSITIVITY AND PLANT BEHAVIOR AGAINST PARASITES	I	434	22/08/00	10:05	HB	F	9	2	9

Sub-titles: (HB=Hotel Bourbon) - (HM=Hotel Mabu) - (CC=Convention Center) - (Bol=Foz Boulevard) - (PS=Poster Session) - (PL=Plenary Lecturer)

AUTHOR	Nº	TITLE	Book	Page	Date	Time	Local	Room	Session	Symp	New Session
Fernandes, J. A. M.	3754	CLADISTIC ANALYSIS OF ANTITEUCHUS (HETEROPTERA, PENTATOMIDAE, DISCOCEPHALINAE)	II	948	22/08/00	16:30	CC		21	PS	21
Fernandes, J. A. M.	3755	DESCRIPTION OF THE CERVUS-GROUP OF EDESSA (HETEROPTERA, PENTATOMIDAE, EDESSINAE)	II	948	22/08/00	16:30	CC		21	PS	21
Fernandes, J. A. M.	3756	DESCRIPTION OF THE DOLICHOCERA-GROUP OF EDESSA (HETEROPTERA, PENTATOMIDAE, EDESSINAE)	II	948	22/08/00	16:30	CC		21	PS	21
Fernandes, J. A. M.	3757	DESCRIPTION OF THE BECKERI-GROUP OF EDESSA (HETEROPTERA, PENTATOMIDAE, EDESSINAE)	II	948	22/08/00	16:30	CC		21	PS	21
Fernandes, J. A. M.	3758	NOMENCLATURAL CHANGES IN EDESSINAE (HETEROPTERA, PENTATOMIDAE)	II	949	22/08/00	16:30	CC		21	PS	21
Fernandes, J. B.	3433	GROWTH INHIBITION OF THE SYMBIOTIC FUNGUS OF ATTA SEXDENS, BY NATURAL PRODUCTS AND SYNTHETIC COMPOUNDS	II	867	23/08/00	11:35	HM	Q	19	4	19
Fernandes, J. B.	1309	METANOLIC EXTRACTS FROM DIMORPHANDRA MOLLIS (BARBATIMÃO) AND THEIR ACTIVITY IN WORKERS OF APIS MELLIFERA	I	330	21/08/00	16:30	CC		7	PS	7
Fernandes, J. B.	2122	PIPERONYL DERIVATES BASED ON SESAMIN AND THEIR INHIBITION OF THE SYMBIOTIC FUNGUS OF LEAF-CUTTING ANTS	I	535	24/08/00	16:30	CC		11	PS	11
Fernandes, M. C.	1322	PESTICIDES EFFECTS ON CHRYSOPERLA EXTERNA (NEUROPTERA: CHRYSOPIDAE)	I	334	22/08/00	16:30	CC		7	PS	7
Fernandes, M. C.	966	RESISTANCE MANAGEMENT OF TUTA ABSOLUTA (LEPIDOPTERA: GELECHIIDAE) TO SPINOSAD	I	244	23/08/00	16:30	CC		6	PS	6
Fernandes, O. A.	2670	MELON RESPONSE TO SILVERLEAF WHITEFLY INJURY	II	674	22/08/00	16:30	CC		14	PS	14
Fernandes, O. A.	2671	INTRODUCTION-PART I: CHALLENGES AND OPPORTUNITIES FOR PEST MANAGEMENT OF BEMISIA IN THE NEW CENTURY	II	675	22/08/00	16:30	CC		14	PS	14
Fernandes, O. A.	2743	EVALUATION OF INDOXACARB FOR LEPIDOPTEROUS PESTS CONTROL ON VEGETABLES	II	693	22/08/00	16:30	CC		14	PS	14
Fernandes, O. A.	2761	SPATIAL DISTRIBUTION OF SILVERLEAF WHITEFLY IN MELON	II	697	23/08/00	16:30	CC		14	PS	14
Fernandes, O. A.	2775	INTRODUCTION-PART 2: CHALLENGES AND OPPORTUNITIES FOR PEST MANAGEMENT OF BEMISIA IN THE NEW CENTURY	II	701	25/08/00	16:30	CC		14	PS	14
Fernandes, O. A.	1081	NUTRITIONAL AND BIOLOGICAL ASPECTS OF VELVETBEAN CATERPILLAR ON SOYBEAN GENOTYPES WITH AND WITHOUT INJURY	I	273	23/08/00	16:30	CC		6	PS	6
Fernandes, O. A.	1082	VELVETBEAN CATERPILLARS PREFERENCE TO SOYBEAN GENOTYPES WITH AND WITHOUT INJURY	I	273	23/08/00	16:30	CC		6	PS	6
Fernandes, O. D.	1248	INSECT RESISTANCE MANAGEMENT ON INSECT PROTECTED CROP IN LATIN AMERICA: PERSPECTIVES, CHALENGES AND EXPERIENCES	I	315	23/08/00	13:30	HM	N	7	6	7
Fernandes, P. M.	236	POPULATIONAL COMPOSITION AND SOIL MOBILITY OF SCAPTOCORIS CASTANEA (HETEROPTERA:CYDNIDAE) IN GOIÁS, BRAZIL	I	60	22/08/00	16:30	CC		2	PS	2
Fernandes, P. M.	1917	WOOD LOSS IN EUCALYPTUS PLANTATIONS BY COPTOTERMES SP. (ISOPTERA:RHINOTERMITIDAE) IN GOIAS–BRAZIL	I	483	21/08/00	16:30	CC		10	PS	10
Fernandes, P. M.	3483	MONITORING TERMITES IN SUGAR CANE FIELDS IN GOIAS, BRAZIL: A PROFITABLE INVESTIMENT.	II	879	23/08/00	16:30	CC		19	PS	19
Fernandez Diaz, C.I.	561	RHOPALOCEROS FROM IGUAZU NATIONAL PARK (MISIONES, ARGENTINA)	I	142	25/08/00	16:30	CC		3	PS	3
Fernandez Diaz, C.I.	562	DISTRIBUTION OF SOME SWALLOWTAIL BUTTERFLIES OF POSADAS, MISIONES, ARGENTINA	I	142	25/08/00	16:30	CC		3	PS	3
Fernandez Diaz, C. I.	302	INSECTS ASSOCIATED WITH TOBACCO CULTURE WITHOUT CHEMICAL MANAGEMENT IN MISIONES ARGENTINA	I	77	25/08/00	16:30	CC		2	PS	2
Fernández M., H.	3484	MYCOCEPURUS SMITHI IN PUERTO RICO: LIFE HISTORY OF A PHYLOGENETICALLY BASAL FUNGUS-GARDENING ANT	II	879	22/08/00	16:30	CC		19	PS	19
Fernández, D.	668	NITROGENOUS COMPOUNDS AS ATTRACTANTS OF TRIATOMA INFESTANS	I	169	22/08/00	16:30	CC		4	PS	4
Fernandez, H. R.	495	STRUCTURE AND DIVERSITY OF STREAM INSECT ASSEMBLAGES APPLIED TO ASSESSMENT: THE LULES RIVER (TUCUMAN, ARGENTINA)	I	125	22/08/00	16:30	CC		3	PS	3
Fernández, J.	3826	SOME WINTER GEOMETRIDS FROM CENTRAL SPAIN (INSECTA: LEPIDOPTERA, GEOMETRIDAE)	II	966	24/08/00	16:30	CC		21	PS	21
Fernández, J.	3487	DEMOGRAPHY OF CAMPONOTUS PUNCTULATUS ANTS ALONG A GRADIENT OF AGRICULTURAL DISTURBANCE AND THROUGH TIME	II	880	24/08/00	16:30	CC		19	PS	19
Fernández, J.	3759	THE GENUS CRYPHIA (INSECTA, LEPIDOPTERA, NOCTUIDAE) IN CENTRAL SPAIN	II	949	22/08/00	16:30	CC		21	PS	21
Fernández, J.	3857	CONTRIBUTION TO THE KNOWLEDGE OF BUTTERFLIES IN THE COIBA NATIONAL PARK, PANAMA. (LEPIDOPTERA: PAPILIONOIDEA)	II	973	24/08/00	16:30	CC		21	PS	21
Fernández, L. A.	967	THE ANNUAL LIFE CYCLE OF AN POPULATION OF DERALLUS ANGUSTUS (COLEOPTERA, HYDROPHILIDAE)	I	244	22/08/00	16:30	CC		6	PS	6
Fernández, M.	968	A STUDY OF MACROINVERTEBRATES IN RIVES ECOSYSTEMS (NW IBERIAN PENINSULA), AFFECTED BY SMALL HYDROELECTRIC DAMS	I	244	22/08/00	16:30	CC		6	PS	6
Fernández, M. J.	2958	ISOENZYMATIC CHARACTERIZATION OF TRIATOMA INFESTANS POPULATIONS FROM EASTERN AND WESTERN REGIONS OF PARAGUAY	II	746	21/08/00	16:30	CC		15	PS	15
Fernández, M.J.	3154	MORPHOMETRIC DIFFERENCES OF TRIATOMA INFESTANS FROM THE EASTERN AND WESTERN REGIONS OF PARAGUAY	II	796	23/08/00	16:30	CC		16	PS	16
Fernández, P. C.	3494	RECRUITMENT IN HONEYBEES: HOW DO FORAGERS AND HIVEMATES INTERACT ACCORDING TO THE FOOD SOURCE PROFITABILITY?	II	882	23/08/00	16:30	CC		19	PS	19
Fernández, R.	999	DO HOST PLANT TRAITS AND GALLING INSECTS AFFECT THE ABUNDANCE OF ISSUS SP. ON COLLIGUAJA ODORIFERA ALONG AN ALTITUDINAL GRADIENT?	I	252	22/08/00	16:30	CC		6	PS	6
Ferran, A.	1426	ARTIFICIAL DIETS FOR REARING PREDATORS AND PARASITOIDS OF GREENHOUSE PEST INSECTS	I	360	21/08/00	13:35	HM	O	8	2	8
Ferran, A.	1665	FOOD AND CARCASS ANALYSES OF THE PREDATORY BUG HARMONIA AXYRIDIS (COLEOPTERA: COCCINELLIDAE) AS REFERENCES FOR THE ELABORATION OF ARTIFICIAL DIETS	I	420	25/08/00	16:30	CC		8	PS	8
Ferrão, M. A. G.	1325	EFFECT OF THIAMETHOXAN ON BEAN CROP DEVELOPMENT	I	334	22/08/00	16:30	CC		7	PS	7
Ferrara, F. A. A.	237	PEST-INSECTS ASSOCIATED WITH CITRUS IN BOM JESUS DO ITABAPOANA, RJ, BRAZIL	I	60	22/08/00	16:30	CC		2	PS	2
Ferrara, F. A. A.	238	PRELIMINARY SURVEY OF TEPHRITID FRUIT FLIES IN THE NORTHWEST OF THE RIO DE JANEIRO STATE, BRAZIL	I	61	22/08/00	16:30	CC		2	PS	2
Ferrara, F. A. A.	2055	EVALUATION OF THE EFFICIENCY OF BACILLUS THURINGIENSIS IN THE CONTROL OF URBANUS ACAWOIOS (LEPIDOPTERA: HESPERIIDAE)	I	518	21/08/00	16:30	CC		11	PS	11
Ferrara, F. A. A.	1625	OCCURRENCE OF SCALES, WHITEFLIES AND NATURAL ENEMIES IN CITRIC PLANTS IN THE MUNICIPAL DISTRICT OF CÁCERES, MT, BRASIL	I	410	25/08/00	16:30	CC		8	PS	8
Ferrara, F. A. A.	1049	DETERMINATION OF THE INFLUENCE OF THE MATURITY OF THE LEAVES OF CLITORIA FAIRCHILDIANA IN THE DEVELOPMENT OF URBANUS ACAWOIOS (LEPIDOPTERA: HESPERIIDAE)	I	265	23/08/00	16:30	CC		6	PS	6
Ferraro, G.	1310	IDENTIFICATION OF A CHEMICAL FRACTION FROM AROMATIC HERBS WITH INSECTICIDAL ACTIVITY AGAINST TRIBOLIUM CASTANEUM (COLEOPTERA, TENEBRIONIDAE)	I	331	21/08/00	16:30	CC		7	PS	7
Ferraz, M. V.	3485	SWARMING BEHAVIOUR OF THE ECONOMICALLY MOST IMPORTANT TERMITE, COPTOTERMES HAVILANDI, IN SOUTHEAST BRAZIL	II	880	22/08/00	16:30	CC		19	PS	19
Ferreira, A. H. P.	2424	PURIFICATION AND CHARACTERIZATION OF TENEBRIO MOLITOR MIDGUT β-GLYCOSIDASES	II	612	22/08/00	16:30	CC		13	PS	13
Ferreira, A. J.	2806	CHEMICAL CONTROL OF "LEAF MINER", LEUCOPTERA COFFEELLA WITH BINFENTHRIN 100 CE LONELY AND ASSOCIATE WITH ANOTHERS INSECTICIDES, IN COFFEE CROP	II	708	24/08/00	16:30	CC		14	PS	14
Ferreira, A. J.	2807	CHEMICAL CONTROL OF "LITTLE FRUIT BORER", NEOLEUCINODES ELEGANTALLIS WITH LAMBDACYHALOTHRIN 50 CS AND 50 CE IN TOMATO CROP	II	709	24/08/00	16:30	CC		14	PS	14

Sub-titles: (HB=Hotel Bourbon) - (HM=Hotel Mabu) - (CC=Convention Center) - (Bol=Foz Boulevard) - (PS=Poster Session) - (PL=Plenary Lecturer)

AUTHOR	Nº	TITLE	Book	Page	Date	Time	Local	Room	Session	Symp	New Session
Ferreira, A. J.	2823	EFFICIENCY OF THE INSECTICIDE LAMBDACYHALOTHRIN 50 CS, 250 CS, 50 EC AND ASSOCIATE WITH CHLORPYRIFOS 480 BR, FOR THE CONTROL OF " LEAF MINER" LEUCOPTERA COFFEELLA, IN COFFEE CROP	II	713	24/08/00	16:30	CC		14	PS	14
Ferreira, C.	2424	PURIFICATION AND CHARACTERIZATION OF TENEBRIO MOLITOR MIDGUT ß-GLYCOSIDASES	II	612	22/08/00	16:30	CC		13	PS	13
Ferreira, C.	2399	ISOLATION OF PERITROPHIC MEMBRANE PROTEINS AND THEIR SECRETION BY SPODOPTERA FRUGIPERDA (LEPIDOPTERA) LARVAE	II	606	21/08/00	16:30	CC		13	PS	13
Ferreira, E.	3154	MORPHOMETRIC DIFFERENCES OF TRIATOMA INFESTANS FROM THE EASTERN AND WESTERN REGIONS OF PARAGUAY	II	796	23/08/00	16:30	CC		16	PS	16
Ferreira, E.	2598	RICE INTEGRATED PEST MANAGEMENT STATUS IN BRAZIL	II	656	25/08/00	11:35	HB	B	14	8	14
Ferreira, G. A.	1523	ECOLOGICAL ASPECTS AND DAMAGE EVALUATION OF FUIT FLIES IN CAGAITA IN THE SAVANNAS OF GOIAS STATE, BRAZIL.	I	384	21/08/00	16:30	CC		8	PS	8
Ferreira, G. A.	3998	INSECT DIVERSITY OCCURRING ON CAGAITA IN SAVANNAS OF GOIÁS, BRAZIL	II	1009	25/08/00	16:30	CC		22	PS	22
Ferreira, I. T.	3504	ADAPTATION OF THE SUBTERRANEAN TERMITE COPTOTERMES HAVILANDI (ISOPTERA: RHINOTERMITIDAE) TO THE INTERIOR OF BRAZIL	II	884	22/08/00	16:30	CC		19	PS	19
Ferreira, J. M. S.	665	EFFICIENCY OF DIFFERENTS LURES AND THEIR PROBABLE INTERACTION IMPROVING RHYNCHOPHORUS PALMARUM ADULTS ATTRACTION TO THE TRAPS	I	168	22/08/00	16:30	CC		4	PS	4
Ferreira, J. M. S.	666	EVALUATION OF THE "PET" TRAP EFFICIENCY ON THE CAPTURE OF ADULTS OF RHYNCHOPHORUS PALMARUM AND THE COST/BENEFIT ANALISYS	I	168	22/08/00	16:30	CC		4	PS	4
Ferreira, J. M. S.	2056	CONIDIAL VIABILITY OF TWO ENTOMOPATHOGENOUS FUNGI KEPT ON AQUEOUS SUSPENSION UNDER DIFFERENTS STORAGE CONDITIONS AND PERIOD	I	519	22/08/00	16:30	CC		11	PS	11
Ferreira, J. M. S.	2057	EFFICIENCY OF THE ENTOMOPATHOGENOUS FUNGUS BEAUVERIA BASSIANA (BBBR057/CPATC) STRAIN ON BLACK COCONUT BUNCH WEEVIL HOMALINOTUS CORIACEUS (COLEOPTERA: CURCULIONIDAE)	I	519	22/08/00	16:30	CC		11	PS	11
Ferreira, J. M. S.	2058	EFFICIENCY OF THE ENTOMOPATHOGENOUS FUNGUS BEAUVERIA BASSIANA (BbBr057/CPATC) STRAIN ON THE AMERICAN PALM WEEVIL RHYNCHOPHORUS PALMARUM (COLEOPTERA:CURCULIONIDAE)	I	519	22/08/00	16:30	CC		11	PS	11
Ferreira, M. C.	239	EFFECT OF RATES, VOLUMES AND APPLICATIONS METHODS ON THE CONTROL OF SPODOPTERA FRUGIPERDA IN MAIZE BY METHOMYL	I	61	23/08/00	16:30	CC		2	PS	2
Ferreira, M. C.	3942	CONTROL OF SPODOPTERA FRUGIPERDA IN CORN FIELD BY DIFFERENT METHOMYL RATES, VOLUMES AND APPLICATIONS METHODS	II	995	21/08/00	16:30	CC		22	PS	22
Ferreira, M. C.	31	MODEL FOR OPTIMISATION OF THE WORKRATE OF AIRBLAST SPRAYERS ON CONTROL OF BREVIPALPUS PHOENICIS	I	8	22/08/00	16:30	CC		1	PS	1
Ferreira, M. C.	32	MODEL FOR REDUCTION OF THE COSTS AND ENVIRONMENTAL IMPACTS ON THE CONTROL OF BREVIPALPUS PHOENICIS	I	8	22/08/00	16:30	CC		1	PS	1
Ferreira, R. J.	2425	ELETROFORETIC PROFILES FROM ADULTS OF CHRYSOPERLA EXTERNA FED ON DIFFERENT DIETS	II	613	22/08/00	16:30	CC		13	PS	13
Ferreira, R. J.	2426	TROUBLES ABOUT THE USAGE OF ANGOUMOIS GRAIN MOTH EGGS TO FEEDING CHRYSOPID LARVAE	II	613	22/08/00	16:30	CC		13	PS	13
Ferreira, R. J.	3326	STORAGE OF EGGS, LARVAE AND PUPAE OF CHRYSOPERLA EXTERNA IN DIFFERENTS PERIODS OF TIME AND TEMPERTURES	II	840	21/08/00	16:30	CC		18	PS	18
Ferreira, R. J.	955	GREEN LACEWINGS OCCURENCE ON WEEDS IN CROP CORN	I	241	22/08/00	16:30	CC		6	PS	6
Ferreira, R. J.	1322	PESTICIDES EFFECTS ON CHRYSOPERLA EXTERNA (NEUROPTERA: CHRYSOPIDAE)	I	334	22/08/00	16:30	CC		7	PS	7
Ferreira, R. J.	1479	HOST SPECIES AND AGE SELECTION BY TRICHOGRAMMA PRETIOSUM IN GREEN LACEWING SPECIES	I	373	21/08/00	16:30	CC		8	PS	8
Ferreira, R. J.	1524	ACARICIDES SELETIVITY EVALUATION ON CHRYSOPERLA EXTERNA (NEUROPTERA: CHRYSOPIDAE)	I	384	23/08/00	16:30	CC		8	PS	8
Ferreira, R. L. M.	969	DAILY AND SEASONAL ACTIVITY OF HORSE FLIES (DIPTERA:TABANIDAE) ATTACKING REPTILES: CAIMAN CROCODILUS (ALLIGATORIDAE) AND EUNECTES MURINUS (BOIDAE), IN AN ANTHROPOGENIC CLEARING IN CENTRAL AMAZON, BRAZIL	I	245	22/08/00	16:30	CC		6	PS	6
Ferreira, R. L. M.	2059	OCCURRENCE OF CULICIDAE (DIPTERA) LARVAE IN WATER HELD IN AQUASCYPHA HYDROPHORA (FUNGUS:STEREACEAE) IN CENTRAL AMAZON, BRAZIL	I	519	23/08/00	16:30	CC		11	PS	11
Ferreira, W. M.	2095	LARGE SCALE BACILLUS SPHAERICUS PRODUCTION	I	528	23/08/00	16:30	CC		11	PS	11
Ferreira-da-Silva, C. T.	1306	INSECTICIDAL PROPERTIES OF CANATOXIN, A TOXIC PROTEIN FROM CANAVALIA ENSIFORMIS SEEDS, AND ITS ENTOMOTOXIC PEPTIDES	I	330	21/08/00	16:30	CC		7	PS	7
Ferrer, F.	1446	TECHNOLOGY TRANSFER IN AUGMENTATIVE BIOLOGICAL CONTROL: AUTOMATION FOR COMMERCIAL PRODUCTION AND APPLICATION OF NATURAL ENEMIES	I	365	22/08/00	15:05	HM	O	8	4	8
Ferrero, A.	649	INSECTICIDE ACTIVITY OF COTTON CRUDE OIL ON ADULTS OF CYDIA POMONELLA (LEPIDOPTERA:TORTRICIDAE)	I	164	23/08/00	16:30	CC		4	PS	4
Ferrero, A.	1314	INSECTICIDES TOXICITY TO DIURAPHIS NOXIA (HOMOPTERA:APHIDIDAE)	I	332	21/08/00	16:30	CC		7	PS	7
Ferrero, A.	1315	TOXICITY OF DELTAMETRIN TO A STRAIN OF TRIBOLIUM CASTANEUM (COLEOPTERA: TENEBRIONIDAE)	I	332	21/08/00	16:30	CC		7	PS	7
Ferrin, J. M.	1052	SEX RATIO IN THE ADULTS OF THE BUTTERFLY EUPHYDRYAS DESFONTAINII IN CENTRAL SPAIN	I	265	23/08/00	16:30	CC		6	PS	6
Ferro, C. L.	2416	POST-EMBRYONIC DEVELOPMENT OF CALYPTRATE FLIES IN ARTIFICIAL DIETS I. CHRYSOMYA MEGACEPHALA (DIPTERA: CALLIPHORIDAE)	II	610	21/08/00	16:30	CC		13	PS	13
Ferro, V. G.	970	PERFORMANCE OF UTETHEISA ORNATRIX (LEP.: ARCTIIDAE) IN TWO SPECIES OF CROTALARIA SP. (FABACEAE) HOST PLANTS	I	245	22/08/00	16:30	CC		6	PS	6
Feschotte, C.	2247	RAPID GENOME SHUFFLING BY TRANSPOSABLE ELEMENTS: WHAT CAN WE LEARN FROM CULEX PIPIENS MOSQUITOES?	I	567	21/08/00	16:30	CC		12	PS	12
Feschotte, V	2210	TRANSPOSABLE ELEMENTS IN CULICINES MOSQUITO GENOMES : CLASSICAL AND ODD STRUCTURES, HIGH COPY NUMBER AND ROLE IN POPULATION POLYMORPHISM	I	558	24/08/00	15:15	HB	L	12	8	12
Fewell, J. H.	3062	FLIGHT RESPIRATION AND ENERGETICS	II	773	23/08/00	14:35	HB	G	16	5	16
Fewell, J. H.	3518	GENETIC MECHANISMS CONTRIBUTING TO DIFFERENCES IN COLONY GROWTH RATES BETWEEN AFRICAN AND EUROPEAN HONEY BEES	II	888	23/08/00	16:30	CC		19	PS	19
Feyereisen, R.	2477	REGULATION OF JH LEVELS IN MOSQUITOES	II	626	23/08/00	16:30	CC		13	PS	13
ffrench-Constant, R. H.	971	SEX, BUTTERFLIES AND BATESIAN MIMICRY: COLOUR PATTERN FORMATION IN THE TIGER SWALLOWTAIL	I	245	22/08/00	16:30	CC		6	PS	6
ffrench-Constant, R. H.	1227	THE MOLECULAR BASIS OF TARGET SITE RESISTANCE: HOW MANY MUTATIONS?	I	310	21/08/00	13:35	HM	N	7	2	7
ffrench-Constant, R. H.	1238	NOVEL INSECTICIDAL TOXINS FROM PHOTORHABDUS: ALTERNATIVES TO BT?	I	313	22/08/00	14:35	HM	N	7	4	7
ffrench-Constant, R. H.	1264	HOW OFTEN DOES RESISTANCE ARISE IN NATURAL POPULATIONS: CYCLODIENE RESISTANCE AS A CASE STUDY	I	319	24/08/00	15:05	HM	N	7	8	7
ffrench-Constant, R. H.	2383	SEX, BUTTERFLIES AND BATESIAN MIMICRY: COLOUR PATTERN FORMATION IN THE TIGER SWALLOWTAIL	II	602	25/08/00	14:05	HB	I	13	9	13
Fiandra, L.	2456	ROLE OF ACTIVATORS OF THE ABSORPTION OF AMINO ACIDS BY THE MIDGUT IN BOMBYX MORI LARVAL NUTRITION	II	620	23/08/00	16:30	CC		13	PS	13
Fickle, D. S.	2857	INTEGRATED PEST MANAGEMENT (IPM) OF GRAPES IN OHIO	II	721	25/08/00	16:30	CC		14	PS	14
Fidalgo, A. A. P.	1517	PRELIMINARY EVALUATION OF AGENIASPIS CITRICOLA (HYM: ENCYRTIDAE) ATTACKING PHYLLOCNISTIS CITRELLA (CITRUS LEAFMINER) IN ARGENTINA	I	383	21/08/00	16:30	CC		8	PS	8
Fidalgo, A. O.	972	NECTAR AND POLLEN COLLECTION PATTERNS OF MELIPONA BICOLOR BICOLOR (HYMENOPTERA, APIDAE, MELIPONINAE)	I	245	22/08/00	16:30	CC		6	PS	6

Sub-titles: (HB=Hotel Bourbon) - (HM=Hotel Mabu) - (CC=Convention Center) - (Bol=Foz Boulevard) - (PS=Poster Session) - (PL=Plenary Lecturer)

AUTHOR	Nº	TITLE	Book	Page	Date	Time	Local	Room	Session	Symp	New Session
Fidalgo, A. O.	1012	CIRCADIAN RHYTHMS ON NECTAR AND POLLEN COLLECTION BY FORAGERS OF MELIPONA BICOLOR BICOLOR (HYMENOPTERA, APIDAE, MELIPONINAE)	I	255	22/08/00	16:30	CC		6	PS	6
Fidalgo, P.	1368	INSECTS ENEMIES OF THE BLACK SCALE, SAISSETIA OLEAE ON OLIVE IN ARGENTINA	I	345	24/08/00	16:30	CC		7	PS	7
Fiedler, K.	458	DIVERSITY OF PYRALOIDEA MOTHS ALONG A GRADIENT OF RAINFOREST DISTURBANCE IN NORTHERN BORNEO	I	116	26/08/00	15:05	HB	C	3	10	3
Field, F.	99	HABITAT FRAGMENTATION AND ITS CONSEQUENCES FOR PLANT-POLLINATOR MUTUALISMS IN SOUTH AFRICA	I	26	22/08/00	12:00	HB	A	2	3	2
Field, L. H.	3132	FUNCTIONAL MORPHOLOGY OF TREE WETA MANDIBULAR WEAPONS	II	790	22/08/00	16:30	CC		16	PS	16
Fields, P.	4080	LABORATORY AND GRANARY TRIALS USING PEA PROTEIN TO CONTROL STORED-PRODUCT INSECTS	II	1030	22/08/00	16:30	CC		23	PS	23
Fields, P.	4054	NATURAL PRODUCT REPELLANTS OR ATTRACTANTS: PART OF A SOLUTION TO CONTROL STORED-PRODUCT INSECTS	II	1024	24/08/00	14:15	HB	J	23	9	23
Fields, P. G.	4041	CANADIAN GRAIN STORAGE CD-ROM	II	1020	23/08/00	15:30	HB	J	23	7	23
Fields, P. G.	3908	LOW TEMPERATURE TO CONTROL STORED-GRAIN INSECTS	II	986	24/08/00	14:00	HB	H	22	6	22
Fields, P. G.	4008	EFFICACY OF DIATOMACEOUS EARTHS AND HEAT TO CONTROL INSECT PESTS IN FLOUR MILLS	II	1012	21/08/00	13:35	HB	J	23	2	23
Fields, P. G.	4010	DIATOMACEOUS EARTH TO CONTROL STORED-GRAIN INSECTS	II	1013	21/08/00	14:45	HB	J	23	2	23
Figueira, J. E. C.	1016	COMMUNITY OF INSECTS FROM PAEPALANTHUS BROMELIOIDES: A NEW PHYTOTELMATA PLANT	I	256	23/08/00	16:30	CC		6	PS	6
Figueira, L. K.	2672	BIOLOGY OF IMMATURE CHRYSOPERLA EXTERNA PREDATOR FED WITH SCHIZAPHIS GRAMINUM APHIDS REARED ON RESISTANT, MODERATELY RESISTANT AND SUSCEPTIBLE SORGHUM GENOTYPES	II	675	22/08/00	16:30	CC		14	PS	14
Figueira, L. K.	2673	EFFECTS OF SORGHUM GENOTYPES RESISTANCE TO SCHIZAPHIS GRAMINUM ON CHRYSOPERLA EXTERNA FECUNDITY	II	675	22/08/00	16:30	CC		14	PS	14
Figueiredo, A. L. P.	3373	EFFECT OF FOOD QUALITY ON THE FECUNDITY OF SPITTLEBUG	II	852	22/08/00	16:30	CC		18	PS	18
Figueiredo, D.	973	MAPPING, SURVEYING AND MODELLING INSECTS USING GIS TOOLS. CASE STUDY: CERAMBYX CERDO AND CERAMBYX VELUTINUS (COLEOPTERA: CERAMBYCIDAE) IN ALQUEVA DAM- PORTUGAL	I	246	22/08/00	16:30	CC		6	PS	6
Figueiredo, E.	1757	DIAPAUSE TO FACILITATE THE REARING OF HELICOVERPA ARMIGERA (HBN.) (LEPIDOPTERA, NOCTUIDAE)	I	443	21/08/00	16:30	CC		9	PS	9
Figueiredo, E.	2060	NOCTUIDAE PARASITOID COMPLEX IN GREENHOUSE VEGETABLE CROPS IN OESTE REGION (PORTUGAL)	I	520	22/08/00	16:30	CC		11	PS	11
Figueiredo, E.	2129	WHITEFLIES AND THEIR PARASITOIDS' STATEMENTS IN HORTICULTURAL PROTECTED CROPS IN PORTUGAL	I	537	24/08/00	16:30	CC		11	PS	11
Figueiredo, E.	2757	IPM PROGRAMMES FOR PROTECTED VEGETABLE CROPS (IN OESTE REGION OF PORTUGAL)	II	696	23/08/00	16:30	CC		14	PS	14
Figueiredo, E.	169	INFLUENCE OF CROPPING SEASON IN FORAGING ACTIVITY OF BUMBLEBEE IN GREENHOUSE TOMATO CROP	I	43	21/08/00	16:30	CC		2	PS	2
Figueiredo, E.	2696	CONSTRAINTS FACED BY THE GREENHOUSE VEGETABLES GROWERS USING BUMBLEBEES TO POLLINATION	II	681	22/08/00	16:30	CC		14	PS	14
Figueiredo, M. B.	3143	MORPHOLOGY OF THE LARVA AND OBSERVATIONS ON BIOLOGY OF PLATYPUS MUTATUS (COLEOPTERA, CURCULIONIDAE, PLATYPODINAE)	II	793	24/08/00	16:30	CC		16	PS	16
Figueiredo, M. L. C.	1513	EFFECT OF A NUCLEAR POLYHEDROSIS VIRUS ON SPODOPTERA FRUGIPERDA LARVAE, ITS DAMAGE AND YIELD OF MAIZE CROP AT DIFFERENT EGG MASS INFESTATION LEVELS	I	382	21/08/00	16:30	CC		8	PS	8
Figueiredo, M. L. C.	2674	STRATEGY MANAGEMENT OF SPODOPTERA FRUGIPERDA THROUGH SELECTIVITY OF INSECTICIDE	II	675	22/08/00	16:30	CC		14	PS	14
Figueiredo, V. L. C.	3377	HEXOKINASE ISOENZYME PATTERN IN THE DEVELOPMENT OF APIS MELLIFERA DRONES	II	853	25/08/00	16:30	CC		18	PS	18
Figueroa, D.	1700	BIOLOGICAL CONTROL OF THE CITRUS LEAFMINER (LEPIDOPTERA: GRACILLARIIDAE) IN NORTHWEST ARGENTINA	I	428	21/08/00	16:30	CC		8	PS	8
Fileni, D. H.	2753	EVALUATION OF THE EFFICIENCY OF THE FARM CHEMICAL FASTANE 1 P (ALPHACYPERMETHRIN) TO CONTROL THE ANTS FROM THE GENUS ACROMYRMEX (HYMENOPTERA: FORMICIDAE)	II	695	23/08/00	16:30	CC		14	PS	14
Fileni, D. H.	2754	A DOSE RECOMENDATION AND AN EVALUATION OF THE EFFICIENCY OF THE FARM CHEMICAL FASTANE 1P (ALPHACIPERMETHRIN) TO CONTROL ATTA LAEVIGATA, ATTA SEXDENS RUBROPILOSA AND ATTA BISPHAERICA (HYMENOPTERA: FORMICIDAE)	II	695	23/08/00	16:30	CC		14	PS	14
Fileni, D. H.	283	A DOSE RECOMENDATION AND AN EVALUATION OF THE EFFICIENCY OF THE FARM CHEMICAL CONFIDOR (IMIDACLOPRID) TO CONTROL MYZUS PERSICAE (HOMOPTERA: APHIDIDAE) IN THE POTATO CROP SOLANUM TUBEROSUM	I	72	23/08/00	16:30	CC		2	PS	2
Filgueira, M. A.	181	FRUIT FLIES OF THE GENUS ANASTREPHA IN THE FRUIT PRODUCING REGION OF MOSSORO/ASSU, RIO GRANDE DO NORTE, BRAZIL	I	46	21/08/00	16:30	CC		2	PS	2
Filho, J. A. A.	3955	ANASTREPHA FRATERCULUS (DIP.: TEPHRITIDAE) INFESTATION IN STRAWBERRIES IN THE STATE OF SÃO PAULO, BRAZIL	II	998	22/08/00	16:30	CC		22	PS	22
Filho, M. F. S.	3955	ANASTREPHA FRATERCULUS (DIP.: TEPHRITIDAE) INFESTATION IN STRAWBERRIES IN THE STATE OF SÃO PAULO, BRAZIL	II	998	22/08/00	16:30	CC		22	PS	22
Finch, R.	2026	PROGRESS IN THE GENETIC IMPROVEMENT OF GRANULOVIRUSES FOR THE CONTROL OF TWO IMPORTANT APPLE PESTS	I	511	24/08/00	15:30	HM	P	11	7	11
Finch, S.	3598	HOST-PLANT SELECTION BY INSECTS – A THEORY BASED ON "APPROPRIATE/INAPPROPRIATE LANDINGS" BY PEST INSECTS OF CRUCIFEROUS PLANTS	II	908	22/08/00	16:30	CC		20	PS	20
Finnegan, J.	2049	BT COTTON: RELATIONSHIP BETWEEN BIOEFFICACY, GENE EXPRESSION AND PROTEIN	I	517	21/08/00	16:30	CC		11	PS	11
Fiorelli, J. H.	2783	MACROSIPHUM EUPHORBIAE (HEMIPTERA: APHIDIDAE) CONTROL AND FRANKLINIELLA SCHULZEI (THYSANOPTERA: THRIPIDAE) WITH DIFFERENT INSECTICIDES ON TOMATO CROP (LYCOPERSICUM ESCULENTUM)	II	703	24/08/00	16:30	CC		14	PS	14
Fischer, M. K.	1758	INTERSPECIFIC AND INTRASPECIFIC VARIATIONS IN APHID HONEYDEW: IMPACT ON THE MUTUALISM WITH ANTS	I	443	21/08/00	16:30	CC		9	PS	9
Fischer, W.	1323	UPTAKE AND DISTRIBUTION OF THIAMETHOXAM AFTER SEED TREATMENT	I	334	22/08/00	16:30	CC		7	PS	7
Fischer, W.	1269	THIAMETHOXAM: NEW INNOVATIVE APPLICATION OPPORTUNITIES FOR A SYSTEMIC PRODUCT	I	320	25/08/00	10:05	HM	N	7	9	7
Fish, D.	2892	INTERACTION AMONG MULTIPLE IXODES SCAPULARIS-BORNE PATHOGENS AND THEIR HOSTS	II	730	22/08/00	15:35	Bol	R	15	4	15
Fish, D.	2963	TAXONOMIC AND PHYLOGENETIC STUDIES OF PERUVIAN LUTZOMYIA SPECIES BASED ON MOLECULAR DATA	II	748	21/08/00	16:30	CC		15	PS	15
Fisher, K.	2473	LIPID CONTENT IN MASS-REARED MEDFLIES	II	625	23/08/00	16:30	CC		13	PS	13
Fitt, G. P.	126	CROPPING PATTERNS. A LANDSCAPE PERSPECTIVE OF CULTURAL CONTROL	I	33	24/08/00	10:30	HB	A	2	7	2
Fitt, G. P.	1249	DEVELOPMENT AND IMPLEMENTATION OF RESISTANCE MANAGEMENT STRATEGIES FOR BT COTTON IN AUSTRALIA	I	315	23/08/00	14:05	HM	N	7	6	7
Fitt, G. P.	2564	IPM IN COTTON: THE CHALLENGE OF INTEGRATING NEW TOOLS TO MINIMISE PESTICIDE DEPENDENCE	II	648	22/08/00	14:20	HB	B	14	4	14
Fitt, G. P.	146	HELICOVERPA LOCAL MOVEMENT AND RESISTANCE MANAGEMENT STRATEGIES FOR TRANSGENIC COTTON: STUDIES WITH A SPATIALLY EXPLICIT METAPOPULATION MODEL	I	38	25/08/00	14:00	HB	A	2	9	2
Fitt, G. P.	3973	EFFICACY OF TRANSGENIC BT COTTON - RELATING BIOASSAY AND ELIZA TECHNIQUES	II	1003	23/08/00	16:30	CC		22	PS	22
Fitt, G. P.	1244	NON-TARGET EFFECTS OF BT-COTTON: A CASE STUDY FROM AUSTRALIA	I	314	23/08/00	10:35	HM	N	7	5	7

Sub-titles: (HB=Hotel Bourbon) - (HM=Hotel Mabu) - (CC=Convention Center) - (Bol=Foz Boulevard) - (PS=Poster Session) - (PL=Plenary Lecturer)

AUTHOR	Nº	TITLE	Book	Page	Date	Time	Local	Room	Session	Symp	New Session
Fitzgerald, B. C.	1094	DYNAMIC STATE VARIABLE MODEL OF OPTIMAL CLUTCH SIZE IN UROPHORA AFFINIS (DIPTERA: TEPHRITIDAE) ON SPOTTED KNAPWEED, CENTAUREA MACULOSA	I	276	24/08/00	16:30	CC		6	PS	6
Fitzgerald, J. D.	1662	THE COMMON EARWIG FORFICULA AURICULARIA; BENEFICIAL OR PEST IN ORCHARDS?	I	419	25/08/00	16:30	CC		8	PS	8
Fitzpatrick, M. J.	1759	WHAT IS SEXY ABOUT FIELD CRICKET COURTSHIP SONG?	I	443	21/08/00	16:30	CC		9	PS	9
Fiuza, L. M.	1515	REMARKS ON THE SEXUAL RATIO OF THE CAMPOLETIS FLAVICINCTA IN LABORATORIAL REARING	I	382	21/08/00	16:30	CC		8	PS	8
Fjerdingstad, E.J.	3430	MATING SYSTEM EVOLUTION IN ATTINE FUNGUS GROWING ANTS	II	866	23/08/00	10:50	HM	Q	19	4	19
Flanders, K.	943	INFERRING ACTIVITIES AND POPULATION DENSITY FROM INCIDENTAL SOILBORNE SOUNDS OF WHITE GRUBS	I	238	21/08/00	16:30	CC		6	PS	6
Flechtmann, C. A. H.	1918	RESPONSE OF BRAZILIAN AMBROSIA BEETLES (COLEOPTERA, SCOLYTIDAE) TO KAIROMONES AND PHEROMONES	I	483	22/08/00	16:30	CC		10	PS	10
Flechtmann, C. A. H.	1919	SCOLYTIDAE TRAPPINGS IN YOUNG LOBLOLLY PINE (PINUS TAEDA) STANDS	I	484	22/08/00	16:30	CC		10	PS	10
Fleming, R. A.	3896	THE EFFECT OF CLIMATE CHANGE ON PESTS AND INTEGRATED PEST MANAGEMENT.	II	983	23/08/00	13:35	HB	H	22	5	22
Fletcher, S.	2635	DEVELOPMENT OF A METHOD OF RISK ASSESSMENT TO FACILITATE INTEGRATED MANAGEMENT OF SPOTTED WILT DISEASE OF PEANUT IN GEORGIA	II	666	22/08/00	16:30	CC		14	PS	14
Fleurat-Lessard, F.	3907	POST-HARVEST INSECT CONTROL: RADIO-FREQUENCIES AND MICROWAVES AND OTHER HEAT-SHOCK MEANS	II	986	24/08/00	13:30	HB	H	22	6	22
Fleurat-Lessard, F.	3908	LOW TEMPERATURE TO CONTROL STORED-GRAIN INSECTS	II	986	24/08/00	14:00	HB	H	22	6	22
Fleurat-Lessard, F.	4038	GRAIN QUALITY MAINTENANCE: USING QUALITATIVE REASONING IN GRAIN PEST MANAGEMENT	II	1020	23/08/00	14:15	HB	J	23	7	23
Fleurat-Lessard, F.	3906	PHYSICAL CONTROL MEASURES FOR POST-HARVEST DISINFESTATION OF CEREAL GRAIN AND DRY BEANS PRACTICABLE IN DEVELOPING COUNTRIES: A REVIEW	II	986	24/08/00	11:35	HB	H	22	6	22
Fleurisse, L.	2400	IMMUNOHISTOCHEMICAL CONTRIBUTION TO THE STUDY OF MORPHINE METABOLISM IN CALLIPHORIDAE LARVAE AND IMPLICATIONS IN FORENSIC ENTOMOTOXICOLOGY	II	606	21/08/00	16:30	CC		13	PS	13
Flexner, J. L.	1990	VIRUSES	I	502	21/08/00	10:35	HM	P	11	1	11
Flexner, L. J.	1270	INDOXACARB: ATTRIBUTES THAT IMPACT FIELD PERFORMANCE AND CONTRIBUTE TO CONSERVATION OF BENEFICIALS	I	321	25/08/00	10:20	HM	N	7	9	7
Flinn, M.	3883	MOLECULAR MARKERS IN WHEAT LINKED TO GENES EXPRESSING RESISTANCE TO THE GREENBUG AND THE RUSSIAN WHEAT APHID	II	980	22/08/00	13:35	HB	H	22	3	22
Flinn, P. W.	4036	MODELLING A NEW AND EFFECTIVE TOOL IN STORED PRODUCT PEST CONTROL	II	1019	23/08/00	13:35	HB	J	23	7	23
Flinn, P. W.	4039	STORED GRAIN ADVISOR PRO: A DECISION SUPPORT SYSTEM FOR INSECT MANAGEMENT IN COMMERCIAL GRAIN STORES	II	1020	23/08/00	14:45	HB	J	23	7	23
Flinn, P. W.	4067	ENZYME LINKED IMMUNOASSAY TESTS FOR INSECT MYOSIN IN WHEAT: EFFECTS OF MYOSIN DEGRADATION	II	1027	21/08/00	16:30	CC		23	PS	23
Flinn, P. W.	4068	ENZYME LINKED IMMUNOASSAY TESTS FOR INSECT MYOSIN IN WHEAT: EFFECTS OF MYOSIN DEGRADATION	II	1027	21/08/00	16:30	CC		23	PS	23
Flinn, P. W.	4110	MODELING TEMPERATURE CHANGES DURING HEAT TREATMENT OF FLOUR MILLS FOR INSECT CONTROL	II	1038	25/08/00	16:30	CC		23	PS	23
Flinn, P. W.	2778	EFFECTS OF AGE AND SEX ON MORTALITY OF TRIBOLIUM CASTANEUM EXPOSED TO WHEAT TREATED WITH DIATOMACEOUS EARTH	II	701	24/08/00	16:30	CC		14	PS	14
Floate, K. D.	974	FLIES UNDER STRESS: A TEST OF FLUCTUATING ASYMMETRY AS A BIOMONITOR OF ENVIRONMENTAL QUALITY	I	246	22/08/00	16:30	CC		6	PS	6
Floate, K. D.	1324	COMPARATIVE LARVICIDAL ACTIVITY OF THE ENDECTOCIDES, DORAMECTIN, EPRINOMECTIN, IVERMECTIN, AND MOXIDECTIN AGAINST THREE SPECIES OF PEST FLIES (DIPTERA: MUSCIDAE) IN DUNG OF TREATED CATTLE	I	334	23/08/00	16:30	CC		7	PS	7
Floate, K. D.	1525	DISPERSAL OF THE FILTH FLY PARASITOID MUSCIDIFURAX RAPTORELLUS (HYMENOPTERA: PTEROMALIDAE) FOLLOWING MASS-RELEASES IN CATTLE CONFINEMENTS	I	385	22/08/00	16:30	CC		8	PS	8
Florcovski, J. L.	2735	TONIC EFFECT OF SOIL INSECTICIDE ON THE COFFEE (COFFEA ARABICA) PLANT AND ITS COST-BENEFICE	II	691	23/08/00	16:30	CC		14	PS	14
Florcovski, J. L.	2837	INFLUENCE OF PHOSPHORUS GRADES IN DIFFERENT VARIETIES OF CORN (ZEA MAYS) ON THE FALL ARMYWORM (SPODOPTERA FRUGIPERDA) GROWTH	II	716	25/08/00	16:30	CC		14	PS	14
Floren, A.	3577	WHAT CAN WE SAY ABOUT THE PROPORTION OF SPECIALIST AND GENERALIST SPECIES OF COLEOPTERA IN TREES OF SE-ASIAN LOWLAND RAIN FORESTS?	II	903	24/08/00	10:05	Bol	U	20	2	20
Flores, A. E.	18	LIFE HISTORY PARAMETERS AND FUNCTIONAL RESPONSE PHYTOSEIULUS PERSIMILIS ON TETRANYCHUS URTICAE	I	5	21/08/00	16:30	CC		1	PS	1
Flores, A. E.	19	FUNCTIONAL RESPONSE OF PHYTOSEIULUS PERSIMILIS ON TETRANYCHUS URTICAE ON THREE DIFFERENT ROSE VARIETIES	I	5	21/08/00	16:30	CC		1	PS	1
Flores, A. E.	20	FUNCTIONAL RESPONSE OF THE PREDACEOUS, EUSEIUS HIBISCI ON IMMATURE STAGES OF TWO-SPOTTED SPIDER MITE, TETRANYCHUS URTICAE	I	5	21/08/00	16:30	CC		1	PS	1
Flores, A.E.	1526	SUBLETHAL EFFECTS OF BACILLUS THURINGIENSIS VAR. ISRAELENSIS (VECTOBAC G & AS) ON LIFE PARAMETERS OF AEDES AEGYPTI	I	385	22/08/00	16:30	CC		8	PS	8
Flores, D.	1530	BIOLOGICAL CONTROL OF FLORIDA RED SCALE IN TEXAS CITRUS	I	386	22/08/00	16:30	CC		8	PS	8
Floret, L.	975	INTERACTIONS BETWEEN FEMALES OF MANUELIA POSTICA (SPINOLA) AND COMPARISONS OF ITS NESTS WITH THE NESTS OF MANUELIA GAYI (SPINOLA) (HYMENOPTERA: ANTHOPHORIDAE)	I	246	21/08/00	16:30	CC		6	PS	6
Flores, P. S.	3843	DESCRIPTION OF THE IMMATURE AND ADULT PHASES OF PHTHIA PICTA (HEMIPTERA: COREIDAE)	II	970	24/08/00	16:30	CC		21	PS	21
Florim, A. C. P.	33	KETOENOLE: A NEW CHEMICAL GROUP TO THE MITES CONTROL IN THE CITRUS CULTURE	I	9	22/08/00	16:30	CC		1	PS	1
Florim, A. C. P.	295	BIOLOGICAL ACTIVITY OF ORANGE MOTH, ECDYTOLOPHA AURANTIANUM, WHEN SUBMITED TO THE PHYSIOLOGICAL INSECTICIDE - METHOFENOZIDE	I	75	24/08/00	16:30	CC		2	PS	2
Florim, A. C. P.	296	EFFICACY EVALUATION OF KARATE ZEON 50 CS FOR THE CONTROL OF Dilobopterus costalimai, INSECT VECTOR OF CVC IN CITRUS	I	75	24/08/00	16:30	CC		2	PS	2
Floris, I.	3486	SEARCHING FOR AN ACCURATE METHOD TO EVALUATE THE EFFICACY OF AN ACARICIDE IN THE Varroosis CONTROL	II	880	22/08/00	16:30	CC		19	PS	19
Flowers, R. W.	4121	THE DIVERSITY OF THE CHRYSOMELIDAE FAUNA IN COSTA RICA: INSIGHTS FROM A MALAISE TRAPLINE	II	1041	25/08/00	10:00	HM	P	24	2	24
Floyd, R. B.	1888	INSECT RESISTANCE IN EUCALYPTUS GLOBULUS TO ACUTE AND CHRONIC INSECT DAMAGE IN AUSTRALIA	I	476	26/08/00	14:05	HB	M	10	10	10
Flugel, R.	4094	ARTIFICIAL FEEDING OF MOSQUITOS VIA A MEMBRANELESS SYTSTEM	II	1034	24/08/00	16:30	CC		23	PS	23
Fochetti, R.	3102	COMPARATIVE SPERMATOLOGY IN PLECOPTERA	II	783	26/08/00	15:45	HB	G	16	9	16
Focks, D.	2903	SPATIAL AND TEMPORAL HETEROGENEITY IN DENGUE VIRUS TRANSMISSION AND AEDES AEGYPTI POPULATION DENSITIES IN IQUITOS, PERU	II	733	23/08/00	14:35	Bol	R	15	6	15
Foerster, L. A	1518	DEVELOPMENT, SURVIVAL AND REPRODUCTION OF TRISSOLCUS BASALIS AND TELENOMUS PODISI (HYMENOPTERA: SCELIONIDAE) REARED IN GREENHOUSE IN SOUTHERN PARANÁ STATE, BRAZIL	I	383	21/08/00	16:30	CC		8	PS	8
Foerster, L. A	1519	COLD STORAGE OF IMMATURE STAGES OF TRISSOLCUS BASALIS AND TELENOMUS PODISI (HYMENOPTERA: SCELIONIDAE): EFFECT ON DEVELOPMENT, ADULT LONGEVITY AND REPRODUCTION	I	383	21/08/00	16:30	CC		8	PS	8

Sub-titles: (HB=Hotel Bourbon) - (HM=Hotel Mabu) - (CC=Convention Center) - (Bol=Foz Boulevard) - (PS=Poster Session) - (PL=Plenary Lecturer)

AUTHOR	Nº	TITLE	Book	Page	Date	Time	Local	Room	Session	Symp	New Session
Foerster, L. A.	1471	EFFECT OF ALTERNATING TEMPERATURES ON THE DEVELOPMENT, LONGEVITY AND REPRODUCTION OF TRISSOLCUS BASALIS (HYMENOPTERA: SCELIONIDAE)	I	371	26/08/00	10:20	HM	O	8	8	8
Foerster, L. A.	2608	MANAGING HETEROPTERANS IN TROPICAL SOYBEANS	II	659	26/08/00	13:30	HB	B	14	9	14
Foerster, L. A.	1527	EGG PARASITOIDS OF ANTICARSIA GEMMATALIS (LEPIDOPTERA: NOCTUIDAE) ON SOYBEANS IN BRAZIL.	I	385	22/08/00	16:30	CC		8	PS	8
Foerster, L. A.	1629	CHARACTERIZATION OF THREE SPECIES OF THE GENUS TRICHOGRAMMA	I	411	22/08/00	16:30	CC		8	PS	8
Foerster, L. A.	1498	EGG PARASITOIDS OF HELICOVERPA ZEA IN SOUTHERN PARANÁ, BRAZIL AND REARING OF TRICHOGRAMMA ATOPOVIRILIA ON AN ALTERNATIVE HOST	I	378	21/08/00	16:30	CC		8	PS	8
Fogaça, A. C.	2061	ANTIMICROBIAL PEPTIDES FROM THE CATTLE TICK BOOPHILUS MICROPLUS	I	520	22/08/00	16:30	CC		11	PS	11
Foil, L. D.	2983	THE EFFECTS OF MANAGEMENT STRATEGIES ON RESISTANCE IN THE HORN FLY, HAEMATOBIA IRRITANS	II	753	22/08/00	16:30	CC		15	PS	15
Folcia, A. M.	3606	EFFECT OF INTERCROP WITH CHINESE BEET (BRASSICA JUNCEA) ON THE ABUNDANCE OF BREVICORYNE BRASSICAE AND THE QUALITY OF CABBAGE (BRASSICA OLERACEA VAR. CAPITATA)	II	910	24/08/00	16:30	CC		20	PS	20
Folcia, A. M.	240	ABUNDANCE OF MESO AND MACROFAUNA IN PAMPEAN HAPLUDOLLS AND ARGIUDOLLS: THE INFLUENCE OF TOPSOIL MACROPOROSITY	I	61	22/08/00	16:30	CC		2	PS	2
Folcia, A. M.	328	BASIL-TOMATO INTERCROPPING EFFECT ON MACROSIPHUM EUPHORBIAE (HEMIPTERA: APHIDIDAE) ABUNDANCE	I	83	24/08/00	16:30	CC		2	PS	2
Folgarait, P. J.	506	FUNCTIONAL BIODIVERSITY AMONGST DIFFERENT MICROSITES IN A PATAGONIAN STEPPE, SOUTHERN ARGENTINA	I	128	23/08/00	16:30	CC		3	PS	3
Folgarait, P. J.	496	GEOGRAPHIC RANGES AND PATTERNS OF DIVERSITY FOR PSEUDACTEON FLIES, PARASITOIDS OF SOLENOPSIS ANTS, FROM ARGENTINA AND BRAZIL	I	126	22/08/00	16:30	CC		3	PS	3
Folgarait, P. J.	1528	PHENOLOGICAL PATTERNS FOR PARASITOIDS SPECIALIZED IN ATTACKING SOLENOPSIS FIRE ANTS, AT THE RESERVA ECOLÓGICA COSTANERA SUR, ARGENTINA	I	385	23/08/00	16:30	CC		8	PS	8
Folgarait, P. J.	3487	DEMOGRAPHY OF CAMPONOTUS PUNCTULATUS ANTS ALONG A GRADIENT OF AGRICULTURAL DISTURBANCE AND THROUGH TIME	II	880	24/08/00	16:30	CC		19	PS	19
Follett, P. A.	3926	UPROOTING THE PROBIT 9 STANDARD FOR QUARANTINE SECURITY	II	991	26/08/00	10:15	HB	H	22	8	22
Follett, P. A.	3918	HISTORICAL OVERVIEW OF QUARANTINE TREATMENTS IN INTERNATIONAL TRADE	II	989	25/08/00	15:20	HB	H	22	8	22
Fonagy, A.	597	MOLECULAR MECHANISM OF SEX PHEROMONE PRODUCTION IN THE SILKWORM, BOMBYX MORI	I	151	23/08/00	10:00	Bol	S	4	4	4
Fonalleras, M. L.	368	FRUIT FLY (DIPTERA:TEPHRITIDAE) QUARANTINE PROCEDURES FOR EXPORT OF AVOCADOS FROM ARGENTINA TO CHILE	I	93	25/08/00	16:30	CC		2	PS	2
Fonseca, A. H.	3248	SEROLOGY FOR BABESIA BOVIS IN HUMAN PATIENTS WITH LYME- LYKE DISEASE SYNDROME, SYPHILIS, SEPTICEMIA AND AUTOIMMUNE DISEASES	II	820	25/08/00	16:30	CC		17	PS	17
Fonseca, A. R.	976	EFFECT OF TEMPERATURE ON THE SEX RATIO AND WEIGHT OF CHRYSOPERLA EXTERNA ADULTS OBTAINED FROM LARVAE FED ON SCHIZAPHIS GRAMINUM	I	246	22/08/00	16:30	CC		6	PS	6
Fonseca, A. R.	1529	FUNCTIONAL RESPONSE OF CHRYSOPERLA EXTERNA FED ON SCHIZAPHIS GRAMINUM	I	386	22/08/00	16:30	CC		8	PS	8
Fonseca, C. R. V. da	402	ABUNDANCE, DIVERSITY AND SEASONALITY OF ARTHROPODA ASSOCIATED WITH THE SAPOTACEAE AND LECITHIDACEAE TREE CANOPIES AT THE ADOLPHO DUCKE FOREST RESERVE, MANAUS, AMAZONAS, BRAZIL. PRELIMINARY FINDING.	I	102	22/08/00	16:20	HB	C	3	2	3
Fonseca, C. R. V. da	390	DIVERSITY AND LIFE HISTORY TRAITS OF TIGER BEETLES (COLEOPTERA: CICINDELIDAE) FROM CENTRAL AMAZONIA (BRAZIL)	I	99	22/08/00	11:20	HB	C	3	2	3
Fonseca, C. R. V. da	391	GROUND BEETLE COMMUNITIES (COLEOPTERA, CARABIDAE) AT FRUIT FALLS IN A TERRA FIRME RAINFOREST NEAR MANAUS (AMAZONIA) - A FIRST REVIEW	I	99	22/08/00	11:35	HB	C	3	2	3
Fonseca, F. L.	1531	PARASITISM OF EGGS OF APPLE LEAF ROLLER BONAGOTA CRANAODES (LEPIDOPTERA: TORTRICIDAE) BY TRICHOGRAMMA SP. IN FIELD CONDITIONS	I	386	22/08/00	16:30	CC		8	PS	8
Fonseca, F. V.	2506	OCCURRENCE OF ALPHA-GLUCOSIDASE AS A BIOCHEMICAL MARKER FOR PERIMICROVILLAR MEMBRANES IN HEMIPTERA AND THYSANOPTERA	II	633	24/08/00	16:30	CC		13	PS	13
Fonseca, P.	1747	FREQUENCY DISCRIMINATION IN CICADAS: A FRAMEWORK FOR EVOLUTION OF COMPLEX SIGNALS?	I	440	23/08/00	14:00	HB	F	9	3	9
Fonseca, P. J.	2500	NEW STRIDULATORY STRUCTURES IN A TIGER BEETLE (COLEOPTERA, CICINDELIDAE): MORPHOLOGY AND SOUND CHARACTERIZATION	II	631	24/08/00	16:30	CC		13	PS	13
Fonseca, R. H. C.	1220	PROPOSAL OF MODIFICATION IN LIFE TABLES TO STUDY THE EFFECT OF PROPORTIONAL MORTALITY DIFFERENCES ON LIFE EXPECTANCIES	I	307	25/08/00	16:30	CC		6	PS	6
Fonseca, V. L. I.	3460	RELATIVE ABUNDANCE AND EXPLOITATION OF AVAILABLE RESOURCES BY APID BEES (HYMENOPTERA: APOIDEA) IN AN URBANIZED AREA	II	873	21/08/00	16:30	CC		19	PS	19
Fontal, F.	3857	CONTRIBUTION TO THE KNOWLEDGE OF BUTTERFLIES IN THE COIBA NATIONAL PARK, PANAMA. (LEPIDOPTERA: PAPILIONOIDEA)	II	973	24/08/00	16:30	CC		21	PS	21
Fontán, A.	667	COPULATION PHEROMONE OF THE VECTOR OF CHAGAS DISEASE, TRIATOMA infestans: IDENTIFICATION AND BIOASSAY	I	169	22/08/00	16:30	CC		4	PS	4
Fontán, A.	668	NITROGENOUS COMPOUNDS AS ATTRACTANTS OF TRIATOMA INFESTANS	I	169	22/08/00	16:30	CC		4	PS	4
Fontanetti, C.	2284	DOES AN X-AUTOSOME CENTRIC FUSION IN ACRIDOIDEA CONDEMN THE SPECIES TO EXTINTION?	I	576	23/08/00	16:30	CC		12	PS	12
Fontdevila, A.	2207	RETROTRANSPOSON MEDIATED HYBRID INSTABILITY IN DROSOPHILA	I	557	24/08/00	13:55	HB	L	12	8	12
Fontellas, T. M. L.	2427	DIET SELECTION WITH DIFFERENT SUCROSE CONCENTRATIONS BY ANASTREPHA OBLIQUA (DIPTERA, TEPHRITIDAE)	II	613	22/08/00	16:30	CC		13	PS	13
Fontenelle, J. C. R.	497	COMPOSITION AND RELATIVE ABUNDANCE OF DIPTERAN FAMILIES (EXCLUDING NEMATOCERA AND ACALYPTRATAE) COLLECTED BY MALAISE TRAPS, WITHIN AND OUTSIDE FOREST FRAGMENTS IN TWO DIFFERENT AREAS	I	126	22/08/00	16:30	CC		3	PS	3
Fontenelle, J. C. R.	498	COMPOSITION AND RELATIVE ABUNDANCE OF HYMENOPTERA FAMILIES IN TWO URBAN AREAS OF BELO HORIZONTE, MINAS GERAIS, BRAZIL	I	126	22/08/00	16:30	CC		3	PS	3
Fontes, E. M. G.	977	PHENOTYPIC PLASTICITY IN DEOIS FLAVOPICTA - VARIATION IN THE DRY SEASON DORMANCY AMONG FAMILIES AND AMONG GEOGRAPHICALLY ISOLATED POPULATIONS	I	247	22/08/00	16:30	CC		6	PS	6
Fontes, E. M. G.	1110	DRY-SEASON EMBRIONIC DORMANCY IN DEOIS FLAVOPICTA (HOMOPTERA: CERCOPIDAE): ROLES OF TEMPERATURE AND MOISTURE IN NATURE	I	280	24/08/00	16:30	CC		6	PS	6
Fontes, E. M. G.	3373	EFFECT OF FOOD QUALITY ON THE FECUNDITY OF SPITTLEBUG	II	852	22/08/00	16:30	CC		18	PS	18
Fontes, L. R.	2984	BRAZILIAN SPOTTED FEVER TRANSMITED BY AMBLYOMMA AUREOLATUM (ACARI) IN MOGI DAS CRUZES, BRAZIL: REPORT OF FOUR HUMAN CASES AND ENVIRONMENTAL CONTROL MEASURES	II	753	22/08/00	16:30	CC		15	PS	15
Fontes, L. R.	3397	TERMITE FAUNA OF THE SOUTH AMERICA CONTINENT AND THEIR ECONOMIC IMPORTANCE	II	858	21/08/00	14:15	HM	Q	19	1	19
Fontes, L. R.	3488	INVASION OF URBAN BUILDINGS BY THE MOUND BUILDING TERMITE, CORNITERMES CUMULANS (ISOPTERA): REPORT OF TWO CASES OCCURRED IN THE SOUTHEAST OF BRAZIL	II	880	22/08/00	16:30	CC		19	PS	19
Fontes, L. R.	3401	TERMITE AS PESTS OF SUGARCANE IN THE SOUTHEAST AND NORTHEAST REGIONS OF BRAZIL	II	859	21/08/00	15:15	HM	Q	19	1	19
Fontes, L. R.	4089	OCCURRENCE OF RHINOTERMES MARGINALIS(ISOPTERA: RHINOTERMITIDAE) IN URBAN AREAS OF RIO DE JANEIRO CITY	II	1032	24/08/00	16:30	CC		23	PS	23
Fontes, R. L. B.	58	ACTION OF THIAMETHOXAN ON THE POPULATION DYNAMICS OF THE BROAD MITE Polyphagotarsonemus latus (Banks) ON COTTON AND ITS SELECTIVITY TO PREDATOR MITE Euseius concordis (Chant).	I	15	25/08/00	16:30	CC		1	PS	1
Foozhou, W.-C.	871	THE MIGRATORY LOCUST IN CHINA	I	220	26/08/00	10:35	HB	D	6	9	6

Sub-titles: (HB=Hotel Bourbon) - (HM=Hotel Mabu) - (CC=Convention Center) - (Boi=Foz Boulevard) - (PS=Poster Session) - (PL=Plenary Lecturer)

AUTHOR	Nº	TITLE	Book	Page	Date	Time	Local	Room	Session	Symp	New Session
Forcella, M.	2456	ROLE OF ACTIVATORS OF THE ABSORPTION OF AMINO ACIDS BY THE MIDGUT IN BOMBYX MORI LARVAL NUTRITION	II	620	23/08/00	16:30	CC		13	PS	13
Forer, G.	1277	PROGRESSIVE INSECTICIDE RESISTANCE MANAGEMENT PROGRAMS IN THE ISRAELI AGRICULTURAL ECOSYSTEM	I	322	25/08/00	14:20	HM	N	7	10	7
Foresti, J.	1531	PARASITISM OF EGGS OF APPLE LEAF ROLLER BONAGOTA CRANAODES (LEPIDOPTERA: TORTRICIDAE) BY TRICHOGRAMMA SP. IN FIELD CONDITIONS	I	386	22/08/00	16:30	CC		8	PS	8
Forlin, A.	1917	WOOD LOSS IN EUCALYPTUS PLANTATIONS BY COPTOTERMES SP. (ISOPTERA:RHINOTERMITIDAE) IN GOIAS-BRAZIL	I	483	21/08/00	16:30	CC		10	PS	10
Fornarolli, D. A.	2641	CONTROL OF ANTICARSIA GEMMATALIS IN SOYBEAN BY RIMON 10 EC (NOVALURON) IN PARANÁ, BRAZIL. 1999	II	667	22/08/00	16:30	CC		14	PS	14
Fornarolli, D. A.	2642	EFFECT OF THE CONTROL OF ARMY WORMS SPODOPTERA FRUGIPERDA IN CORN BY RIMON 10 EC (NOVALURON). 1999	II	667	21/08/00	16:30	CC		14	PS	14
Fornarolli, D. A.	2643	EFFICACY OF CONTROL OF ANTICARSIA GEMMATALIS IN SOYBEAN BY RIMON 10 EC (NOVALURON) AND OTHER INSECTICIDES. 1999	II	668	22/08/00	16:30	CC		14	PS	14
Fornazier, M. J.	1325	EFFECT OF THIAMETHOXAN ON BEAN CROP DEVELOPMENT	I	334	22/08/00	16:30	CC		7	PS	7
Fornazier, M. J.	277	EVALUATION OF SYSTEMIC INSECTICIDE THIAMETHOXAN ON THE VEGETATIVE GROWTH OF DRY BEAN PLANTS	I	70	23/08/00	16:30	CC		2	PS	2
Fornazier, M. J.	1360	TONIC EFFECT OF THIAMETHOXAN ON GROWTH OF DRY BEAN PLANT	I	343	24/08/00	16:30	CC		7	PS	7
Forrester, N. W.	1338	MANAGING INSECTICIDE RESISTANCE IN AUSTRALIAN HELICOVERPA ARMIGERA	I	338	22/08/00	16:30	CC		7	PS	7
Forschler, B. T.	3409	AN INTEGRATED MANAGEMENT APPROACH FOR CONTROLLING TERMITES IN THE URBAN AREAS OF NORTH AMERICA	II	861	22/08/00	10:50	HM	Q	19	2	19
Forschler, B. T.	2079	DNA SEQUENCE DATA USED TO VALIDATE SPECIES TAXONOMY AND ORIGIN OF UK SUBTERRANEAN TERMITE (ISOPTERA: RHINOTERMITIDAE) INFESTATION	I	524	22/08/00	16:30	CC		11	PS	11
Forschler, B.T.	2005	MICROBIAL CONTROL OF TERMITES IN THE USA IN THE UNITED STATES	I	506	22/08/00	14:35	HM	P	11	4	11
Fortes, N. D. F. de	3764	CLADISTIC ANALYSIS OF GENUS SERDIA (HETEROPTERA: PENTATOMIDAE: PENTATOMINI)	II	950	22/08/00	16:30	CC		21	PS	21
Fortes, P.	978	VELVETBEAN CATERPILLAR PREFERENCE TO SOYBEAN AND PENUTS VARIETIES	I	247	22/08/00	16:30	CC		6	PS	6
Fortes, P.	715	AZADIRACTA INDICA AND BOUGAINVILLEA SPECTABILIS EXTRACTS TO CONTROL VELVETBEAN CATERPILLAR	I	181	24/08/00	16:30	CC		4	PS	4
Fortes, P.	1687	EFFECT OF DIATRAEA SACCHARALIS TREATED EGGS ON CRISOPIDS LARVAE	I	425	25/08/00	16:30	CC		8	PS	8
Fortes, P.	3111	EFFECT OF TWO PLANT EXTRACTS ON CERAEOCHRYSA CINCTA AND C. CUBANA (NEUROPTERA: CHRYSOPIDAE)	II	785	21/08/00	16:30	CC		16	PS	16
Forti, L. C.	2675	ANALYSIS OF RESIDUES OF SULFLURAMIDA IN GRASS AND SOIL AS WELL AS EFFICIENCY OF THE PRODUCT "MIREX-S MAX" IN THE CONTROL OF ATTA CAPIGUARA (HYMENOPTERA: FORMICIDAE)	II	676	22/08/00	16:30	CC		14	PS	14
Forti, L. C.	3513	EFFECT OF TOXIC-BAITS ON THE ANT COMMUNITY STRUCTURE IN AN AREA OF EUCALYPTUS SPP. PLANTATION	II	887	23/08/00	16:30	CC		19	PS	19
Forti, L. C.	3514	EFFECTS OF TOXIC BAITS ON NON-TARGET ANT SPECIES	II	887	23/08/00	16:30	CC		19	PS	19
Forti, L. C.	3524	INTERNAL ARCHITECTURE OF ATTA BISPHAERICA NESTS (HYMENOPTERA; FORMICIDAE)	II	889	24/08/00	16:30	CC		19	PS	19
Forti, L. C.	3525	RESPONSE OF ATTA BISPHAERICA (HYMENOPTERA, FORMICIDAE) TO METHANOLIC EXTRACTS OF SUGAR CANE AND ANDROPOGON GRASS	II	889	24/08/00	16:30	CC		19	PS	19
Forti, L. C.	3337	COLONY DEVELOPMENT OF ATTA LEAFCUTTING ANTS UNDER LABORATORY AND FIELD CONDITIONS	II	843	22/08/00	16:30	CC		18	PS	18
Forti, L. C.	3452	BROOD-DEVELOPMENT OF THE THREE ACROMYRMEX SUBTERRANEUS (HYMENOPTERA, FORMICIDAE) SUBSPECIES	II	871	21/08/00	16:30	CC		19	PS	19
Forti, L. C.	3453	NEST-ARCHITECTURE OF TWO ACROMYRMEX SUBTERRANEUS (HYMENOPTERA, FORMICIDAE) SUBSPECIES	II	872	21/08/00	16:30	CC		19	PS	19
Forti, L. C.	3509	LEAFCUTTING ANTS AS PESTS IN ARAUCARIA CULTURES: DIET PREFERENCE BIO-ASSAY UNDER LABORATORY CONDITIONS	II	886	23/08/00	16:30	CC		19	PS	19
Forti, L. C.	4156	FOOD PRODUCTION SEASONALLY ADJUSTED FOR THE BROOD REARING IN THE LEAF-CUTTING ANT, ACROMYRMEX BALZANI	II	1050	21/08/00	16:30	CC		Erratum	PS	2
Fortier, J. C.	3760	CLADISTICS OF THE ALEIODES LINEAGE OF THE SUBFAMILY ROGADINAE (HYMENOPTERA: BRACONIDAE)	II	949	22/08/00	16:30	CC		21	PS	21
Foster, G. N.	379	HABITAT CONSTRAINTS AND PATTERNS OF DIVERSITY	I	96	21/08/00	11:05	HB	C	3	1	3
Foster, G. N.	546	HABITAT CONSTRAINTS AND PATTERNS OF DIVERSITY	I	138	24/08/00	16:30	CC		3	PS	3
Foster, J. E.	165	TRANSGENIC MAIZE FOR MANAGEMENT OF DIABROTICINE PESTS	I	42	26/08/00	16:05	HB	A	2	11	2
Foster, J. E.	953	DEPOSITION OF CORN POLLEN ON MILKWEED AND EXPOSURE RISK TO MONARCH BUTTERFLY LARVAE.	I	241	22/08/00	16:30	CC		6	PS	6
Foster, J. E.	2311	GENETIC VARIATION OF EUROPEAN CORN BORER (OSTRINIA NUBILALIS) POPULATIONS IN NEBRASKA DETECTED BY RANDOM AMPLIFIED POLYMORPHIC DNA (RAPD)	I	583	24/08/00	16:30	CC		12	PS	12
Foster, S. P.	1284	CHALLENGES WITH MANAGING INSECTICIDE RESISTANCE IN THE APHID, MYZUS PERSICAE	I	324	25/08/00	16:05	HM	N	7	10	7
Foster, W. A.	3549	ANT-TENDING INFLUENCES SOLDIER PRODUCTION IN A SOCIAL APHID	II	895	25/08/00	16:30	CC		19	PS	19
Foster, W. A.	2873	RESPONSE OF MOSQUITOES TO NECTAR-RELATED INFOCHEMICALS OF PLANTS	II	725	21/08/00	11:05	Boi	R	15	1	15
Foster, W. A.	1107	THE ROLE OF PREDATORS IN THE POPULATION AND BEHAVIOURAL ECOLOGY OF THE SOLDIER-PRODUCING APHID SPECIES, PEMPHIGUS SPYROTHECAE	I	279	24/08/00	16:30	CC		6	PS	6
Foster, W. A.	1756	HOW WELL DOES FOGGING SAMPLE A HIGH CANOPY EPIPHYTE?	I	442	21/08/00	16:30	CC		9	PS	9
Foster, W. A.	3579	HOW WELL DOES FOGGING SAMPLE A HIGH CANOPY EPIPHYTE?	II	903	24/08/00	11:05	Boi	U	20	2	20
Fouque, F.	510	BLACK FLIES (DIPTERA: SIMULIIDAE) OF FRENCH GUIANA: A PRELIMINARY LIST OVER 50 YEARS AFTER FLOCH AND ABONNENC.	I	129	23/08/00	16:30	CC		3	PS	3
Foureaux, L. V	4150	EFFECT OF DIFFERENT TEMPERATURES ON THE BIOLOGY OF TAKECALLIS TAIWANUS (HOMOPTERA: APHIDIDAE) AND THERMAL REQUIREMENTS	II	1048	21/058/00	16:30	CC		Erratum	PS	18
Foureaux, L. V.	1537	EFFECT OF THE AGE OF APHIDIUS COLEMANI (HYMENOPTERA: APHIDIIDAE) ON THE GREEN APHID SCHIZAPHIS GRAMINUM (HOMOPTERA: APHIDIDAE) PARASITISM	I	388	22/08/00	16:30	CC		8	PS	8
Fowler, H. G.	1638	ANALYSIS OF THE BIOLOGICAL CONTROL OF THE DIATRAEA SACCHARALIS AT DIFFERENT SPATIAL SCALES: LACK OF CONTROL OR POOR DATA SET?	I	413	24/08/00	16:30	CC		8	PS	8
Fox, , L. R.	1650	COEVOLUTION OF CONTRARY CHOICES IN HOST-PARASITOID SYSTEMS	I	416	24/08/00	16:30	CC		8	PS	8
Fox, A. S.	974	FLIES UNDER STRESS: A TEST OF FLUCTUATING ASYMMETRY AS A BIOMONITOR OF ENVIRONMENTAL QUALITY	I	246	22/08/00	16:30	CC		6	PS	6
Fraga, M. B.	2416	POST-EMBRYONIC DEVELOPMENT OF CALYPTRATE FLIES IN ARTIFICIAL DIETS I. CHRYSOMYA MEGACEPHALA (DIPTERA: CALLIPHORIDAE)	II	610	21/08/00	16:30	CC		13	PS	13
Fragoso, D. B.	1232	RESISTANCE AND SYNERGISM TO ORGANOSPHOSPHATE INSECTICIDES IN POPULATIONS OF LEUCOPTERA COFFEELLA (LEPIDOPTERA: LYONETIIDAE)	I	311	21/08/00	16:05	HM	N	7	2	7
Fragoso, R. R.	2119	CHARACTERIZATION OF THE PROTEOLYTIC ACTIVITY OF ANTHONOMUS GRANDIS AND ISOLATION OF CDNAS ENCODING SERINE AND CYSTEINE PROTEASES	I	534	24/08/00	16:30	CC		11	PS	11
Franc, A.	958	SPREAD OF A MIGRATORY LOCUST PLAGUE IN MADAGASCAR	I	242	22/08/00	16:30	CC		6	PS	6
França, J. A. S.	221	AGRONOMIC EFFICIENCY THE INSECTICIDES AND DOSES OF CONTROL TO TIBRACA LIMBATIVENTRIS IN IRRIGATED RICE	I	56	22/08/00	16:30	CC		2	PS	2

Sub-titles: (HB=Hotel Bourbon) - (HM=Hotel Mabu) - (CC=Convention Center) - (Bol=Foz Boulevard) - (PS=Poster Session) - (PL=Plenary Lecturer)

AUTHOR	Nº	TITLE	Book	Page	Date	Time	Local	Room	Session	Symp	New Session
França, F. H.	2739	ENVIRONMENT PROTECTION THROUGH RESISTANT POTATO: RESEARCH, EDUCATION AND DELIVERING INFORMATION IN BRAZIL	II	692	23/08/00	16:30	CC		14	PS	14
França, F. H.	1203	ADAPTIVE POTENTIAL OF THE SWEET-POTATO WHITEFLY BEMISIA ARGENTIFOLII TO SEVERAL HOST PLANTS	I	303	25/08/00	16:30	CC		6	PS	6
França, F. H.	2647	USE OF INSECTICIDES FOR CONTROLLING THE BRAZILIAN TOMATO PINWORM AND THE DIAMONDBACK MOTH IN THE FEDERAL DISTRICT, BRAZIL: A CASE STUDY	II	669	22/08/00	16:30	CC		14	PS	14
França, F. H.	2616	EVALUATING SWEET POTATO FOR RESISTANCE TO THE WEST INDIAN SWEET POTATO WEEVIL	II	661	21/08/00	16:30	CC		14	PS	14
França, F. H.	3233	THE TRANSMISSION SPECIFICITY AND EFFICIENCY OF BRAZILIAN TOSPOVIRUSES OCCURRING ON TOMATO BY FOUR THRIPS SPECIES	II	816	23/08/00	16:30	CC		17	PS	17
França, F. H.	1581	CONTROL OF THE SOUTH AMERICAN TOMATO PINWORM IN GLASSHOUSE WITH T. PRETIOSUM: BIOLOGICAL AND ECONOMICAL EFFICIENCY	I	399	23/08/00	16:30	CC		8	PS	8
França, F. T.	2158	EFFECT OF TREATMENT TIMING OF BACULOVIRUS SPODOPTERA AND BACILLUS THURINGIENSIS ON SPODOPTERA FRUGIPERDA	I	544	25/08/00	16:30	CC		11	PS	11
Francardi, V.	1920	DISTRIBUTION AND ABUNDANCE OF MONOCHAMUS SPECIES ON PINES IN ITALY	I	484	22/08/00	16:30	CC		10	PS	10
Francardi, V.	2277	MITOCHONDRIAL DNA ANALYSIS IN SPECIES OF DREYFUSIA IN ITALY	I	575	23/08/00	16:30	CC		12	PS	12
France, R. A.	1996	USE OF PATHOGENIC NEMATODES AND THEIR SYMBIOTIC BACTERIA FOR THE CONTROL OF SLUG PEST	I	504	21/08/00	15:05	HM	P	11	2	11
France, R. A.	2062	CONTROL OF PINE SHOOTS MOOTH IN MONTERREY PINE WITH ENTOMOPATHOGENIC FUNGI	I	520	22/08/00	16:30	CC		11	PS	11
France, R. A.	2068	USE OF ENTOMOPATHOGENIC FUNGI FOR THE CONTROL OF CALIROA CERASI	I	522	22/08/00	16:30	CC		11	PS	11
Franceschi, V. R.	2410	DEFENCE MECHANISMS OF NORWAY SPRUCE AGAINST BARK BEETLE-FUNGUS ATTACKS	II	609	21/08/00	16:30	CC		13	PS	13
Franceschini, S.	1993	PERSPECTIVES AND LIMITATIONS ON THE COMMERCIAL DEVELOPMENT OF ENTOMOPATHOGENIC NEMATODES	I	503	21/08/00	13:35	HM	P	11	2	11
Franceschini, S.	965	THE AGONY OF A HONEYBEE COLONY PARASITIZED BY THE SARCOPHAGID FLY SENOTAINIA TRICUSPIS (MEIGEN): TEMPERATURE AND HUMIDITY VARIATIONS	I	244	22/08/00	16:30	CC		6	PS	6
Franchechi, C. C.	30	SPACIAL AND TEMPORAL DISTRIBUTION OF CALACARUS HEVEAE ON RUBBER TREES IN BRAZIL	I	8	22/08/00	16:30	CC		1	PS	1
Franchini, J. C.	711	ROLE OF NEZARA VIRIDULA (HEMIPTERA:PENTATOMIDAE) ON INDUCING THE PRODUCTION OF FLAVONOID IN SOYBEAN GENOTYPES	I	180	21/08/00	16:30	CC		4	PS	4
Francini , I. B.	979	BEETLE ASSEMBLAGES (COLEOPTERA) IN THE PARQUE ESTADUAL XIXOVÁ-JAPUI, SÃO VICENTE-PRAIA GRANDE, SÃO PAULO	I	247	24/08/00	16:30	CC		6	PS	6
Francini, R.B.	1822	ANTS AS INDICATORS OF ENVIRONMENTAL CHANGE IN LOWLAND FORESTS OF THE ALTO RIO JURUÁ, ACRE, BRAZIL	I	459	21/08/00	16:20	HB	M	10	1	10
Francini, R.B.	499	LANDSCAPE DIVERSITY AND THE DISTRIBUTION OF THE BUTTERFLIES OF THE GENUS ACTINOTE (LEPIDOPTERA: NYMPHALIDAE) IN SE BRAZIL	I	126	23/08/00	16:30	CC		3	PS	3
Francini, R.B.	979	BEETLE ASSEMBLAGES (COLEOPTERA) IN THE PARQUE ESTADUAL XIXOVÁ-JAPUI, SÃO VICENTE-PRAIA GRANDE, SÃO PAULO	I	247	24/08/00	16:30	CC		6	PS	6
Francini, R.B.	1760	BEHAVIOR OF ACTINOTE PELLENEA PELLENEA (LEPIDOPTERA: NYMPHALIDAE) IN SE BRAZIL OVIPOSITING IN ITS FOOD-PLANT EUPATORIUM INULAEFOLIUM	I	443	21/08/00	16:30	CC		9	PS	9
Francini, R.B.	2248	ECOLOGICAL FACTORS VERSUS MACRO-EVOLUTIONARY FORCES: A CASE STUDY OF THE BUTTERFLIES OF THE GENUS ACTINOTE (LEPIDOPTERA: NYMPHALIDAE) IN SOUTHEASTERN BAZIL	I	567	22/08/00	16:30	CC		12	PS	12
Francini, R.B.	3489	ANT ASSEMBLAGES (FORMICIDAE) IN THE PARQUE ESTADUAL XIXOVÁ-JAPUI, SÃO VICENTE-PRAIA GRANDE, SÃO PAULO	II	881	25/08/00	16:30	CC		19	PS	19
Francisco, E. C.	979	BEETLE ASSEMBLAGES (COLEOPTERA) IN THE PARQUE ESTADUAL XIXOVÁ-JAPUI, SÃO VICENTE-PRAIA GRANDE, SÃO PAULO	I	247	24/08/00	16:30	CC		6	PS	6
Francisco, F. O.	2249	PHYLOGENETIC RELATIONSHIP AMONG STINGLESS BEE SPECIES INFERRED BY MITOCHONDRIAL DNA RESTRICTION FRAGMENT LENGTH POLYMORPHISM	I	568	21/08/00	16:30	CC		12	PS	12
Francke, W.	725	POLLINATOR ATTRACTION BY PHEROMONE-MIMICKING VOLATILES IN AUSTRALIAN AND EUROPEAN ORCHIDS	I	183	25/08/00	16:30	CC		4	PS	4
Francke, W.	627	IDENTIFICATION OF FEMALE AND MALE SEX PHEROMONES IN THE SOLITARY BEE OSMIA RUFA (HYMENOPTERA: MEGACHILIDAE)	I	159	21/08/00	16:30	CC		4	PS	4
Francke, W.	712	BEHAVIOURAL AND ELECTROPHYSIOLOGICAL RESPONSES OF SILVER Y MOTH, AUTOGRAPHA GAMMA (LEPIDOPTERA: NOCTUIDAE), TO FLORAL VOLATILES	I	180	24/08/00	16:30	CC		4	PS	4
Franco, C. R.	2082	BASELINE SUSCEPTIBILITY OF BREVIPALPUS (ACARI: TENUIPALPIDAE) TO ORGANOTIN ACARICIDES IN BRAZILIAN CITRUS GROVES	I	525	22/08/00	16:30	CC		11	PS	7
Franco, C. R.	14	BASES FOR AN ACARICIDE RESISTANCE MANAGEMENT PROGRAM OF BREVIPALPUS PHOENICIS (ACARI: TENUIPALPIDAE) TO THE ACARICIDE DICOFOL IN BRAZILIAN CITRUS	I	4	21/08/00	16:30	CC		1	PS	7
Franco, M-D.	604	HORMONAL REGULATION OF OLFACTORY DEVELOPMENT: DIAPAUSE ACCOMODATION?	I	153	23/08/00	13:35	Bol	S	4	5	4
Franco, O. L.	2063	EFFECTS IN VITRO AND IN VIVO OF SOYBEAN KUNITZ TRYPSIN INHIBITORS AGAINST THE BOOL WEEVIL ANTHONOMUS GRANDIS	I	520	22/08/00	16:30	CC		11	PS	11
Francovig, P. C.	2682	EXPERIMENTAL VARIABILITY OF SOYBEAN BENEFITIAL INSECTS SAMPLING METHODS	II	677	22/08/00	16:30	CC		14	PS	14
Frank, K.	983	SOURCE-SINK RE-COLONISATION: A POSSIBLE STRATEGY OF INSECTS LIVING IN TEMPORARILY SUITABLE HABITATS	I	248	22/08/00	16:30	CC		6	PS	6
Frank, R.	4142	SOCIOECONOMIC ANALYSIS OF THE IMPACT OF PLATYPUS SULCATUS CHAPUIS AT A FOREST FARM IN THE DELTA BONAERENSE	II	1046	21/08/00	16:30	CC		24	PS	24
Frank, R.	245	INCIDENCE OF THE DAMAGE OF PLATYPUS SULCATUS CHAPUIS (COLEOPTERA, PLATYPODIDAE) IN THE QUALITY OF POPULUS DELTOIDES WOODS	I	62	23/08/00	16:30	CC		2	PS	2
Frankie, G. W.	94	ARE POLLINATOR NUMBERS DECLINING OR FLUCTUATING NORMALLY ?	I	25	22/08/00	10:15	HB	A	2	3	2
Fransen, J.	961	CAN PLANTS USE ENTOMOPATHOGENS AS BODYGUARDS?	I	243	22/08/00	16:30	CC		6	PS	6
Franz, G.	2226	GENETIC AND MOLECULAR APPROACHES IN SUPPORT OF THE STERILE INSECT TECHNIQUE	I	562	25/08/00	11:05	HB	L	12	11	12
Franz, H.	2872	HOW THE FINE-SCALE PLUME STRUCTURE OF HOST-ODOURS AFFECT THE FLIGHT BEHAVIOUR OF MOSQUITOES	II	725	21/08/00	10:50	Bol	R	15	1	15
Franz, N. M.	3490	FORAGING SUCCESS AND INDIVIDUAL LEARNING OF ORIENTATION AND TIMING IN ECTATOMMA RUIDUM (FORMICIDAE: PONERINAE)	II	881	22/08/00	16:30	CC		19	PS	19
Franz, N. M.	3622	EVOLUTION OF "DERELOMINE FLOWER WEEVILS" (COLEOPTERA: CURCULIONIDAE) IN ASSOCIATION WITH PALMS AND CYCLANTHS	II	915	21/08/00	15:05	HB	E	21	2	21
Franz, O.	2433	FUNCTION-SPECIFIC TRANSCRIPTION IN THE NERVOUS SYSTEM AND SENSE ORGANS OF INSECTS	II	615	22/08/00	16:30	CC		13	PS	13
Frauer, A. M.	669	IDENTIFICATION OF HOSTPLANT VOLATILES ATTRACTIVE TO THE SPHINX MOTH, MANDUCA SEXTA	I	169	22/08/00	16:30	CC		4	PS	4
Fratello, B.	987	APHIDS: NOT ONLY A PEST INSECT	I	249	22/08/00	16:30	CC		6	PS	6
Frati, F.	3730	THE PHYLOGENY OF BASAL INSECTS: MOLECULAR AND MORPHOLOGICAL DATA COMPARED	II	942	21/08/00	16:30	CC		21	PS	21
Frati, F.	3097	ABERRANT SPERMATOGENESIS AND POST ZYGOTIC SEX-DETERMINATION IN COLLEMBOLA	II	781	26/08/00	13:30	HB	G	16	9	16
Frazier, M.	3085	BODY SIZE AND TRACHEAL FUNCTION IN GRASSHOPPERS	II	778	25/08/00	13:35	HB	G	16	8	16

Sub-titles: (HB=Hotel Bourbon) - (HM=Hotel Mabu) - (CC=Convention Center) - (Bol=Foz Boulevard) - (PS=Poster Session) - (PL=Plenary Lecturer)

AUTHOR	Nº	TITLE	Book	Page	Date	Time	Local	Room	Session	Symp	New Session
Frazier, M. R.	3133	INTERACTION OF OXYGEN TENSION AND TEMPERATURE ON INSECT DEVELOPMENT	II	790	22/08/00	16:30	CC		16	PS	16
Frederick, J. R.	2750	ARTHROPODS ASSOCIATED WITH DOUBLECROPPED SOYBEAN	II	694	23/08/00	16:30	CC		14	PS	14
Freebairn, C. G.	2676	CITRUS LEAFHOPPER IPM IN AUSTRALIA - ALTERNATIVE HOSTS FOR ENHANCEMENT OF MYMARID EGG PARASITOIDS?	II	676	22/08/00	16:30	CC		14	PS	14
Freeman, T. P.	1089	CHARACTERIZATION OF THE WAXY PARTICLES, AND THE PENETRATION AND FEEDING PROCESS OF WHITEFLIES	I	275	24/08/00	16:30	CC		6	PS	6
Freidberg, A.	3805	REVISION OF THE SUBGENUS CERATITIS (PTERANDRUS) BEZZI (DIPTERA: TEPHRITIDAE)	II	960	24/08/00	16:30	CC		21	PS	21
Freitas, A. C.	3639	CONTRIBUTION OF JUVENILE, CHEMICAL, AND BEHAVIORAL CHARACTERS TO LEPIDOPTERAN SYSTEMATICS	II	919	22/08/00	14:25	HB	E	21	4	21
Freitas, A. L.	2138	ENTOMOPHTHORALEAN PATHOGENIC FUNGI (ZYGOMYCOTINA – ZYGOMYCETES) IN THE NATURAL CONTROL OF INSECTS – PROSPECTS IN THE SOUTH OF BAHIA, BRAZIL	I	539	24/08/00	16:30	CC		11	PS	11
Freitas, A. V. L.	469	CONSERVATION IN ANTHROPOGENIC LANDSCAPES IN THE NEOTROPICS: RICHNESS, COMPOSITION, SIMILARITY, AND ENVIRONMENTAL CORRELATES OF BUTTERFLY FAUNULAS	I	119	21/08/00	16:30	CC		3	PS	3
Freitas, A. V. L.	1509	INFLUENCE OF PREY SIZE ON PREDATION SUCCESS BY ZELUS LONGIPES (HETEROPTERA: REDUVIIDAE)	I	381	21/08/00	16:30	CC		8	PS	8
Freitas, A. V. L.	1760	BEHAVIOR OF ACTINOTE PELLENEA PELLENEA (LEPIDOPTERA: NYMPHALIDAE) IN SE BRAZIL OVIPOSITING IN ITS FOOD-PLANT EUPATORIUM INULAEFOLIUM	I	443	21/08/00	16:30	CC		9	PS	9
Freitas, A. V. L.	1822	ANTS AS INDICATORS OF ENVIRONMENTAL CHANGE IN LOWLAND FORESTS OF THE ALTO RIO JURUÁ, ACRE, BRAZIL	I	459	21/08/00	16:20	HB	M	10	1	10
Freitas, F. C.	360	FIRST EVIDENCE OF COPTOTERMES HAVILANDI IN CAMPOS DOS GOYTACAZES (RJ), BRAZIL	I	91	25/08/00	16:30	CC		2	PS	2
Freitas, G. D.	1895	MANAGEMENT PROGRAMS FOR LEAF CUTTING ANTS IN BRAZIL	I	478	26/08/00	15:50	HB	M	10	10	10
Freitas, G. D.	1887	USE OF STRIPS OF NATIVE VEGETATION WITHIN EUCALYPTUS PLANTATIONS AS A STRATEGY TO REDUCE LEPIDOTERA PEST POPULATIONS	I	476	26/08/00	13:35	HB	M	10	10	10
Freitas, J. G.	2769	DEVELOPMENT AND DAMAGE OF THE RICE WEEVIL ON TRITICALE AND WHEAT CULTIVARS	II	699	21/08/00	16:30	CC		14	PS	23
Freitas, S.	184	FUNCTIONAL RESPONSE OF CHRYSOPERLA EXTERNA (HAGEN) (NEUROPTERA: CHRYSOPIDAE) FED NYMPHS OF UROLEUCON AMBROSIAE (THOMAS) (HEMIPTERA: APHIDIDAE) APHID FROM LETTUCE	I	47	21/08/00	16:30	CC		2	PS	2
Freitas, S.	1484	BIOLOGICAL ASPECTS OF CHRYSOPERLA EXTERNA AND CERAEOCHRYSA CINCTA IMMATURE STAGES FED EGGS AND NYMPHS OF BIOTYPE "B" BEMISIA TABACI	I	374	22/08/00	16:30	CC		8	PS	8
Freitas, S. de	1827	USE OF CRISOPIDAE ON BIOLOGICAL CONTROL OF TROPICAL FOREST INSECT	I	461	22/08/00	10:50	HB	M	10	2	10
Freitas, S. de	3189	MORPHOMETRIC STUDY OF THE GREEN LACEWING'S WING	II	804	25/08/00	16:30	CC		16	PS	16
Freitas, S. de	3326	STORAGE OF EGGS, LARVAE AND PUPAE OF CHRYSOPERLA EXTERNA IN DIFFERENTS PERIODS OF TIME AND TEMPERTURES	II	840	21/08/00	16:30	CC		18	PS	18
Freitas, S. de	2426	TROUBLES ABOUT THE USAGE OF ANGOUMOIS GRAIN MOTH EGGS TO FEEDING CHRYSOPID LARVAE	II	613	22/08/00	16:30	CC		13	PS	13
Freitas, S. de	1524	ACARICIDES SELETIVITY EVALUATION ON CHRYSOPERLA EXTERNA (NEUROPTERA: CHRYSOPIDAE)	I	384	23/08/00	16:30	CC		8	PS	8
Freitas, S. de	955	GREEN LACEWINGS OCCURENCE ON WEEDS IN CROP CORN	I	241	22/08/00	16:30	CC		6	PS	6
French, B. W.	500	MANAGING THE DIVERSITY OF CARABIDAE IN AGRICULTURAL LANDSCAPES	I	127	22/08/00	16:30	CC		3	PS	3
French, B. W.	1326	EFFECTS OF TRANSGENIC HYBRID MAIZE ON ADULT WESTERN CORN ROOTWORM EMERGENCE AND ROOT RATINGS	I	335	22/08/00	16:30	CC		7	PS	7
French, J. V.	1530	BIOLOGICAL CONTROL OF FLORIDA RED SCALE IN TEXAS CITRUS	I	386	22/08/00	16:30	CC		8	PS	8
Frérot, B.	640	NO PLEIOTROPIC EFFECT OF INSECTIDE RESISTANCE ON SEXUAL COMMUNICATION IN CYDIA POMOMELLA	I	162	21/08/00	16:30	CC		4	PS	4
Frescata, C.	670	MATING DISRUPTION PHEROMONES RELEASE IN PORTUGAL	I	169	22/08/00	16:30	CC		4	PS	4
Frey-da-Silva, A.	3761	ON THE GENUS PARAMECOCEPHALA (HETEROPTERA, PENTATOMIDAE, PENTATOMINI)	II	949	22/08/00	16:30	CC		21	PS	21
Freytag, E. D.	2677	FIELD TRIALS WITH PREMISE (IMIDACLOPRID) TERMITICIDE FOR CONTROLLING FORMOSAN SUBTERRANEAN TERMITES IN TREES IN NEW ORLEANS, LOUISIANA	II	676	22/08/00	16:30	CC		14	PS	14
Freytag, E. D.	2678	THERMAL IMAGING FOR THE DETECTION OF SUBTERRANEAN TERMITES AND DAMAGE	II	676	22/08/00	16:30	CC		14	PS	14
Freytag, E. D.	3542	A PILOT TEST FOR AREA WIDE MANAGEMENT OF THE FORMOSAN SUBTERRANEAN TERMITE IN THE FRENCH QUARTER, NEW ORLEANS, LOUISIANA	II	894	24/08/00	16:30	CC		19	PS	19
Freytag, E. D.	285	THE SIBERT TECHNOLOGY DIGITAL MICROPROBE (DMP) AND ITS USES IN DETECTING TERMITE GALLERIES, CAVITIES, AND DECAYED WOOD IN TREES, STRUCTURAL LUMBER, AND TRANSMISSION POLES	I	72	23/08/00	16:30	CC		2	PS	2
Frias, E. A.	1517	PRELIMINARY EVALUATION OF AGENIASPIS CITRICOLA (HYM: ENCYRTIDAE) ATTACKING PHYLLOCNISTIS CITRELLA (CITRUS LEAFMINER) IN ARGENTINA	I	383	21/08/00	16:30	CC		8	PS	8
Fridlender, B.	1997	BIOPESTICIDES BASED ON ENTOMOPATHOGENIC NEMATODES: DREAM OR REALITY?	I	504	21/08/00	15:35	HM	P	11	2	11
Fridlender, B.	4171	NEMATODES ADVANCEMENTS AND SUCCESSES	II	1053	21/08/00	9:30	HM	P	Erratum	1	11
Friedl, R. A.	1909	MORPHOLOGICAL CHARACTERISTICS OF NESTS AND CONTROL OF ATTA SEXDENS RUBROPILOSA WITH GRANULATED BAITS IN A PLANTATION OF PINUS TAEDA, SAFAC, WANDA, MISIONES	I	481	21/08/00	16:30	CC		10	PS	10
Friedländer, M.	3099	TRYPSIN-INDUCED MOTILITY IN MANDUCA SEXTA SPERMATOZOA IN VITRO	II	782	26/08/00	14:15	HB	G	16	9	16
Frieiro-Costa, F. A.	4140	BIOLOGICAL AND ECOLOGICAL STUDIES ON OMASPIDES TRICOLORATA (COLEOPTERA: CHRYSOMELIDAE: CASSIDINAE)	II	1046	26/08/00	10:00	HM	P	24	0	24
Frieiro-Costa, F. A.	980	BIOLOGICAL AND ECOLOGICAL STUDIES ON OMASPIDES TRICOLORATA (COLEOPTERA: CHRYSOMELIDAE: CASSIDINAE)	I	247					6		6
Friger, M.	4093	LOUSE COMB VERSUS HAND EXAMINATION FOR THE DIAGNOSIS OF HEAD LOUSE INFESTATIONS	II	1033	25/08/00	16:30	CC		23	PS	23
Friger, M.	2105	DESTRUCTION OF BACTERIA IN THE DIGESTIVE TRACT OF THE MAGGOT OF THE GREEN BOTTLE FLY, PHAENICIA SERICATA	I	531	23/08/00	16:30	CC		11	PS	11
Frigidi, V. M	1391	EXTRACTS OF CHRYSANTHEMUM CINERARIAEFOLIUM AND QUASSIA AMARA: EVALUATION OF EFICIENCE AND EFFECT ON SITOPHILUS ORYZAE (COLEOPTERA:CURCULIONIDAE)	I	351	25/08/00	16:30	CC		7	PS	7
Fritz, A. H.	3134	FINE STRUCTURE OF THE REPRODUCTIVE SYSTEM OF THE CARIBBEAN FRUITFLY	II	791	22/08/00	16:30	CC		16	PS	16
Fritz, G. N.	981	NEST DYNAMICS OF POLYGYNE COLONIES OF THE SOUTHEASTERN YELLOWJACKET.	I	248	23/08/00	16:30	CC		6	PS	6
Fritzsche, M. E.	1422	IS IT FEASIBLE TO INCREASE THE ATTRACTIVENESS OF CROP PLANTS TO PARASITOIDS?	I	359	21/08/00	10:50	HM	O	8	1	8
Fritzsche-Hoballah, M. E.	861	THE ACTIVE ROLE OF PLANTS IN ATTRACTING PARASITOIDS: DOES IT BENEFIT THE PLANTS?	I	218	25/08/00	13:35	HB	D	6	8	6
Fritzsche-Hoballah, M. E.	1452	POST-EMERGENCE HOST MANIPULATION BEHAVIOR BY LARVAE OF THE SOLITARY ENDOPARASITOID COTESIA MARGINIVENTRIS (HYMENOPTERA: BRACONIDAE)	I	366	23/08/00	13:55	HM	O	8	6	8
Frizzas, M. R.	982	SURVEY OF INSECTS IN WEEDS DURING THE OFF-SEASON OF CORN CULTURE	I	248	22/08/00	16:30	CC		6	PS	6

Sub-titles: (HB=Hotel Bourbon) - (HM=Hotel Mabu) - (CC=Convention Center) - (Bol=Foz Boulevard) - (PS=Poster Session) - (PL=Plenary Lecturer)

AUTHOR	Nº	TITLE	Book	Page	Date	Time	Local	Room	Session	Symp	New Session
Frohlich, D. R.	314	IDENTIFICATION OF PROTEOLYTIC ACTIVITY IN BEMISIA TABACI B TYPE (HOMOPTERA: ALEYRODIDAE)	I	80	24/08/00	16:30	CC		2	PS	2
Frohlich, D. R.	3720	MOLECULAR PHYLOGENY OF BEMISIA TABACI (HOMOPTERA; ALEYRODIDAE) USING A MITOCHONDRIAL MARKER, THE 16S RIBOSOMAL SUBUNIT GENE	II	939	21/08/00	16:30	CC		21	PS	21
Frommer, M.	2337	TRACKING AUSTRALIAN FRUIT FLIES USING MICROSATELLITES	I	590	25/08/00	16:30	CC		12	PS	12
Frouz, J.	1181	INTERACTIONS OF MICROFLORA AND LARVAE OF BIBIONIDS IN TRANSFORMATION OF PLANT LITTER	I	298	25/08/00	16:30	CC		6	PS	6
Frouz, J.	983	SOURCE-SINK RE-COLONISATION: A POSSIBLE STRATEGY OF INSECTS LIVING IN TEMPORARILY SUITABLE HABITATS	I	248	22/08/00	16:30	CC		6	PS	6
Frouz, J.	984	THERMOREGULATION OF NEST OF WOOD ANT FORMICA POLYCTENA	I	248	22/08/00	16:30	CC		6	PS	6
Fry, C.	1717	MEIOTIC DRIVE, SPERM COMPETITION AND THE EVOLUTION OF MULTIPLE MATING BY FEMALE STALK-EYED FLIES (DIOPSIDAE)	I	433	21/08/00	15:10	HB	F	9	1	9
Fuchsberger, N.	34	INTERACTION OF TICK SALIVA WITH THE HOST IMMUNE MECHANISMS AND ITS SIGNIFICANCE FOR PATHOGEN TRANSMISSION	I	9	22/08/00	16:30	CC		1	PS	1
Fuchsberger, N.	2893	TICK-HOST INTERACTIONS IN THE CO-FEEDING TRANSMISSION OF TICK-BORNE ENCEPHALITIS VIRUS: CELL INVOLVEMENT	II	730	22/08/00	15:50	Bol	R	15	4	15
Fuentes-Contreras, E.	1539	AN EXOTIC APHID SPECIES IS FAVOURED BY ADJACENT TROPHIC LEVELS: HOST PLANT AND NATURAL ENEMY IMPACT ON CEREAL APHID COMPETITION	I	388	22/08/00	16:30	CC		8	PS	8
Fuester, R. W.	3916	ASSESSING HOST RANGE OF A GYPSY MOTH PARASITOID: APHANTORHAPHOPSIS SAMARENSIS (DIPTERA: TACHINIDAE)	II	988	25/08/00	14:00	HB	H	22	7	22
Fujii, K.	2712	INTEGRATED PEST MANAGEMENT PROGRAM USING MATING DISRUPTOR IN JAPANESE PEAR ORCHARDS	II	685	22/08/00	16:30	CC		14	PS	14
Fujii, Y.	2142	TRANSINFECTION OF WOLBACHIA ENDOSYMBIONTS AMONG THREE SPECIES OF LEPIDOPTERAN INSECTS	I	540	25/08/00	16:30	CC		11	PS	11
Fujimoto, H.	3264	RELATIONSHIPS BETWEEN THE LOCATION AND THE RADIATION SENSITIVITY OF RETROTRANSPOSONS IN THE GENOME AND THE INSERTION MECHANISM	II	824	22/08/00	10:20	HB	K	18	2	18
Fujimoto, H.	3167	ISOLATION AND COMPARISON OF MARINER-LIKE SEQUENCES (MLSS) AMONG SOME LEPIDOPTERAN INSECTS AND INVERTEBRATES	II	799	24/08/00	16:30	CC		16	PS	16
Fujisaki, K.	2428	EFFECT OF LARVAL DIETS ON THE SURVIVAL AND DEVELOPMENT OF LARVAE IN THE COTTON BOLLWORM, HELICOVERPA ARMIGERA (LEPIDOPTERA: NOCTUIDAE)	II	613	22/08/00	16:30	CC		13	PS	13
Fujita, A.	2429	POSSIBLE DIGESTIVE FUNCTION OF LYSOZYME IN A WOOD-FEEDING TERMITE, RETICULITERMES SPERATUS	II	614	22/08/00	16:30	CC		13	PS	13
Fujiwara, H.	3313	ECDYSTEROID CONTROL OF WING MORPHOGENESIS DURING METAMORPHOSIS AND PUPAL DEVELOPMENT	II	837	23/08/00	16:30	CC		18	PS	18
Fukatsu, T.	826	MOLECULAR PHYLOGENETIC ANALYSIS OF GALL STRUCTURE AND EVOLUTION IN APHIDS	I	209	23/08/00	9:50	HB	D	6	5	6
Fukuda, H.	3346	DETECTION OF WOLBACHIA IN A LINE WITH FEMALE-BIASED SEX RATIO OF A BUTTERFLY, HYPOLIMNAS BOLINA	II	845	23/08/00	16:30	CC		18	PS	18
Fukui, M.	1761	THE CHANGES OF SIGNALS IN MALE-FEMALE DUETS OF THE DEPHALICIDAE LEAFHOPPER, NEPHOTETTIX NIGROPICUTUS	I	444	22/08/00	16:30	CC		9	PS	9
Fukumoto, E.	3327	THE EFFECTS OF EGG AND ADULT TEMPERATURES ON INDUCTION OF EMBRYONIC DIAPAUSE IN DIANEMOBIUS NIGROFASCIATUS (ORTHOPTERA: GRYLLIDAE)	II	840	21/08/00	16:30	CC		18	PS	18
Fuller, B. W.	241	ROOTWORM EMERGENCE FROM Cry3Bb HYBRIDS COMPARED TO THAT OBSERVED WITH INSECTICIDE-TREATED MAISE.	I	61	22/08/00	16:30	CC		2	PS	2
Funderburk, J. E.	2828	EFFECTS OF INFECTION BY THE PARASITIC NEMATODE THRIPINEMA FUSCUM ON FRANKLINIELLA FUSCA POPULATION DYNAMICS AND TOSPOVIRUS EPIDEMIOLOGY IN PEANUT	II	714	25/08/00	16:30	CC		14	PS	14
Furiatti, R. S.	4074	EVALUATION OF INSECTICIDES TO CONTROL SITOPHILUS ORYZAE (COLEOPTERA: CURCULIONIDAE) AND RHYZOPERTHA DOMINICA IN STORED BARLEY	II	1029	22/08/00	16:30	CC		23	PS	23
Furiatti, R. S.	1327	EVALUATION OF IMIDACLOPRID, THIACLOPRID AND METHIOCARB TO CONTROL MYZUS PERSICAE (HOMOPTERA: APHIDIDADE) IN POTATO	I	335	22/08/00	16:30	CC		7	PS	7
Furiatti, R. S.	2739	ENVIRONMENT PROTECTION THROUGH RESISTANT POTATO: RESEARCH, EDUCATION AND DELIVERING INFORMATION IN BRAZIL	II	692	23/08/00	16:30	CC		14	PS	14
Furiatti, R. S.	4034	EFFICACY OF PHOSPHINE TO CONTROL SITOPHILUS ORYZAE, S. ZEAMAIS (COLEOPTERA: CURCULIONIDAE), RHYZOPERTHA DOMINICA (COL: BOSTRICHIDAE) AND ORYZAEPHILUS SURINAMENSIS (COL: SILVANIDAE) IN THE FUMIGATION OF STORED SOY BRAN	II	1019	23/08/00	11:15	HB	J	23	6	23
Furlan, M.	1365	INSECTICIDE PROPERTIES OF ETHANOLIC EXTRACT ISOLATED FROM SEEDS OF PIPER TUBERCULATUM SEEDS (PIPERACEAE) ON DIATRAEA SACCHARALIS (LEPIDOPTERA: PYRALI DAE)	I	344	25/08/00	16:30	CC		7	PS	7
Furlan, M.	703	SUSCEPTIBILITY TESTS OF 4,5-DIIDROPIPERLONGUMININA ISOLATED FROM PIPER TUBERCULATUM SEEDS ON VELVETBEAN CATERPILLAR	I	178	24/08/00	16:30	CC		4	PS	4
Furtado, A. F.	623	UTILIZATION OF PCR FOR DETECTION OF WUCHERERIA BANCROFTI IN BARRA DE GUABIRABA - PE, NON-EDEMIC CONSIDERED AREA	I	158	21/08/00	16:30	CC		4	PS	4
Furtado, A. F.	2227	RAPD MARKERS FOR GENETIC POPULATIONS STUDIES IN AEDES	I	562	21/08/00	16:30	CC		12	PS	12
Furth, D.	4120	ALTICINAE DIVERSITY IN COSTA RICA	II	1041	25/08/00	9:40	HM	P	24	2	24
Furukawa, S.	2356	REGULATION OF TISSUE-SPECIFIC AND LIPOPOLYSACCHARIDE-INDUCIBLE GENE EXPRESSION OF AN ANTIBACTERIAL PROTEIN FROM THE SILKWORM, BOMBYX MORI	II	595	23/08/00	11:45	HB	I	13	4	13
Furukawa, S.	2516	CDNA CLONING AND EXPRESSION ANALYSIS OF REL PROTEINS FROM BOMBYX MORI	II	635	25/08/00	16:30	CC		13	PS	13
Furusawa, H.	564	RELATION BETWEEN THE DIVERSITY OF CARABID BEETLES AND DEER, MICE, AND DWARF BAMBOO IN A DECLINING ALPINE FOREST	I	143	25/08/00	16:30	CC		3	PS	3
Fusco, R. A.	1869	NEW BACILLUS THURINGIENSIS PRODUCTS AND THE FUTURE OF BACILLUS THURINGIENSIS PRODUCTS IN THE NEW MILLENNIUM	I	471	25/08/00	10:35	HB	M	10	7	10
Fuse, M.	2338	CHECK-POINTS AND TRIGGERS IN THE PEPTIDE CASCADE THAT ORCHESTRATES ECDYSIS BEHAVIOR IN INSECTS	II	591	21/08/00	9:35	HB	I	13	1	13
G.H. Bechara	2985	IXODID TICKS COLLECTED FROM ARMADILLO EUPHRACTUS SEXCINCTUS AND ANTEATER MYMERCOPHAGA TRIDACTYLA AT EMAS NATIONAL PARK, STATE OF GOIÁS, BRAZIL.	II	753	22/08/00	16:30	CC		15	PS	15
Gabriel, D.	1762	BOLL WEEVIL: BIOLOGY IN ALTERNATE HOST BY ARTIFICIAL OVIPOSITION	I	444	22/08/00	16:30	CC		9	PS	9
Gadelhak, G. G.	1480	TETRASTICHUS PHYTOMYZAE (HYMENOPTERA: EULOPHIDAE), AN INTERNAL PARASITOID ON THE BROOMRAPE FLY, PHYTOMYZA OROBANCHIA (DIPTERA : AGROMYZIDAE)	I	373	21/08/00	16:30	CC		8	PS	8
Gadoury, G. D.	2581	INTERACTIONS BETWEEN MITES AND PLANT PATHOGENS AND IMPLICATIONS FOR BIOLOGICAL CONTROL IN GRAPES	II	652	24/08/00	10:35	HB	B	14	6	14
Gage, S. H.	811	MOVEMENT OF ORGANISMS IN THE BIOSPHERE: A PERSPECTIVE ON SPATIAL AND TEMPORAL SCALES	I	205	22/08/00	9:50	HB	D	6	3	6
Gaglianone, M. C.	1763	FORAGING BEHAVIOR OF EPICHARIS BEES (HYMENOPTERA, APOIDEA, CENTRIDINI)	I	444	22/08/00	16:30	CC		9	PS	9
Gagou, M. E.	2265	CLONING OF THE ACIDIC RIBOSOMAL P-PROTEINS IN THE SILKMOTH BOMBYX MORI	I	572	22/08/00	16:30	CC		12	PS	12
Gahan, L. J.	1262	RESISTANCE IN DIAMONDBACK MOTH: LESSONS FROM THE HELIOTHINES	I	319	24/08/00	14:35	HM	N	7	8	7
Gaimari, S. D.	501	SYSTEMATICS AND BIOGEOGRAPHY OF THE CYCLOTELINE THEREVINAE (DIPTERA: THEREVIDAE)	I	127	22/08/00	16:30	CC		3	PS	3

Sub-titles: (HB=Hotel Bourbon) - (HM=Hotel Mabu) - (CC=Convention Center) - (Bol=Foz Boulevard) - (PS=Poster Session) - (PL=Plenary Lecturer)

AUTHOR	N°	TITLE	Book	Page	Date	Time	Local	Room	Session	Symp	New Session
Gais, N. L.	2118	VIRULENCE OF BEAUVERIA BASSIANA ISOLATES TO OLIGONYCHUS YOTHERSI (ACARI: TETRANICHIDAE)	I	534	24/08/00	16:30	CC		11	PS	11
Gaju, M.	3394	TERMITE DAMAGE TO BUILDINGS IN THE PROVINCE OF CORDOBA	II	857	21/08/00	11:50	HM	Q	19	1	19
Gaju, M.	3832	MULTIVARIATE STATISTICAL ANALYSIS AIDS TO THE CHARACTERIZATION OF THE GENUS RETICULITERMES IN SPAIN (ISOPTERA: RHINOTERMITIDAE)	II	967	24/08/00	16:30	CC		21	PS	21
Galante, E.	925	LOSS OF TENEBRIONID DIVERSITY IN MEDITERRANEAN ISLANDs AS INDICATOR OF ENVIROMENTAL DEGRADATION (COLEOPTERA TENEBRIONIDAE)	I	234	21/08/00	16:30	CC		6	PS	6
Galante, E.	3671	HOPLIINI OF THE IBERIAN PENINSULA SCARABAEOIDEA, MELOLONTHIDAE): A BIOGEOGRAPHICAL AND TAXONOMIC STUDY	II	927	24/08/00	14:35	HB	E	21	7	21
Galán-Wong, L.	2125	GENETIC VARIABILITY AMONG BEAUVERIA BASSIANA AND PAECILOMYCES FUMOSOROSEUS	I	536	24/08/00	16:30	CC		11	PS	11
Galán-Wong, L.	2077	A PAECILOMYCES FUMOSOROSEUS MUTANT OVERPRODUCING CHITINASE DISPLAYS HIGH VIRULENCE AGAINST BEMISIA TABACI	I	524	22/08/00	16:30	CC		11	PS	11
Galardo, A. K. R.	1303	EVALUATION OF THE STATUS OF RESISTANCE OF AEDES AEGYPTI TOTEMEPHOS IN THE STATE OF RIO DE JANEIRO - BRAZIL	I	329	21/08/00	16:30	CC		7	PS	7
Galardo, A. K. R.	4075	DISPERSION OF AEDES AEGYPTI AND AEDES ALBOPICTUS AND THEIR RELATIONSHIP TO DENGUE TRANSMISSION IN THE STATE OF RIO DE JANEIRO, BRAZIL, 1986•1997	II	1029	22/08/00	16:30	CC		23	PS	23
Galardo, A. K. R.	4076	EVALUATION OF TEMEPHOS SUSCEPTIBILITY IN AEDES AEGYPTI IN RIO DE JANEIRO, BRAZIL	II	1029	22/08/00	16:30	CC		23	PS	23
Galeano, P. E.	1305	BOTANICAL EXTRACT EFFECT ON ANASTREPHA FRATERCULUS (DIP., TEPHRITIDAE) BIOLOGY	I	329	21/08/00	16:30	CC		7	PS	7
Galián, J.	3762	INVESTIGATION OF THE VALIDITY OF SPECIES STATUS OF TOMICUS DESTRUENS (COLEOPTERA, SCOLYTIDAE) USING RIBOSOMAL DNA	II	950	22/08/00	16:30	CC		21	PS	21
Galián, J.	2304	PATTERNS OF rDNA LOCALIZATION IN TIGER BEETLES (COLEOPTERA: CICINDELIDAE)	I	581	24/08/00	16:30	CC		12	PS	12
Galián, J.	3718	PHYLOGENETIC RELATIONSHIPS OF THE GENUS ZABRUS (COLEOPTERA, CARABIDAE) BASED ON MORPHOLOGICAL, KARYOTYPIC, AND MOLECULAR DATA	II	939	21/08/00	16:30	CC		21	PS	21
Galileo, M. H. M.	1944	NEW RECORDS OF COLEOPTERA AND HYMENOPTERA FROM ARAUCARIA ANGUSTIFOLIA TREES IN THE SOUTH OF BRAZIL	I	490	23/08/00	16:30	CC		10	PS	10
Galileo, M. H. M.	3159	THE WEEVIL GENUS ARAUCARIUS (CURCULIONIDAE, COSSONINAE) - NEW INVESTIGATION OF AN UNUSUAL TIBIAL STRUCTURE	II	797	24/08/00	16:30	CC		16	PS	16
Galileo, M. H. M.	3765	NEW TAXA AND NOTES ON NEOTROPICAL CERAMBYCIDAE (COLEOPTERA)	II	950	22/08/00	16:30	CC		21	PS	21
Galindo-Cardona, A.	985	CONNECTIVITY AND HABITAT PREFERENCE OF SPASSALUS CRENATUS (COLEOPTERA: PASSALIDAE) IN THE LUQUILLO EXPERIMENTAL FOREST, PUERTO RICO	I	249	22/08/00	16:30	CC		6	PS	6
Gallardo, F.	488	BIODIVERSITY OF CYNIPOIDEA FROM BRAZIL (HYMENOPTERA).	I	124	22/08/00	16:30	CC		3	PS	3
Gallardo, F. E.	1571	THE TYPES OF ENCYRTIDAE (HYMENOPTERA, CHALCIDOIDEA) HOUSED IN THE MUSEO DE LA PLATA	I	396	23/08/00	16:30	CC		8	PS	8
Gallego, D.	3762	INVESTIGATION OF THE VALIDITY OF SPECIES STATUS OF TOMICUS DESTRUENS (COLEOPTERA, SCOLYTIDAE) USING RIBOSOMAL DNA	II	950	22/08/00	16:30	CC		21	PS	21
Gállego, L.	3103	PRACTICAL APPLICATION OF A CLASSIFICATION FUNCTION TO DETERMINE WING MORPHOLOGY DIFFERENCES BETWEEN WILD AND STERILE MALES OF CERATITIS CAPITATA (DIPTERA: TEPHRITIDAE).	II	783	21/08/00	16:30	CC		16	PS	16
Gallegos, D. M. N.	2746	MORTALITY OF THE ANTICARSIA GEMMATALIS IN ARTIFICIAL DIET TREATED WITH AQUEOUS EXTRATS OF THE MELIA AZEDARACH	II	693	23/08/00	16:30	CC		14	PS	14
Galli, J. C.	1651	PREDATORS OF FRUIT FLY ANASTREPHA SPP (DIPTERA, TEPHRITIDAE) COLLECTED WITH PIT FALL TRAPS IN PSIDIUM GUAJAVA ORCHARDS UNDER REGULAR APPLICATION OF INSECTICIDE	I	416	24/08/00	16:30	CC		8	PS	8
Galusky, P. S.	986	IMPLICATIONS OF HOST-PLANT CARBON UPTAKE PATTERNS AND LEAF SIZE ON THE PERFORMANCE AND ABUNDANCE OF A CYNIPID GALLFORMER	I	249	22/08/00	16:30	CC		6	PS	6
Galvan, T. L.	673	ECONOMIC INJURY LEVEL AND SEQUENCIAL SAMPLING FOR BEMISIA TABACI IN TOMATO	I	170	23/08/00	16:30	CC		4	PS	4
Galvão, J. C. C.	636	INTENSITY OF LOSSES IN MAIZE CULTIVATED UNDER MINERAL AND ORGANIC FERTILIZATION SYSTEMS.	I	161	21/08/00	16:30	CC		4	PS	4
Galvão, J. C. C.	732	LIFE TABLES OF THE CULTURES APPLIED TO PESTS OF MAIZE UNDER INTERCROPPED CULTIVATION	I	185	25/08/00	16:30	CC		4	PS	4
Gan, M.	40	THE CAPTURE EFFECT OF PREDACEOUS MITE AMBLYSEIUS ORIENTALIS TO THE RED MITE PANONYCHUS CITRI AT DIFFERENT TEMPERATURES	I	10	23/08/00	16:30	CC		1	PS	1
Ganassi, S.	987	APHIDS: NOT ONLY A PEST INSECT	I	249	22/08/00	16:30	CC		6	PS	6
Gandolfo, D.	1580	CLASSICAL BIOLOGICAL CONTROL OF SOLANUM VIARUM (SOLANACEAE) IN THE USA	I	398	23/08/00	16:30	CC		8	PS	8
Gandolfo, D.	2064	SAFETY OF GRATIANA BOLIVIANA AS A BIOCONTROL AGENT OF TROPICAL SODA APPLE (SOLANUM VIARUM): IS EGGPLANT A SUITABLE HOST?	I	521	22/08/00	16:30	CC		11	PS	11
Ganio, L. M.	3585	SEASONAL AND DISTURBANCE-INDUCED VARIATION IN CANOPY INVERTEBRATE COMMUNITIES IN NEOTROPICAL RAIN FORESTS	II	905	24/08/00	15:30	Bol	U	20	2	20
Gapparov, F. A.	2732	LOCUST MANAGEMENT IN RUSSIA, UZBEKISTAN, KAZAKHSTAN AND OTHER CIS COUNTRIES: LESSONS OF DECENTRALIZATION	II	690	23/08/00	16:30	CC		14	PS	14
Gara, R. I.	1834	AN IPM APPROACH TO PREVENT THE ACCIDENTAL IMPORTATION OF SUBCORTICAL INSECTS FROM CHILE TO THE UNIDET STATES	I	462	22/08/00	14:35	HB	M	10	3	10
Gara, R. I.	373	EFFECTIVENESS OF METHYL BROMIDE ALTERNATIVES AGAINST POTENTIAL PESTS TO BE IMPORTED TO THE UNITED STATES FROM CHILE	I	94	25/08/00	16:30	CC		2	PS	2
Gara, R. I.	2856	AN IPM APPROACH TO PREVENTION OF POTENTIAL PESTS THAT MIGHT BE IMPORTED TO THE UNITED STATES ON CHILEAN LOGS: PART I, EFFECTIVENESS OF METHYL BROMIDE ALTERNATIVES	II	721	24/08/00	16:30	CC		14	PS	14
García, B. A.	2250	MITOCHONDRIAL DNA SEQUENCES OF TRIATOMINAE (HEMIPTERA: REDUVIIDAE): PHYLOGENETIC RELATIONSHIPS	I	568	22/08/00	16:30	CC		12	PS	12
García, C. D.	232	SUSCEPTIBILITY OF DIFFERENT ONION HYBRIDS AND VARIETIES TO THE ATTACK OF ONION MAGGOT DELIA ANTIQUA (DIPTERA: ANTHOMYIIDAE)	I	59	22/08/00	16:30	CC		2	PS	2
García, G.	1830	PLATYPUS SULCATUS: A RATIONAL APPROACH TO ITS CONTROL IN POPULUS SPP. IN ARGENTINA	I	461	22/08/00	11:35	HB	M	10	2	10
García, J. E.	2985	IXODID TICKS COLLECTED FROM ARMADILLO EUPHRACTUS SEXCINCTUS AND ANTEATER MYMERCOPHAGA TRIDACTYLA AT EMAS NATIONAL PARK, STATE OF GOIÁS, BRAZIL.	II	753	22/08/00	16:30	CC		15	PS	15
García, J. F.	2130	ULTRASTRUCTURAL ASPECTS OF THE COLONIZATION PROCESS OF ECDYTOLOPHA AURANTIANA BY THE ENTOMOPATHOGENIC NEMATODE STEINERNEMA GLASERI	I	537	24/08/00	16:30	CC		11	PS	11
García, M. S.	1531	PARASITISM OF EGGS OF APPLE LEAF ROLLER BONAGOTA CRANAODES (LEPIDOPTERA: TORTRICIDAE) BY TRICHOGRAMMA SP. IN FIELD CONDITIONS	I	386	22/08/00	16:30	CC		8	PS	8
García, M. V. B.	900	ON THE BIOLOGY OF THREE NEW POLLINATING SPECIES (COLEOPTERA: CURCULIONIDAE: DERELOMINI) OF CAIAUÉ ELAEIS OLEIFERA CORTÉS AND OF THE F1 HYBRID (E. GUINEENSIS X E. OLEIFERA) IN THE STATE OF AMAZONAS, BRAZIL	I	227	21/08/00	16:30	CC		6	PS	6
García, P.	3328	FECUNDITY OF TRICHOGRAMMA CORDUBENSIS FEMALES FROM SEXUAL AND ASEXUAL LINES	II	840	22/08/00	16:30	CC		18	PS	18
García, P. C.	2283	A X-AUTOSOME TANDEM FUSION IN AN UNDESCRIBED SPECIES OF THE FAMILY PODOSCIRTIDAE	I	576	23/08/00	16:30	CC		12	PS	12
García, P. C.	2285	NON MENDELIAN BEHAVIOR IN MALE MEIOSIS ASYNAPTICAL MULTIPLE SEX CHROMOSOMES IN CRICKETS	I	577	25/08/00	16:30	CC		12	PS	12

Sub-titles: (HB=Hotel Bourbon) - (HM=Hotel Mabu) - (CC=Convention Center) - (Bol=Foz Boulevard) - (PS=Poster Session) - (PL=Plenary Lecturer)

AUTHOR	Nº	TITLE	Book	Page	Date	Time	Local	Room	Session	Symp	New Session
García, P. C.	3766	PHALLIC STRUCTURE, BIOACUSTIC AND CHROMOSOMES OF THE CRICKET UROGRYLLUS TOLEDOPIZAI	II	951	21/08/00	16:30	CC		21	PS	21
García, P. C.	3767	MORPHOLOGY, BIOACUSTIC AND CYTOGENETIC IN 4 SPECIES OF ANUROGRYLLUS (ORTHOPTERA, GRYLLIDAE).	II	951	22/08/00	16:30	CC		21	PS	21
García, P. C.	2284	DOES AN X-AUTOSOME CENTRIC FUSION IN ACRIDOIDEA CONDEMN THE SPECIES TO EXTINTION?	I	576	23/08/00	16:30	CC		12	PS	12
Garcia, P. V.	1532	EFFECTS OF WASP DENSITY ON THE BIOLOGY OF TRICHOGRAMMA CORDUBENSIS	I	386	22/08/00	16:30	CC		8	PS	8
Garcia, P. V.	1686	EFFECTS OF CONVENTIONAL PESTICIDES ON THE PREIMAGINAL DEVELOPMENT OF TRICHOGRAMMA CORDUBENSIS (HYMENOPTERA: TRICHOGRAMMATIDAE)	I	425	25/08/00	16:30	CC		8	PS	8
Garcia, R.	3110	INCIDENCE AND MORPHOLOGIC ASPECTS OF LONOMIA OBLIQUA (LEPIDOPTERA: SATURNIIDAE).	II	785	21/08/00	16:30	CC		16	PS	16
García, R.	4091	DATA ON INSECTS IMPLICATED IN THE DESTRUCTION OF WORKS OF ART IN SPAIN	II	1033	23/08/00	16:30	CC		23	PS	23
García-Barros, E.	3135	INTERSPECIFIC ALLOMETRY IN THE EGG TO BODY SIZE RATIO IN BUTTERFLIES (LEPIDOPTERA): IS THERE A PATTERN?	II	791	22/08/00	16:30	CC		16	PS	16
García-Barros, E.	3768	PHENOLOGY OF A POTENTIALLY MULTIVOLTINE BUTTERFLY, COENONYMPHA PAMPHILUS IN A MEDITERRANEAN ENVIRONMENT	II	951	23/08/00	16:30	CC		21	PS	21
García-Barros, E.	4077	PARSIMONY ANALYSIS OF ENDEMICITY AND ITS APPLICATION TO DETECT HIGH ENDEMISM AREAS USING COMBINED DATA FROM INSECTS, VERTEBRATES, AND PLANTS, FROM THE IBERIAN PENINSULA	II	1029	21/08/00	16:30	CC		23	PS	23
García-Criado, F.	566	AQUATIC COLEOPTERA ASSEMBLAGES FROM SHALLOW LAKES ASSOCIATED TO THE CANAL DE CASTILLA (CENTRAL SPAIN)	I	143	22/08/00	16:30	CC		3	PS	3
García-Franco, J.	960	SEEDLINGS AS EPHEMERAL UNDERSTORY IN MANGROVES : IMPACT OF HERBIVORES AND WATER LEVEL ON SEEDLING SURVIVAL	I	242	22/08/00	16:30	CC		6	PS	6
García-Lara, S.	637	SELECTION OF TROPICAL STEM BORERS FOR RESISTANCE TO CRYIAB IN MAIZE	I	161	21/08/00	16:30	CC		4	PS	4
García-Lara, S.	638	BIOCHEMICAL BASIS FOR STORAGE PEST RESISTANCE IN MAIZE	I	161	21/08/00	16:30	CC		4	PS	4
García-Lara, S.	639	DEVELOPMENT AND CHARACTERIZATION OF MAIZE POPULATIONS RESISTANT TO TROPICAL STEM BORERS AND ARMYWORM	I	162	21/08/00	16:30	CC		4	PS	4
Gardenal, C. N.	2310	MITOCHONDRIAL DNA "A+T RICH" REGION AS A GENETIC MARKER IN AEDES AEGYPTI POPULATION STUDIES	I	583	24/08/00	16:30	CC		12	PS	12
Gardi, T.	886	IMPROVEMENT OF HONEY-BEE POLLINATION IN ACTINIDIA DELICIOSA	I	224	21/08/00	16:30	CC		6	PS	6
Gardiner, E. M. M.	2371	THE ROLE OF POLYDNAVIRUSES IN DEFINING PARASITOID HOST RANGES	II	599	24/08/00	13:35	HB	I	13	7	13
Gardner, J.	2859	POTENTIAL OF MILLET AS A SWEET CORN COMPANION PLANT: EFFECT ON EUROPEAN CORN BORER AND BENEFICIAL INSECTS	II	722	25/08/00	16:30	CC		14	PS	14
Gardner, J.	1550	INOCULATIVE RELEASES OF TRICHOGRAMMA OSTRINIAE FOR EUROPEAN CORN BORER CONTROL	I	391	22/08/00	16:30	CC		8	PS	8
Gare, D.	2890	INTERACTIONS BETWEEN MALARIA PARASITES AND THE MOSQUITO VECTOR	II	729	22/08/00	14:35	Bol	R	15	4	15
Gavelis, P. A.	477	AQUATIC INSECT BIODIVERSITY IN STREAMS OF DIFFERENT BASINS AT A REGIONAL SCALE	I	121	21/08/00	16:30	CC		3	PS	3
Gargalianou, I.	3242	APHID POPULATION FLUCTUATION AND SPREAD OF APHID-BORNE VIRUSES IN TOBACCO CROPS IN GREECE	II	818	23/08/00	16:30	CC		17	PS	17
Gargalianou, I.	3227	NEW APHID VECTORS OF ZUCCHINI YELLOW MOSAIC VIRUS AND THEIR ROLE IN THE EPIDEMIOLOGY OF THE VIRUS IN GREECE	II	815	22/08/00	16:30	CC		17	PS	17
Garín, C. F.	2301	MOLECULAR PHYLOGENY, CHROMOSOMES, AND HOST PLANT AFFILIATION IN CHRYSOLINA AND OREINA (COLEOPTERA, CHRYSOMELIDAE)	I	581	24/08/00	16:30	CC		12	PS	12
Garin, I.	996	INSECTS AS BATS' PREY: A CASE STUDY ON KUHL'S PIPISTRELLE (PIPISTRELLUS KUHLII)	I	251	22/08/00	16:30	CC		6	PS	6
Gariou-Papalexiou, A.	3976	A CENTROMERE-SPECIFIC CLONE IN THE MEDFLY, CERATITIS CAPITATA	II	1003	24/08/00	16:30	CC		22	PS	22
Gariou-Papalexiou, A.	2251	CYTOGENETIC STUDIES OF POLYTENE CHROMOSOMES IN THE TSETSE FLIES GLOSSINA AUSTENI AND GLOSSINA PALLIDIPES	I	568	23/08/00	16:30	CC		12	PS	12
Garneria, I.	4133	MOLECULAR PHILOGENY OF THE GENUS CYRTONUS (COLEOPTERA: CHRYSOMELIDAE)	II	1044	25/08/00	16:00	HM	P	24	2	24
Garneria, I.	3769	MOLECULAR PHILOGENY OF THE GENUS CYRTONUS (COLEOPTERA: CHRYSOMELIDAE)	II	951					21		21
Garnería, I.	2301	MOLECULAR PHYLOGENY, CHROMOSOMES, AND HOST PLANT AFFILIATION IN CHRYSOLINA AND OREINA (COLEOPTERA, CHRYSOMELIDAE)	I	581	24/08/00	16:30	CC		12	PS	12
Garnier, M.	3215	INSERTIONAL MUTAGENESIS OF SPIROPLASMA CITRI IN RELATION TO PATHOGENICITY	II	812	22/08/00	15:30	Bol	U	17	2	17
Garófalo, C. A.	991	THE NESTING BIOLOGY OF EUFRIESEA VIOLACEA (HYMENOPTERA: APIDAE) IN TRAP-NESTS	I	250	22/08/00	16:30	CC		6	PS	6
Garófalo, C. A.	1750	FRAGRANCE COLLECTION BY MALE EUGLOSSINE BEES, EUGLOSSA TOWNSENDI (HYMENOPTERA, APIDAE) IN FLOWERS OF CRINUM PROCERUM (AMARYLLIDACEAE)	I	441	21/08/00	16:30	CC		9	PS	9
Garófalo,C. A.	1769	SPECIES RICHNESS AND SEASONAL ABUNDANCE OF MALE EUGLOSSINE BEES (HYMENOPTERA: APIDAE) IN A SEMIDECIDUAL STATIONAL FOREST OF THE SÃO PAULO STATE	I	446	22/08/00	16:30	CC		9	PS	9
Garrido, J.	479	LAKES, PONDS AND WETLANDS AS HABITAT FOR BEETLES (COLEOPTERA, ADEPHAGA AND POLYPHAGA)	I	121	23/08/00	16:30	CC		3	PS	3
Garrido, J.	502	A RELATIONAL DATABASE MODEL TO INTEGRATE DISTRIBUTION DATA IN GEOGRAPHICAL INFORMATION SYSTEMS (G.I.S.)	I	127	23/08/00	16:30	CC		3	PS	3
Garrido, J.	555	PRELIMINARY CHECK LIST OF ISOPODA (ARTHROPODA: CRUSTACEA) IN RÍA DE VIGO (NO ESPAÑA)	I	140	22/08/00	16:30	CC		3	PS	3
Garrido, J.	566	AQUATIC COLEOPTERA ASSEMBLAGES FROM SHALLOW LAKES ASSOCIATED TO THE CANAL DE CASTILLA (CENTRAL SPAIN)	I	143	22/08/00	16:30	CC		3	PS	3
Garrido, J.	1901	ARTHROPODS DIVERSITY IN SEABIRDS COLONIES: APPLIED TO PHALACROCORAX ARISTOTELIS L. OF ISLANDS CÍES AND ONS (NW PENÍNSULA IBÉRICA)	I	479	22/08/00	16:30	CC		10	PS	10
Garrido, J.	968	A STUDY OF MACROINVERTEBRATES IN RIVES ECOSYSTEMS (NW IBERIAN PENINSULA), AFFECTED BY SMALL HYDROELECTRIC DAMS	I	244	22/08/00	16:30	CC		6	PS	6
Garrido, J.	3713	NEW INFORMATION ABOUT HETEROPTERA IN THE NORTHWEST OF THE IBERIAN PENINSULA PONDS.	II	937	24/08/00	16:30	CC		21	PS	21
Garrouste, R.	1921	COMMUNITIES OF SOILS INSECTS ON FRENCH GUYANA INSELBERGS : A SYNCRONIC STUDY THROUGHT VEGETATION DYNAMICS	I	484	22/08/00	16:30	CC		10	PS	10
Garrouste, R.	2430	PRELIMINARY RESULTS ON THERBIOLOGICAL STUDIES ON NEOTROPICAL STINK BUGS OEBALUS POECILUS (HEMIPTERA, PENTATOMIDAE)	II	614	23/08/00	16:30	CC		13	PS	13
Garrouste, R.	2961	TRIATOMINES SPECIES (HEMIPTERA, REDUVIIDAE, TRIATOMINAE) AND TRYPANOSOMA CRUZI IN FRENCH GUYANA	II	747	21/08/00	16:30	CC		15	PS	15
Garrouste, R.	3770	AN ORIGINAL FRESHWATER INSECT COMMUNITY ON FRENCH GUYANA INSELBERGS : INCLINED WET ROCK	II	952	24/08/00	16:30	CC		21	PS	21
Garvey, C. F.	2275	THE ORIGIN AND MOLECULAR EVOLUTION OF MOSQUITO NON-LTR RETROTRANSPOSONS BELONGING TO THE CR1 AND JOCKEY CLADES	I	574	23/08/00	16:30	CC		12	PS	12
Gashawbeza, A.	2825	SURVEY OF PRACTICES AND PERCEPTIONS OF SMALL HOLDER FARMERS RELATING TO PEST MANAGEMENT ON VEGETABLE CROPS IN EASTERN AFRICA	II	713	23/08/00	16:30	CC		14	PS	14
Gasperi, G.	2315	FROM SEVEN CRYPTIC SPECIES OF THE CULICOIDES IMICOLA COMPLEX (DIPTERA: CERATOPOGONIDAE)	I	584	24/08/00	16:30	CC		12	PS	12
Gasperi, G.	2209	TRANSPOSABLE ELEMENT ABUNDANCE, DISTRIBUTION AND EVOLUTION IN TEPHRITID FLIES	I	558	24/08/00	14:35	HB	L	12	8	12

Sub-titles: (HB=Hotel Bourbon) - (HM=Hotel Mabu) - (CC=Convention Center) - (Boi=Foz Boulevard) - (PS=Poster Session) - (PL=Plenary Lecturer)

AUTHOR	Nº	TITLE	Book	Page	Date	Time	Local	Room	Session	Symp	New Session
Gasperi, G.	2316	SPECIES DIAGNOSTIC DIFFERENCES IN RIBOSOMAL DNA INTERNAL TRANSCRIBED SPACER 2 FROM SEVEN CRYPTIC SPECIES OF THE CULICOIDES IMICOLA COMPLEX (DIPTERA: CERATOPOGONIDAE)	I	584	25/08/00	16:30	CC		12	PS	12
Gasperi, G.	2230	POLYMORPHIC MICROSATELLITE MARKERS TO ASSESS THE GENETIC VARIABILITY IN THE MEDITERRANEAN FRUIT FLY, CERATITIS CAPITATA, SPECIES RANGE	I	563	21/08/00	16:30	CC		12	PS	12
Gassen, D.	242	PEST AND BENEFICIAL SCARABS IN NO-TILL CULTIVATION	I	62	21/08/00	11:20	HB	A	2	1	2
Gastaminza, G.	1000	COMPARISON OF SENSITIVITY TO COLD IN SOUTH AMERICAN FRUIT FLY AND MEDFLY (DIPTERA: TEPHRITIDAE)	I	252	22/08/00	16:30	CC		6	PS	6
Gatehouse, A. M. R.	2679	TRANSGENIC PLANTS; AN ENVIRONMENTALLY-FRIENDLY METHOD OF PEST CONTROL?	II	677	22/08/00	16:30	CC		14	PS	14
Gatehouse, J. A.	2679	TRANSGENIC PLANTS; AN ENVIRONMENTALLY-FRIENDLY METHOD OF PEST CONTROL?	II	677	22/08/00	16:30	CC		14	PS	14
Gathmann, A.	988	INTRAGUILD PREDATION BETWEEN APHIDOPHAGOUS PREDATORS AND ERIGONID SPIDERS IN CEREALS	I	249	22/08/00	16:30	CC		6	PS	6
Gathmann, A.	989	TRAP-NESTING BEES AND WASPS AND THEIR NATURAL ENEMIES AS BIOINDICATORS	I	250	22/08/00	16:30	CC		6	PS	6
Gattaz, N. C.	753	INTERNATIONAL INFORMATION SYSTEM ABOUT BIOLOGICAL CONTROL OF PESTS THROUGH THE INTERNET	I	190	22/08/00	10:05	Boi	T	5	2	5
Gauer, E. A. B.	990	MORPHOLOGICAL CHARACTERIZATION OF TWO PASSIFLORA SUBEROSA FORMS AND INFLUENCE ON HOST PLANT SELECTION BY HELICONIUS ERATO	I	250	22/08/00	16:30	CC		6	PS	6
Gaugler, R.	1995	GENETIC IMPROVEMENT OF ENTOMOPATHOGENIC NEMATODES	I	503	21/08/00	14:35	HM	P	11	2	11
Gaunivaud, P.	3215	INSERTIONAL MUTAGENESIS OF SPIROPLASMA CITRI IN RELATION TO PATHOGENICITY	II	812	22/08/00	15:30	Boi	U	17	2	17
Gava, C. A. T.	2065	SCREENING FOR NEW INSECTICIDAL COMPOUNDS PRODUCED BY ENTOMOPATHOGENIC FUNGI	I	521	22/08/00	16:30	CC		11	PS	11
Gay, P.-E.	892	RAINFALL AND RECENT OUTBREAKS OF THE AFRICAN MIGRATORY LOCUST IN THE LAKE CHAD BASIN	I	225	21/08/00	16:30	CC		6	PS	6
Gaynor, P.	3491	THE EFFECTS OF ELECTRICAL FIELDS ON THE BEHAVIOUR OF ANTS	II	881	22/08/00	16:30	CC		19	PS	19
Gayoso, A.	502	A RELATIONAL DATABASE MODEL TO INTEGRATE DISTRIBUTION DATA IN GEOGRAPHICAL INFORMATION SYSTEMS (G.I.S.)	I	127	23/08/00	16:30	CC		3	PS	3
Gazola, A. L.	991	THE NESTING BIOLOGY OF EUFRIESEA VIOLACEA (HYMENOPTERA: APIDAE) IN TRAP-NESTS	I	250	22/08/00	16:30	CC		6	PS	6
Gazzoni, D. L.	2659	INSECTICIDE SELECTIVITY FOR PREDATORS AND PARASITOIDS OF SOYBEAN INSECT PESTS	II	672	21/08/00	16:30	CC		14	PS	14
Gazzoni, D. L.	2680	EFFECT OF INSECT RESISTANT AND SUSCEPTIBLE GENOTYPES ON SURVIVAL AND INSTAR LENGTH OF NEZARA VIRIDULA (HETEROPTERA:PENTATOMIDAE)	II	677	21/08/00	16:30	CC		14	PS	14
Gazzoni, D. L.	2681	FIELD EVALUATION OF SOYBEAN INSECT RESISTANT LINES	II	677	21/08/00	16:30	CC		14	PS	14
Gazzoni, D. L.	2682	EXPERIMENTAL VARIABILITY OF SOYBEAN BENEFITIAL INSECTS SAMPLING METHODS	II	677	22/08/00	16:30	CC		14	PS	14
Gazzoni, D. L.	2683	EFFECT OF COMBINED EFFECT OF HPR AND INSECTICIDE ON SOYBEAN PESTS	II	678	22/08/00	16:30	CC		14	PS	14
Gazzoni, D. L.	2684	AN EVALUATION OF THE BRAZILIAN SOY-IPM PROGRAMME	II	678	22/08/00	16:30	CC		14	PS	14
Gazzoni, D. L.	2685	DAMAGE LEVELS OF STINK BUGS ON SEED PRODUCTION OF SOYBEAN VARIETIES	II	678	23/08/00	16:30	CC		14	PS	14
Gazzoni, D. L.	2686	VARIABILITY OF SOYBEAN INSECT SAMPLING METHODS	II	678	23/08/00	16:30	CC		14	PS	14
Gazzoni, D. L.	2687	EVALUATION OF SOYBEAN LINES WITH PARENTALS BACKGROUND RESISTANT TO STINK BUGS	II	679	23/08/00	16:30	CC		14	PS	14
Gazzoni, D. L.	2688	A PROPOSAL FOR ERADICATING FRUIT FLIES FROM WESTERN PERU	II	679	24/08/00	16:30	CC		14	PS	14
Gazzoni, D. L.	2689	MANAGING THE BOLL WEEVIL ON COTTON IN PARAGUAY	II	679	24/08/00	16:30	CC		14	PS	14
Gazzoni, D. L.	2690	QUARANTINE INTELLIGENCE, A NEW APPROACH TO REDUCE THE RISK OF INTRODUCTION OF QUARANTINE PESTS	II	679	24/08/00	16:30	CC		14	PS	14
Gazzoni, D. L.	2691	BIOLOGICAL CONTROL AS AN OPPORTUNITY FOR SMALL BUSINESS	II	680	24/08/00	16:30	CC		14	PS	14
Gazzoni, D. L.	2692	A MODELING APPROACH TO IDENTIFY WEAKNESSES AND STRENGHTENING PLANT PROTECTION SYSTEMS	II	680	25/08/00	16:30	CC		14	PS	14
Gazzoni, D. L.	2693	MONITORING AGRICULTURAL PESTS THROUGH AN IMPROVED SURVEILLANCE SYSTEM	II	680	25/08/00	16:30	CC		14	PS	14
Gazzoni, D. L.	2699	VELVETBEAN CATERPILLAR CONTROL WITH AIR AND TERRESTRIAL APPLICATIONS OF ITS NUCLEAR POLYHEDROSIS VIRUS (NPV)	II	682	25/08/00	16:30	CC		14	PS	14
Gazzoni, D. L.	2070	THE VELVETBEAN CATERPILLAR CONTROL WITH BACULOVIRUS ANTICARSIA APPLIED ON SOYBEAN CROP THROUGH A CENTER PIVOT SPRINKLE WATER IRRIGATION	I	522	22/08/00	16:30	CC		11	PS	11
Gbedjissi, G.	3855	NOT ALL SCIOMYZIDAE KILL MOLLUSKS : SEPEDONELLA NANA EATS WORMS	II	973	25/08/00	16:30	CC		21	PS	21
Geden, C. J.	1482	INFLUENCE OF HOST DENSITY ON ATTACK RATES OF TACHINAEPIAGUS ZEALANDICUS ASHMEAD (HYMENOPTERA: ENCYRTIDAE) ON MUSCA DOMESTICA (DIPTERA: MUSCIDAE) AND CHRYSOMYA PUTORIA (DIPTERA: CALLIPHORIDAE	I	374	21/08/00	16:30	CC		8	PS	8
Geest, L. P. S. van der	961	CAN PLANTS USE ENTOMOPATHOGENS AS BODYGUARDS?	I	243	22/08/00	16:30	CC		6	PS	6
Geetha, K.	1406	NEEM DERIVATIVES AGAINST CRAWLERS AND ADULT COCCIDS	I	355	24/08/00	16:30	CC		7	PS	7
Geetha, N.	2066	FIELD TRIALS ON THE EFFICACY AND PERSISTENCE OF IMPROVED FORMULATIONS OF NUCLEAR POLYHEDROSIS VIRUS AGAINST HELICOVERPA ARMIGERA ON CHICKPEA	I	521	22/08/00	16:30	CC		11	PS	11
Geetha, N.	2067	FIELD EVALUATION OF IMPROVED FORMULATIONS OF NUCLEAR POLYHEDROSIS VIRUS AGAINST HELICOVERPA ARMIGERA ON COTTON	I	521	22/08/00	16:30	CC		11	PS	11
Geetha, N.	2052	STUDIES ON ENTOMOPATHOGENIC FUNGI AGAINST WHITE GRUB HOLOTRICHIA SERRATA (COLEOPTERA : SCARABAEIDAE) IN SUGARCANE	I	518	21/08/00	16:30	CC		11	PS	11
Geethalakshmi, L.	1599	DEVELOPING A COMMERCIALLY VIABLE SYSTEM USING CHRYSOPERLA CARNEA FOR CONTROL OF COTTON PESTS IN INDIA	I	403	23/08/00	16:30	CC		8	PS	8
Geier, M.	2872	HOW THE FINE-SCALE PLUME STRUCTURE OF HOST-ODOURS AFFECT THE FLIGHT BEHAVIOUR OF MOSQUITOES	II	725	21/08/00	10:50	Boi	R	15	1	15
Geier, M.	2929	ATTRACTION OF FEMALE AEDES AEGYPTI TO IDENTIFIED COMPOUNDS ON HUMAN SKIN	II	739	25/08/00	11:50	Boi	R	15	9	15
Geier, M.	2980	L-LACTIC ACID IS AN IMPORTANT HOST STIMULUS FOR THE ANTHROPOPHILIC ANOPHELES GAMBIAE S.S.	II	752	22/08/00	16:30	CC		15	PS	15
Gelbic, I.	992	CHANGES IN THE DEVELOPMENT OF MOSQUITOES OF THE CULEX PIPIENS COMPLEX CAUSED BY HORMONES, TEMPERATURE AND POPULATION DENSITY	I	250	22/08/00	16:30	CC		6	PS	6
Gelman, D. B.	1554	DEVELOPMENT OF AN ARTIFICIAL DIET FOR REARING EDOVUM PUTTLERI, AN EGG PARASITOID OF THE COLORADO POTATO BEETLE, LEPTINOTARSA DECEMLINEATA	I	392	22/08/00	16:30	CC		8	PS	8
Gelman, D. B.	2431	TIMING AND ECDYSTEROID REGULATION OF THE MOLT IN LAST INSTAR GREENHOUSE AND SILVERLEAF WHITEFLIES	II	614	23/08/00	16:30	CC		13	PS	13
Gelman, D. B.	3044	HORMONES/NEUROHORMONES-INVOLVEMENT IN HOST/PARASITE RELATIONSHIPS IN THE TOBACCO HORNWORM, MANDUCA SEXTA	II	768	22/08/00	9:35	HB	G	16	2	16
Gelman, D. B.	3250	TESTIS ECDYSIOTROPIN, AN INSECT GONADOTROPIN THAT INDUCES SYNTHESIS OF ECDYSTEROID	II	821	21/08/00	9:50	HB	K	18	1	18
Gelman, D. B.	1435	LABORATORY PRODUCTION AND FIELD EVALUATION OF HYMEMOPTEROUS ECTOPARASITOIDS REARED ON ARTIFICIAL DIETS	I	362	21/08/00	15:50	HM	O	8	2	8
Gencer, N.S.	1038	ECOLOGICAL ADAPTATIONS AND CONSERVATION OF THREE PAPILIONID SPECIES LIVING ON THE ARISTOLOCHIA SPECIES IN ULUDAG, BURSA, TURKEY	I	262	23/08/00	16:30	CC		6	PS	6

Sub-titles: (HB=Hotel Bourbon) - (HM=Hotel Mabu) - (CC=Convention Center) - (Bol=Foz Boulevard) - (PS=Poster Session) - (PL=Plenary Lecturer)

AUTHOR	Nº	TITLE	Book	Page	Date	Time	Local	Room	Session	Symp	New Session
Genise, J. F.	1752	NEST ARCHITECTURE AND NESTING BEHAVIOR OF ALEPIDOSCELES FILITARSIS (APIDAE, ANTHOPHORINAE)	I	441	21/08/00	16:30	CC		9	PS	9
Genovese, C. C.	1328	INSECTICIDE AND REPELLENT EFFECTS OF MELIA AZEDARACH EXTRACTS AGAINST AEDES AEGYPTI (DIPTERA: CULICIDAE)	I	335	22/08/00	16:30	CC		7	PS	7
Gentili, M.	1911	ARTHROPODS IN RELATION WITH ARAUCARIA ARAUCANA: AN APPROACH TO ITS BIODIVERSITY IN ARGENTINA	I	482	21/08/00	16:30	CC		10	PS	10
Geraldes, J. A.	1414	THIACLOPRID - FIRST EXPERIENCES WITH THE NOVEL INSECTICIDE IN BRAZIL	I	357	25/08/00	16:30	CC		7	PS	7
Geraldi, S. E.	3110	INCIDENCE AND MORPHOLOGIC ASPECTS OF LONOMIA OBLIQUA (LEPIDOPTERA: SATURNIIDAE).	II	785	21/08/00	16:30	CC		16	PS	16
Geraud-Pouey, F.	3771	BIONOMICS OF THE GUAVA COTTONY SCALE, CAPULINIA SP. NEAR JABOTICABAE (HEMIPTERA: ERIOCOCCIDAE) ON PSIDIUM SPECIES	II	952	22/08/00	16:30	CC		21	PS	21
Geraud-Pouey, F.	932	BIOLOGY OF THE GUAVA COTTONY SCALE, CAPULINIA SP. NEAR JABOTICABAE (HEMIPTERA: ERIOCOCCIDAE) AND PHYSICAL EFFECT OF BARK EXFOLIATIONS OF GUAVA PLANT	I	235	21/08/00	16:30	CC		6	PS	6
Gerberg , E. J.	2936	BITING FLY REPELLENTS, PAST, PRESENT AND FUTURE	II	741	25/08/00	15:15	Bol	R	15	10	15
Gerding, M. E.	2068	USE OF ENTOMOPATHOGENIC FUNGI FOR THE CONTROL OF CALIROA CERASI	I	522	22/08/00	16:30	CC		11	PS	11
Gerding, M. E.	1996	USE OF PATHOGENIC NEMATODES AND THEIR SYMBIOTIC BACTERIA FOR THE CONTROL OF SLUG PEST	I	504	21/08/00	15:05	HM	P	11	2	11
Gerding, M. E.	2062	CONTROL OF PINE SHOOTS MOOTH IN MONTERREY PINE WITH ENTOMOPATHOGENIC FUNGI	I	520	22/08/00	16:30	CC		11	PS	11
Gereben-Krenn, B.-A.	993	LIVING AT THE EDGE OF ICE: CARABID BEETLES IN AN ALPINE GLACIER FORELAND.	I	251	22/08/00	16:30	CC		6	PS	6
Gereben-Krenn, B.-A.	3575	LIVING AT THE EDGE OF ICE: CARABID BEETLES IN AN ALPINE GLACIER FORELAND.	II	902	23/08/00	14:30	Bol	U	20	1	20
Gergerich, R. C.	3216	CYTOPATHOLOGY AND DOUBLE MEMBRANE-BOUND VIRUS-LIKE PARTICLES ASSOCIATED WITH HIGH PLAINS DISEASE AND OTHER DISEASES CAUSED BY ERIPHYID MITE-BORNE AGENTS OF UNKNOWN ETIOLOGY	II	812	22/08/00	16:00	Bol	U	17	2	17
Gergis, M. F.	2694	BIOLOGICALLY BASED NEW APPROACH FOR INTEGRATED PEST MANAGEMENT OF CORN KEY PESTS IN MIDDLE EGYPT	II	680	22/08/00	16:30	CC		14	PS	14
Gerling, D.	2558	BIOLOGICAL CONTROL WITH PREDATORS AND PARASITOIDS	II	646	22/08/00	11:05	HB	B	14	3	14
Gerling, D.	1089	CHARACTERIZATION OF THE WAXY PARTICLES, AND THE PENETRATION AND FEEDING PROCESS OF WHITEFLIES	I	275	24/08/00	16:30	CC		6	PS	6
German, T. L.	3211	IDENTIFICATION OF A PLANT VIRUS RECEPTOR IN THE INSECT VECTOR CELLS	II	811	22/08/00	13:35	Bol	U	17	2	17
Gerson, E. A.	2432	PUPAL DIAPAUSE OF COLORADIA PANDORA: THERMAL CONSTRAINTS ON SUCCESSFUL PUPATION	II	614	22/08/00	16:30	CC		13	PS	13
Gertsch, P.J.	3430	MATING SYSTEM EVOLUTION IN ATTINE FUNGUS GROWING ANTS	II	866	23/08/00	10:50	HM	Q	19	4	19
Gerty, S. M.	3491	THE EFFECTS OF ELECTRICAL FIELDS ON THE BEHAVIOUR OF ANTS	II	881	22/08/00	16:30	CC		19	PS	19
Gesraha, M. A.	1699	RATES OF PARASITISM BY METEORUS RUBENS AND M. GYRATOR ON THEIR INSECT HOSTS	I	428	25/08/00	16:30	CC		8	PS	8
Getis, A.	2903	SPATIAL AND TEMPORAL HETEROGENEITY IN DENGUE VIRUS TRANSMISSION AND AEDES AEGYPTI POPULATION DENSITIES IN IQUITOS, PERU	II	733	23/08/00	14:35	Bol	R	15	6	15
Getz, W. M.	1650	COEVOLUTION OF CONTRARY CHOICES IN HOST-PARASITOID SYSTEMS	I	416	24/08/00	16:30	CC		8	PS	8
Geudens, G.	567	BEETLE DIVERSITY AND FOREST CHARACTERISTICS IN FLANDERS (BELGIUM)	I	143	25/08/00	16:30	CC		3	PS	3
Geudens, G.	1977	DEAD WOOD AND BEETLES: A CASE STUDY IN FLANDERS (BELGIUM)	I	498	25/08/00	16:20	HB	M	10	8	10
Gewecke, M.	2433	FUNCTION-SPECIFIC TRANSCRIPTION IN THE NERVOUS SYSTEM AND SENSE ORGANS OF INSECTS	II	615	22/08/00	16:30	CC		13	PS	13
Gewecke, M.	2347	BIOGENIC AMINES AS NEUROTRANSMITTERS AND NEUROMODULATORS	II	593	22/08/00	9:35	HB	I	13	3	13
Ghersa, C. M.	1613	IMPACT OF A SYMBIOTIC GRASS-ENDOPHYTE ASSOCIATION ON INSECT HERBIVORES AND THEIR NATURAL ENEMIES	I	407	23/08/00	16:30	CC		8	PS	8
Ghini, S.	3492	THE USE OF HONEYBEES (APIS MELLIFERA) AS INDICATORS FOR THE PRESENCE OF THE PHYTOPATHOGEN BACTERIUM ERWINIA AMYLOVORA IN THE ENVIRONMENT	II	881	22/08/00	16:30	CC		19	PS	19
Ghonaim, M. F.	2986	AN ANNOTATED CHECKLIST OF THE CHIRONOMIDAE (DIPTERA) OF EGYPT	II	753	22/08/00	16:30	CC		15	PS	15
Ghosh, A.	2919	SELECTION OF PEPTIDES FROM A PHAGE-DISPLAY LIBRARY WHICH BIND TO THE MOSQUITO MIDGUT AND TO SALIVARY GLANDS	II	737	24/08/00	16:05	Bol	R	15	8	15
Giachino, P.M.	3707	ULTRASTRUCTURE OF FILTERING MOUTH PARTS IN HIGHLY SPECIALIZED TROGLOBITIC LEPTODIRINAE (COLEOPTERA, CHOLEVIDAE)	II	936	26/08/00	Poster dentro da sessão	HB	E	21	10	21
Giannotti, E.	243	ENTROPY OF ADULT WASPS OF POLISTES LANIO AND MISCHOCYTTARUS CERBERUS (HYMENOPTERA, VESPIDAE) FROM COLONIES STUDIED IN FIELD CONDITIONS	I	62	22/08/00	16:30	CC		2	PS	2
Giannotti, E.	3493	DIVISION OF LABOR IN ECTATOMMA EDENTATUM (HYMENOPTERA, FORMICIDAE)	II	882	23/08/00	16:30	CC		19	PS	19
Giannotti, E.	1799	INDIVIDUAL MATERIAL COLLECTION AND FORAGING TRIP DURATION IN MISCHOCYTTARUS DREWSENI (HYMENOPTERA, VESPIDAE)	I	453	25/08/00	16:30	CC		9	PS	9
Giannotti, O.	680	OLFACTORY RESPONSES TO ISOAMYL ACETATE AND ADULTS OF THE LARGE MILKWEED BUGS (ONCOPELTUS FASCIATUS, HETEROPTERA:LYGAEIDAE) IN MALE AND FEMALE ANTENNAE OF THE SAME SPECIES	I	172	23/08/00	16:30	CC		4	PS	4
Gibb, T. J.	1496	PREDATION OF PHYLLOPHAGA (COLEOPTERA: SCARABAEIDAE) EGGS IN NO-TILL AND CONVENTIONAL-TILL MAIZE.	I	377	21/08/00	16:30	CC		8	PS	8
Gibbs, G. W.	3789	MOLECULAR PHYLOGENY OF THE JAPANESE AND NEW ZEALAND MICROPTERIGIDAE (LEPIDOPTERA) BASED ON MITOCHONDRIAL GENE SEQUENCES	II	956	23/08/00	16:30	CC		21	PS	21
Giblin-Davis, R.	3839	MOLECULAR SYSTEMATICS OF FERGUSONINA SPP. (DIPTERA: FERGUSONINIDAE): HOST SPECIFICITY, HOST-USE EVOLUTION, AND IMPLICATIONS FOR BIOCONTROL OF MELALEUCA QUINQUENERVA IN THE FLORIDA EVERGLADES	II	969	25/08/00	16:30	CC		21	PS	21
Gibson, G. A. P.	1525	DISPERSAL OF THE FILTH FLY PARASITOID MUSCIDIFURAX RAPTORELLUS (HYMENOPTERA: PTEROMALIDAE) FOLLOWING MASS-RELEASES IN CATTLE CONFINEMENTS	I	385	22/08/00	16:30	CC		8	PS	8
Giebultowicz, J. M.	3275	INVOLVEMENT OF CIRCADIAN RHYTHMS IN THE REPRODUCTIVE PHYSIOLOGY OF INSECT MALES	II	827	23/08/00	15:50	HB	K	18	3	18
Giebultowicz, J. M.	3276	ORGANIZATION OF THE CIRCADIAN SYSTEMS IN INSECTS	II	827	23/08/00	16:05	HB	K	18	3	18
Gielfi, F. S.	1533	SURVEY OF PARASITOIDS OF THE FALL ARMYWORM, SPODOPTERA FRUGIPERDA (LEPIDOPTERA: NOCTUIDAE), IN FERNANDÓPOLIS REGION, SÃO PAULO STATE, BRAZIL	I	387	22/08/00	16:30	CC		8	PS	8
Gielfi, F. S.	244	DAMAGE LEVELS AND EVALUATION OF COTTON YIELD LOSSES CAUSED BY ANTHONOMUS GRANDIS (COLEOPTERA: CURCULIONIDAE)	I	62	23/08/00	16:30	CC		2	PS	2
Giganti, H.	35	MITE POPULATIONS IN RELATION TO CYDIA POMONELLA CONTROL IN THE ALTO VALLE DE RÍO NEGRO Y NEUQUÉN (ARGENTINA)	I	9	22/08/00	16:30	CC		1	PS	1
Giganti, H.	1911	ARTHROPODS IN RELATION WITH ARAUCARIA ARAUCANA: AN APPROACH TO ITS BIODIVERSITY IN ARGENTINA	I	482	21/08/00	16:30	CC		10	PS	10
Gigliotti, S.	3041	FEMALE STERILE MUTATIONS AND EGG CHAMBER DEVELOPMENT IN DROSOPHILA MELANOGASTER	II	767	21/08/00	15:00	HB	G	16	1	16
Gil, M.	3494	RECRUITMENT IN HONEYBEES: HOW DO FORAGERS AND HIVEMATES INTERACT ACCORDING TO THE FOOD SOURCE PROFITABILITY?	II	882	23/08/00	16:30	CC		19	PS	19

Sub-titles: (HB=Hotel Bourbon) - (HM=Hotel Mabu) - (CC=Convention Center) - (Bol=Foz Boulevard) - (PS=Poster Session) - (PL=Plenary Lecturer)

AUTHOR	Nº	TITLE	Book	Page	Date	Time	Local	Room	Session	Symp	New Session
Gil, M. A.	477	AQUATIC INSECT BIODIVERSITY IN STREAMS OF DIFFERENT BASINS AT A REGIONAL SCALE	I	121	21/08/00	16:30	CC		3	PS	3
Gilbert, L. E.	1528	PHENOLOGICAL PATTERNS FOR PARASITOIDS SPECIALIZED IN ATTACKING SOLENOPSIS FIRE ANTS, AT THE RESERVA ECOLÓGICA COSTANERA SUR, ARGENTINA	I	385	23/08/00	16:30	CC		8	PS	8
Gilbert, L. E.	496	GEOGRAPHIC RANGES AND PATTERNS OF DIVERSITY FOR PSEUDACTEON FLIES, PARASITOIDS OF SOLENOPSIS ANTS, FROM ARGENTINA AND BRAZIL	I	126	22/08/00	16:30	CC		3	PS	3
Gilbert, L. I.	3286	ENDOCRINE CONTROL OF ECDYSTEROID AND JUVENILE HORMONE PRODUCTION	II	830	23/08/00	14:05	HB	K	18	5	18
Gilbert, L. I.	3330	CONTROL OF JUVENILE HORMONE SYNTHESIS BY THE CORPUS ALLATUM	II	841	22/08/00	16:30	CC		18	PS	18
Gilbertson, R.	2765	COTTON HOST PLANT RESISTANCE TO THE SILVERLEAF WHITEFLY TRANSMITTED COTTON LEAF CRUMPLE DISEASE	II	698	24/08/00	16:30	CC		14	PS	14
Gilbertson, R. L.	3214	DO GEMINIVIRUSES LEAD A DUAL LIFE STYLE: MOVEMENT WITHIN THE PLANT VS. PLANT-TO-PLANT	II	811	22/08/00	15:00	Bol	U	17	2	17
Gilliomee, J. H.	1534	THE BIOLOGICAL CONTROL OF HOUSEFLIES ASSOCIATED WITH POULTRY PRODUCTION	I	387	22/08/00	16:30	CC		8	PS	8
Gill, B. D.	3669	SYSTEMATICS AND BIOLOGY OF THE NEW WORLD CERATOCANTHINAE (COLEOPTERA: SCARABAEIDAE)	II	926	24/08/00	14:05	HB	E	21	7	21
Gill, B. S.	3883	MOLECULAR MARKERS IN WHEAT LINKED TO GENES EXPRESSING RESISTANCE TO THE GREENBUG AND THE RUSSIAN WHEAT APHID	II	980	22/08/00	13:35	HB	H	22	3	22
Gill, S. S.	2408	A TRANSPORTER-LIKE PROTEIN INEBRIATED, WHICH RESPONDS TO OSMOTIC STIMULI, IS INVOLVED IN POTASSIUM TRANSPORT	II	608	21/08/00	16:30	CC		13	PS	13
Gill, S. S.	2434	AN EST PROJECT ON AEDES AEGYPTI IDENTIFIES PROTEINS INVOLVED IN ION TRANSPORT IN THE MIDGUT AND MALPIGHIAN TUBULES	II	615	22/08/00	16:30	CC		13	PS	13
Gilli, F. C.	1897	PEST INSECT IN EUCALYPTUS FOREST PLANTATION ON TABASCO STATE, MEXICO.	I	478	26/08/00	16:20	HB	M	10	10	10
Gillings, M. R.	3470	ANTIMICROBIAL COMPOUNDS FROM ANTS AND OTHER INSECTS AND THEIR ROLE IN THE EVOLUTION OF SOCIALITY	II	876	23/08/00	16:30	CC		19	PS	19
Gillison, A.	1811	INSECTS IN THE TROPICAL LAND-USE MOSAIC – THE IMPACT OF AGRICULTURAL AND FOREST DEVELOPMENT	I	457	21/08/00	9:50	HB	M	10	1	10
Gilman, R. H.	2878	THE IMPACT OF DEFORESTATION ON MALARIA: A CASE STUDY FROM THE PERUVIAN AMAZON	II	726	21/08/00	15:05	Bol	R	15	2	15
Gimenez Pecci, M. P.	3236	DELPHACID PLANTHOPPERS AND THE "MAL DE RIO CUARTO" IN MAIZE IN THE NORTH OF ARGENTINA (INSECTA - FULGOROMORPHA)	II	817	23/08/00	16:30	CC		17	PS	17
Giménez, D. O.	207	CHARACTERIZATION OF GREENBUG POPULATIONS COLLECTED IN ARGENTINA AND CHILE	I	53	22/08/00	16:30	CC		2	PS	2
Gunénez, D. O.	921	BIOECOLOGICAL STUDIES OF RUSSIAN WHEAT APHID IN ARGENTINA AND CHILE	I	233	21/08/00	16:30	CC		6	PS	6
Giménez, R.	36	EFFECTS OF CHLORPYRIFOS AND TEFLUTHRIN ON LUMBRICUS TERRESTRIS	I	9	22/08/00	16:30	CC		1	PS	1
Giménez, R.	1830	PLATYPUS SULCATUS: A RATIONAL APPROACH TO ITS CONTROL IN POPULUS SPP. IN ARGENTINA	I	461	22/08/00	11:35	HB	M	10	2	10
Giménez, R. A.	245	INCIDENCE OF THE DAMAGE OF PLATYPUS SULCATUS CHAPUIS (COLEOPTERA, PLATYPODIDAE) IN THE QUALITY OF POPULUS DELTOIDES WOODS	I	62	23/08/00	16:30	CC		2	PS	2
Githig, J.	2905	MICROEPIDEMIOLOGY OF MALARIA IN WESTERN KENYA	II	733	23/08/00	15:35	Bol	R	15	6	15
Gitdin, G.	2137	MICROBIAL CONTROL OF TICKS	I	539	24/08/00	16:30	CC		11	PS	11
Ginsberg, H. S.	2168	MICROBIAL CONTROL OF IXODES SCAPULARIS	I	547	25/08/00	16:30	CC		11	PS	11
Gioia, S. Di	3592	IMPORTANCE OF SOME PLANTS OF THE MEDITERRANEAN FLORA IN THE BIOLOGY OF FRANKLINIELLA OCCIDENTALIS (THYSANOPTERA THRIPIDAE)	II	906	21/08/00	16:30	CC		20	PS	20
Giolo, F. P.	2703	INFLUENCE OF LIBERTY LINK IRRIGATED RICE TECHNOLOGY ON ORYZOPHAGUS ORYZAE (COLEOPTERA: CURCULIONIDAE)	II	683	22/08/00	16:30	CC		14	PS	14
Giolo, F. P.	2744	FOLIAR SPRAY STRATEGY FOR RATIONAL CHEMICAL CONTROL OF ORYZOPHAGUS ORYZAE ON FLOODED RICE	II	693	23/08/00	16:30	CC		14	PS	14
Giordana, B.	2456	ROLE OF ACTIVATORS OF THE ABSORPTION OF AMINO ACIDS BY THE MIDGUT IN BOMBYX MORI LARVAL NUTRITION	II	620	23/08/00	16:30	CC		13	PS	13
Giordani, R. F.	2704	EFFECTS OF INSECTICIDE THIAMETHOXAM ON STERNECHUS SUBSIGNATUS (COL., CURCULIONIDAE) IN SOYBEAN	II	683	22/08/00	16:30	CC		14	PS	14
Giordano, O. S.	729	BIOLOGICAL ACTIVITIES OF PLANT SECONDARY METABOLITES TOWARD INSECTS	I	184	25/08/00	16:30	CC		4	PS	4
Giordano, P. F.	1329	EXPLORING THE INFLUENCE OF INSECTICIDE ON INSECT PEST-PREDATOR INTERACTIONS USING A THEORETICAL TWO-FIELD MODEL	I	335	22/08/00	16:30	CC		7	PS	7
Giorgi, F.	3037	OVARIAN FOLLICLE DIFFERENTIATION IN INSECT OVARIOLES	II	766	21/08/00	11:30	HB	G	16	1	16
Giorgi, F.	2467	CELL DIFFERENTIATION OF THE FOLLICULAR EPITHELIUM IN STICK INSECT OVARIOLES	II	623	23/08/00	16:30	CC		13	PS	13
Giorgi, J. A.	3772	A NEW GENUS OF ONCIDERINI (COLEOPTERA, CERAMBYCIDAE) FROM PERU	II	952	23/08/00	16:30	CC		21	PS	21
Giorgi, J. A.	3773	TRANFERENCE OF TWO SPECIES FROM CLAVIDESMUS DILLON & DILLON, 1945 TO LACHAERUS (COLEOPTERA, CERAMBYCIDAE, LAMIINAE, ONCIDERINI)	II	952	23/08/00	16:30	CC		21	PS	21
Giraldo, E. M.	246	LIPOLYTIC AND PROTEOLYTIC ACTIVITY OF BEAUVERIA BASSIANA AND METARHIZIUM ANISOPLIAE AND THEIR RELATIONSHIP WITH PATHOGENICITY TO HYPOTHENEMUS HAMPEI	I	63	22/08/00	16:30	CC		2	PS	2
Giraldo, E. M.	26	STUDIES ON INFECTION MECHANISMS OF THE FUNGI BEAUVERIA BASSIANA AND METARHIZIUM ANISOPLIAE ON HYPOTHENEMUS HAMPEI USING FLUORESCENCE MICROSCOPY AND SCANNING ELECTRON MICROSCOPY	I	7	23/08/00	16:30	CC		1	PS	1
Giray, T.	2186	HORMONAL LINKS BETWEEN GENES AND PHENOTYPES IN SOCIAL WASPS	I	552	22/08/00	15:15	HB	L	12	4	12
Girolami, V.	135	PHYTOSEIID-POLLEN RELATIONSHIPS IN ITALIAN VINEYARDS	I	35	24/08/00	15:35	HB	A	2	8	2
Girolami, V.	2580	ORGANOPHOSPHATE RESISTANCE IN GRAPE LEAFHOPPERS AND IPM STRATEGIES	II	652	24/08/00	10:05	HB	B	14	6	14
Giron, D.	2496	NUTRITIONAL STATUS AND THE BEHAVIOURAL ECOLOGY OF PARASITOIDS	II	630	24/08/00	16:30	CC		13	PS	13
Girotti, S.	3492	THE USE OF HONEYBEES (APIS MELLIFERA) AS INDICATORS FOR THE PRESENCE OF THE PHYTOPATHOGEN BACTERIUM ERWINIA AMYLOVORA IN THE ENVIRONMENT	II	881	22/08/00	16:30	CC		19	PS	19
Githeko, A. K.	2879	HIGHLAND FRINGE MALARIA IN AFRICA AND CLIMATE CHANGE	II	727	21/08/00	15:35	Bol	R	15	2	15
Githeko, A. K.	3015	LOCAL POPULATION DYNAMICS OF ANOPHELES MOSQUITOES AND MALARIA TRANSMISSION IN WESTERN KENYA	II	761	24/08/00	16:30	CC		15	PS	15
Gitirana Neto, J.	1397	CONTROL OF "WHITE FLY", BEMISIA ARGENTIFOLII WITE THE INSECTICIDES THIACLOPRID 480 SC; IMIDACLOPRID 700 GRDA AND IMIDACLOPRID 200 SC, IN CUCUMBER PLANTATION	I	352	25/08/00	16:30	CC		7	PS	7
Giulio, A. Di	3136	BIOLOGY AND FUNCTIONAL MORPHOLOGY OF PACHYTELES LARVAE (COLEOPTERA: CARABIDAE: PAUSSINAE	II	791	22/08/00	16:30	CC		16	PS	16
Giurfa, M.	3457	ALARM PHEROMONE COMPONENTS AND OPIOID SYSTEM ACTIVATION IN HONEYBEES	II	873	21/08/00	16:30	CC		19	PS	19
Giurfa, M.	718	INTERACTION BETWEEN VISUAL AND OLFACTORY CUES IN THE ASSEMBLING BEHAVIOUR OF THE HAEMATOPHAGOUS BUG TRIATOMA INFESTANS	I	181	24/08/00	16:30	CC		4	PS	4
Giustolin, T. A.	3732	TAXONOMIC STATUS AND NOTES ON BIOLOGY OF ACROGONIA FROM CITRUS: ACROGONIA TERMINALIS OR A NEW SPECIES?	II	942	21/08/00	16:30	CC		21	PS	21
Giustolin, T. A.	3209	VECTOR AND EPIDEMIOLOGICAL ASPECTS OF CITRUS VARIEGATED CHLOROSIS	II	810	21/08/00	15:50	Bol	U	17	1	17
Givois, V.	1725	NEUROPHYSIOLOGICAL ANALYSIS OF ACOUSTIC SIGNALS IN CRICKETS: TEMPORAL PATTERN AND SOUND LOCALIZATION	I	435	22/08/00	14:00	HB	F	9	3	9
Glare, T. R.	84	MANAGEMENT OF RHINOCEROS BEETLES IN MALAYSIA	I	22	21/08/00	11:05	HB	A	2	1	2

Sub-titles: (HB=Hotel Bourbon) - (HM=Hotel Mabu) - (CC=Convention Center) - (Bol=Foz Boulevard) - (PS=Poster Session) - (PL=Plenary Lecturer)

AUTHOR	Nº	TITLE	Book	Page	Date	Time	Local	Room	Session	Symp	New Session
Glass, G. G.	2878	THE IMPACT OF DEFORESTATION ON MALARIA: A CASE STUDY FROM THE PERUVIAN AMAZON	II	726	21/08/00	15:05	Bol	R	15	2	15
Glazer, I.	1988	NEMATODES RESEARCH NEEDS	I	502	21/08/00	9:50	HM	P	11	1	11
Glazer, I.	1994	GENETICS AS A MEAN TO IMPROVE ETNS TOLERANCE TO ENVIRONMENTAL STRESS	I	503	21/08/00	14:05	HM	P	11	2	11
Glazer, I.	2069	IMPROVEMENT OF INSECTICIDAL NEMATODES- A GENETIC APPROACH	I	522	22/08/00	16:30	CC		11	PS	11
Glazer, I.	2137	MICROBIAL CONTROL OF TICKS	I	539	24/08/00	16:30	CC		11	PS	11
Gleeson, P.	88	USE OF A DATABASE AND GEOGRAPHIC INFORMATION SYSTEM TO MONITOR A FRUIT FLY ERADICATION PROGRAM	I	23	21/08/00	14:35	HB	A	2	2	2
Gleeson, D. M.	1263	A HITCH-HIKER'S GUIDE TO RESISTANCE IN THE SHEEP BLOWFLY	I	319	24/08/00	14:50	HM	N	7	8	7
Gleeson, P. V.	3481	SEASONAL AND DAILY FORAGING ACTIVITY OF SUBTERRANEAN, WOOD-EATING TERMITES (ISOPTERA: RHINOTERMITIDAE AND TERMITIDAE)	II	879	22/08/00	16:30	CC		19	PS	19
Gleeson, P. V.	3480	ESTIMATING RELATIVE DECLINE IN POPULATIONS OF SUBTERRANEAN TERMITES (ISOPTERA: RHINOTERMITIDAE) DUE TO BAITING	II	878	22/08/00	16:30	CC		19	PS	19
Gleeson, P. V.	2709	POTENTIAL OF JUVENOIDS IN BAIT TECHNOLOGY FOR THE MANAGEMENT OF SUBTERRANEAN TERMITES (ISOPTERA) - LABORATORY AND FIELD STUDIES WITH A CARBAMATE DERIVATIVE (W-328)	II	684	22/08/00	16:30	CC		14	PS	14
Glenn, D. M.	115	BENEFICIAL PHOTOSYNTHETIC AND HORTICULTURAL EFFECTS OF PARTICLE FILM APPLICATIONS ON PLANTS: DESTROYING THE DOGMA OF THE NEGATIVE EFFECTS OF DUSTS ON PLANTS	I	30	23/08/00	14:15	HB	A	2	6	2
Glenn, D. M.	114	PARTICLE FILM TECHNOLOGY FOR CONTROL OF ARTHROPOD PESTS AND DISEASES IN PLANTS	I	30	23/08/00	13:55	HB	A	2	6	2
Glória, B. A. da	4161	GLANDULAR TRICHOMES IN PLANTS CAN ATTRACT HERBIVORE INSECTS	II	1051	21/08/00	16:30	CC		Erratum	PS	4
Glowacka, B.	2153	BIOLOGICAL ACTIVITY OF NUCLEAR POLYHEDROSIS VIRUS ISOLATED FROM CELERY LOOPER (ANAGRAPHA FALCIFERA) AGAINST NUN MOTH (LYMANTRIA MONACHA)	I	543	25/08/00	16:30	CC		11	PS	11
Glushek, M.	3304	GENE REGULATION DURING OVARIAN DEVELOPMENT IN THE SILKMOTH	II	834	25/08/00	15:35	HB	K	18	7	18
Glynn, C.	2163	BIOLOGICAL CONTROL OF SPRUCE CONE INSECTS USING BACILLUS THURINGIENSIS	I	545	25/08/00	16:30	CC		11	PS	11
Gnanvossou, D.	38	EFFECTS OF CASSAVA CULTIVAR ON ABUNDANCE OF EXOTIC PHYTOSEIID MITES IN AFRICA	I	10	22/08/00	16:30	CC		1	PS	1
Gnaspini, P.	3774	PHYLOGENY AND EVOLUTION OF LEIODIDAE (COLEOPTERA) - INTRODUCTION TO THE SYMPOSIUM	II	953	23/08/00	16:30	CC		21	PS	21
Gnaspini, P.	3588	SYSTEMATICS OF CAVE ANIMALS AND THE USE OF TROGLOMORPHISMS IN PHYLOGENETIC RECONSTRUCTION	II	905	25/08/00	10:45	Bol	U	20	3	20
Gobbi, N.	1697	EVALUATION OF THE INTERACTIONS BETWEEN GALLERIA MELLONELLA (LEPIDOPTERA: PYRALIDAE), ACHROIA GRISELLA (LEPIDOPTERA: PYRALIDAE) AND THE PARASITOID APANTELES GALLERIAE (HYMENOPTERA: BRACONIDAE)	I	428	25/08/00	16:30	CC		8	PS	8
Godfray, C.	4172	COEVOLUTION OF RESISTANCE AND VIRULENCE: INSECT HOSTS AND THEIR PARASITOIDS	II	1054	21/08/00	9:35	HB	L	Erratum	1	12
Godfray, H. C. J.	1079	EFFECTS OF NATURAL ENEMIES AND RESOURCE QUALITY ON HERBIVORE ESABLISHMENT IN TWO HABITATS	I	272	23/08/00	16:30	CC		6	PS	6
Godfray, H. C. J.	1584	A LABORATORY SELECTION EXPERIMENT: EVOLUTION OF DROSOPHILA MELANOGASTER UNDER THE ATTACK OF THE PUPAL PARASITOID PACHYCREPOIDEUS VINDEMIAE	I	399	23/08/00	16:30	CC		8	PS	8
Godfray, H. C. J.	2010	DISEASE/HOST MODELS FOR SOIL-DWELLING PESTS	I	507	23/08/00	10:35	HM	P	11	5	11
Godfray, H. C. J.	1141	INVASION SEQUENCE DETERMINES PREDATOR-PREY DYNAMICS IN A MULTISPECIES ASSEMBLAGE	I	288	24/08/00	16:30	CC		6	PS	6
Godfray, H. C. J.	1638	ANALYSIS OF THE BIOLOGICAL CONTROL OF THE DIATRAEA SACCHARALIS AT DIFFERENT SPATIAL SCALES: LACK OF CONTROL OR POOR DATA SET?	I	413	24/08/00	16:30	CC		8	PS	8
Godfrey, L. D.	2695	INFLUENCE OF COTTON NITROGEN FERTILITY ON COTTON APHID, APHIS GOSSYPII, POPULATION DYNAMICS IN CALIFORNIA	II	681	22/08/00	16:30	CC		14	PS	14
Godinho, M. C.	247	DIGLYPHUS SP. COMPLEX IN OESTE REGION OF PORTUGAL AND ITS ROLE AS NATURAL CONTROL AGENTS IN GREENHOUSE VEGETABLES	I	63	22/08/00	16:30	CC		2	PS	2
Godinho, M. C.	2696	CONSTRAINTS FACED BY THE GREENHOUSE VEGETABLES GROWERS USING BUMBLEBEES TO POLLINATION	II	681	22/08/00	16:30	CC		14	PS	14
Godinho, M. C.	167	FORAGING ACTIVITY OF BUMBLEBEES IN GREENHOUSE MUSKMELON CROP	I	43	21/08/00	16:30	CC		2	PS	2
Godinho, M. C.	2757	IPM PROGRAMMES FOR PROTECTED VEGETABLE CROPS (IN OESTE REGION OF PORTUGAL)	II	696	23/08/00	16:30	CC		14	PS	14
Godoy, F. J.	200	AMMONIUM ACETATE: AN EFFICIENT ADULT ATTRACTANT OF ANASTREPHA SPP & CERATITIS CAPITATA IN MANGOES PLANTATIONS IN MARACAY, VENEZUELA	I	51	21/08/00	16:30	CC		2	PS	2
Godoy, K. B.	994	AGE-SPECIFIC LIFE TABLE OF LIPAPHIS ERYSIMI KALT. (HOMOPTERA: APHIDIDAE) UNDER FIELD CONDITIONS	I	251	22/08/00	16:30	CC		6	PS	6
Godoy, K. B.	995	THERMAL REQUIREMENTS AND PREDICTION OF POPULATION PEAKS OF LIPAPHIS ERYSIMI KALT. (HOMOPTERA: APHIDIDAE)	I	251	22/08/00	16:30	CC		6	PS	6
Godoy, M. C.	3512	PRELIMINARY INVENTORY OF ISOPTERA FROM NATURAL PROTECTED AREAS OF NORTHEAST ARGENTINA	II	886	23/08/00	16:30	CC		19	PS	19
Godoy, M. C.	3495	THE DIGESTIVE TUBE OF THE NEOTROPICAL GENUS TAURITERMES (ISOPTERA: KALOTERMITIDAE): COILING AND MORPHOLOGY	II	882	23/08/00	16:30	CC		19	PS	19
Godt, D.	3039	REGULATION OF OVARIAN MORPHOGENESIS IN DROSOPHILA	II	767	21/08/00	14:00	HB	G	16	1	16
Goff, M. L.	2952	EFFECTS OF HANGING AND BURNING ON DECOMPOSITION PATTERNS AND ARTHROPOD INVASION OF REMAINS	II	745	26/08/00	14:30	Bol	R	15	11	15
Goff, M. L.	2400	IMMUNOHISTOCHEMICAL CONTRIBUTION TO THE STUDY OF MORPHINE METABOLISM IN CALLIPHORIDAE LARVAE AND IMPLICATIONS IN FORENSIC ENTOMOTOXICOLOGY	II	606	21/08/00	16:30	CC		13	PS	13
Gogala, M.	503	ACOUSTIC METHODS IN BIODIVERSITY INVESTIGATIONS OF CICADAS IN TROPICAL RAIN FORESTS	I	127	22/08/00	16:30	CC		3	PS	3
Gogala, M.	1745	EVOLUTION OF SOUND AND VIBRATION PRODUCING ORGANS IN HETEROPTERA AND HOMOPTERA - AUCHENORRHYNCHA	I	440	23/08/00	13:30	HB	F	9	3	9
Gohole, L. S.	1535	EFFECTS OF MOLASSES GRASS (MELINIS MINUTIFLORA) VOLATILES ON THE FORAGING BEHAVIOUR OF THE STEMBORER PARASITOID COTESIA SESAMIAE	I	387	22/08/00	16:30	CC		8	PS	8
Goiti, U.	996	INSECTS AS BATS' PREY: A CASE STUDY ON KUHL'S PIPISTRELLE (PIPISTRELLUS KUHLII)	I	251	22/08/00	16:30	CC		6	PS	6
Gold, C. S.	2697	MANAGEMENT OF THE BANANA WEEVIL COSMOPOLITES SORDIDUS (COLEOPTERA:CURCULIONIDAE) IN BANANA-BASED CROPPING SYSTEMS IN NTUNGAMO, UGANDA	II	681	22/08/00	16:30	CC		14	PS	14
Goldbach, R.	3217	A WAY TO DIFFERENTIATE VECTOR SPECIFICITY BY THRIPS IN TOMATO SPOTTED WILT VIRUS TRANSMISSION	II	812	22/08/00	16:30	Bol	U	17	2	17
Goldbach, R. W.	3212	CHAPERONIN CAMOUFLAGE: AN INTRIGUING PHENOMENON IN THE TRANSMISSION OF LUTEOVIRUSES BY APHIDS	II	811	22/08/00	14:00	Bol	U	17	2	17
Goldin, A. L.	1229	SODIUM CHANNEL MUTATIONS AND PYRETHROID RESISTANCE	I	310	21/08/00	14:35	HM	N	7	2	7
Goldsmith, M. R.	3262	RECENT PROGRESS IN GENOMIC MAPPING IN BOMBYX MORI: WHERE SHOULD WE GO FROM HERE?	II	824	22/08/00	9:35	HB	K	18	2	18
Golubeva, T. V.	2435	INDUCTION OF HUMORAL IMMUNITY IN LARVAE OF LYMANTRIA DISPAR (LEPIDOPTERA: LYMANTRIDAE)	II	615	22/08/00	16:30	CC		13	PS	13

Sub-titles: (HB=Hotel Bourbon) - (HM=Hotel Mabu) - (CC=Convention Center) - (Bol=Foz Boulevard) - (PS=Poster Session) - (PL=Plenary Lecturer)

AUTHOR	N°	TITLE	Book	Page	Date	Time	Local	Room	Session	Symp	New Session
Gombarovits, M. E. C.	1306	INSECTICIDAL PROPERTIES OF CANATOXIN, A TOXIC PROTEIN FROM CANAVALIA ENSIFORMIS SEEDS, AND ITS ENTOMOTOXIC PEPTIDES	I	330	21/08/00	16:30	CC		7	PS	7
Gomes, G.	3489	ANT ASSEMBLAGES (FORMICIDAE) IN THE PARQUE ESTADUAL XIXOVÁ-JAPUÍ, SÃO VICENTE-PRAIA GRANDE, SÃO PAULO	II	881	25/08/00	16:30	CC		19	PS	19
Gomes, J. P.	3022	EFFICACY OF DIFFERENT INSECTICIDES ON THE CONTROL OF THE ADULT MUSCA DOMESTICA IN LABORATORY CONDITIONS	II	762	25/08/00	16:30	CC		15	PS	15
Gomes, S.	1536	DEVELOPMENT OF TRICHOGRAMMA PRETIOSUM (HYMENOPTERA: TRICHOGRAMMATIDAE) IN ARTIFICIAL DIET, FOCUSING ON PROTEIN UTILIZATION	I	387	22/08/00	16:30	CC		8	PS	8
Gomes, S. M. A.	2984	BRAZILIAN SPOTTED FEVER TRANSMITED BY AMBLYOMMA AUREOLATUM (ACARI) IN MOGI DAS CRUZES, BRAZIL: REPORT OF FOUR HUMAN CASES AND ENVIRONMENTAL CONTROL MEASURES	II	753	22/08/00	16:30	CC		15	PS	15
Gómez López, V.	2698	APPLIED RESEARCH WITH THE BWACT TO DETERMINE USE METHODS FOR THE PARAGUAYAN NATIONAL COTTON PROGRAM	II	681	22/08/00	16:30	CC		14	PS	14
Gomez, C. A.	997	DO INSECTS CONTRIBUTE TO LENGA (NOTHOFAGUS PUMILIO) DECLINE? A STUDY IN TIERRA DEL FUEGO, ARGENTINA	I	252	22/08/00	16:30	CC		6	PS	6
Gomez, S. A.	2070	THE VELVETBEAN CATERPILLAR CONTROL WITH BACULOVIRUS ANTICARSIA APPLIED ON SOYBEAN CROP THROUGH A CENTER PIVOT SPRINKLE WATER IRRIGATION	I	522	22/08/00	16:30	CC		11	PS	11
Gomez, S. A.	2699	VELVETBEAN CATERPILLAR CONTROL WITH AIR AND TERRESTRIAL APPLICATIONS OF ITS NUCLEAR POLYHEDROSIS VIRUS (NPV)	II	682	25/08/00	16:30	CC		14	PS	14
Gomulski, L. M.	2209	TRANSPOSABLE ELEMENT ABUNDANCE, DISTRIBUTION AND EVOLUTION IN TEPHRITID FLIES	I	558	24/08/00	14:35	HB	L	12	8	12
Gomulski, L. M.	2230	POLYMORPHIC MICROSATELLITE MARKERS TO ASSESS THE GENETIC VARIABILITY IN THE MEDITERRANEAN FRUIT FLY, CERATITIS CAPITATA, SPECIES RANGE	I	563	21/08/00	16:30	CC		12	PS	12
Gomulski, L. M.	2316	SPECIES DIAGNOSTIC DIFFERENCES IN RIBOSOMAL DNA INTERNAL TRANSCRIBED SPACER 2 FROM SEVEN CRYPTIC SPECIES OF THE CULICOIDES IMICOLA COMPLEX (DIPTERA: CERATOPOGONIDAE)	I	584	25/08/00	16:30	CC		12	PS	12
Gomulski, L. M.	2315	FROM SEVEN CRYPTIC SPECIES OF THE CULICOIDES IMICOLA COMPLEX (DIPTERA: CERATOPOGONIDAE)	I	584	24/08/00	16:30	CC		12	PS	12
Gonçalves, R. O.	2742	ECOLOGICAL AND BIOLOGICAL STUDIES ON THE POLYMORPHIC SPECIES CHELYMORPHA CRIBRARIA (COL.: CHRYSOMELIDAE) IN RIO DE JANEIRO, BRAZIL	II	692	23/08/00	16:30	CC		14	PS	14
Gonçalves, J.	2700	DIAGRAM OF ELEMENTS AGROCLIMATYCALS IN PEST MANAGEMENT	II	682	22/08/00	16:30	CC		14	PS	14
Gonçalves, J. F.	1985	LEPIDOPTERAN COLLECTED IN AN EUCALYPTUS PLANTATION IN GOIÁS, BRAZIL, FROM MAY 1995 TO APRIL 1996 - EFFECT OF TEMPERATURE AND RAINFALL ON POPULATION DYNAMICS	I	500	25/08/00	16:30	CC		10	PS	10
Gonçalves, L. S.	3436	HONEY BEE TOLERANCE AGAINST VARROA JACOBSONI IN ARGENTINA	II	867	24/08/00	9:50	HM	Q	19	5	19
Gonçalves, L. S.	3443	VARROA RESEARCH IN BRAZIL	II	869	24/08/00	11:50	HM	Q	19	5	19
Gonçalves, M. E. C.	1330	EFFECT OF VEGETAL AQUEOUS EXTRACTS ON IMMATURE STAGES AND FEMALES OF THE CASSAVA GREEN MITE MONONYCHELUS TANAJOA	I	336	22/08/00	16:30	CC		7	PS	7
Gonçalves, M. E. C.	1371	CONTROL OF BEAN LEAFHOPPER EMPOASCA KRAEMERI (HEMIPTERA: CICADELLIDAE) WITH THIAMETHOXAM ON COWPEA	I	346	22/08/00	16:30	CC		7	PS	7
Gonçalves, M. E. C.	2714	CONTROL OF POTATO LEAFHOPPER EMPOASCA KRAEMERI (HEMIPTERA: CICADELLIDAE) WITH THIAMETHOXAM ON COWPEA	II	685	23/08/00	16:30	CC		14	PS	14
Gonçalves, R.O.	4132	POLYMORPHISM IN A CASSIDINAE SPECIES	II	1044	25/08/00	15:40	HM	P	24	2	24
Gonçalves-Alvim, S. J.	504	BIODIVERSITY OF GALLING INSECTS: HISTORICAL, COMMUNITY AND HABITAT EFFECTS IN THE NEOTROPICAL SAVANNAS	I	128	22/08/00	16:30	CC		3	PS	3
Gonçalves-Alvim, S. J.	1922	RESIN-COLLECTING BEES (HYMENOPTERA, APIDAE) ON CLUSIA PALMICIDA (CLUSIACEAE) IN A RIPARIAN FOREST IN BRAZIL	I	484	22/08/00	16:30	CC		10	PS	10
Gonçalves-Gervásio, R. C. R.	1537	EFFECT OF THE AGE OF APHIDIUS COLEMANI (HYMENOPTERA: APHIDIIDAE) ON THE GREEN APHID SCHIZAPHIS GRAMINUM (HOMOPTERA: APHIDIDAE) PARASITISM	I	388	22/08/00	16:30	CC		8	PS	8
Gonçalves-Gervásio, R. de C.R.	1538	FOOD CONSUMPTION OF CHRYSOPERLA EXTERNA (NEUROPTERA: CHRYSOPIDAE) IN THE DIFFERENT DEVELOPMENTAL PHASES OF DYSMICOCCUS BREVIPES (HEMIPTERA: PSEUDOCOCCIDAE), UNDER LABORATORY CONDITIONS	I	388	22/08/00	16:30	CC		8	PS	8
Gonçalves-Gervásio, R. de C.R.	1648	FUNCTIONAL RESPONSE OF CYCLONEDA SANGUINEA (COLEOPTERA : COCCINELLIDAE) AT DIFFERENT DENSITIES OF THE APHID MYZUS PERSICAE (HOMOPTERA: APHIDIDAE)	I	415	22/08/00	16:30	CC		8	PS	8
Goncharuk, A. I.	1443	UNIFICATION OF INDUSTRIAL LINES OPERATING TIME ENTOMOPHAGES	I	364	22/08/00	14:20	HM	O	8	4	8
Gondim, E. G. S.	505	COMPARISON OF CARYOCAR BRASILIENSE CATERPILLAR FAUNA IN TWO CERRADO AREAS OF THE DISTRITO FEDERAL, BRAZIL	I	128	22/08/00	16:30	CC		3	PS	3
Gong, H.	2436	TWO COLLAGENASES BEING SECRETED BY TERATOCYTES FROM MICROPLITIS MEDIATOR (HYMENOPTERA: BRACONIDAE) CULTURED IN VITRO*	II	615	22/08/00	16:30	CC		13	PS	13
Gong, Y.	2822	A STUDY ON LIRIMYZA SATIVAE	II	712	25/08/00	16:30	CC		14	PS	14
Goñi, A.	3021	MONITORING OF HEMATOPHAGOUS VECTORS IN THE AREA OF INFLUENCE OF THE YACYRETA DAM	II	762	22/08/00	16:30	CC		15	PS	15
Gonring, A. H. R.	998	EFFECT OF CATERPILLARS AND DEFOLIATION IN OVIPOSICION OF PLUTELLA XYLOSTELLA	I	252	22/08/00	16:30	CC		6	PS	6
Gonring, A. H. R.	636	INTENSITY OF LOSSES IN MAIZE CULTIVATED UNDER MINERAL AND ORGANIC FERTILIZATION SYSTEMS.	I	161	21/08/00	16:30	CC		4	PS	4
Gonzaga, S. R.	3517	STINGLESS BEES OF THE PARANA STATE ASSOCIATION OF BEEKEEPERS	II	887	23/08/00	16:30	CC		19	PS	19
Gonzáles, J.	1939	APPLICATION OF A GEOGRAPHICAL INFORMATION SYSTEM TO THE STUDY OF SIREX NOCTILIO (HYMENOPTERA-SIRICIDAE) IN CALAMUCHITA VALLEY, CÓRDOBA, ARGENTINA	I	489	23/08/00	16:30	CC		10	PS	10
Gonzales, J. P.	2206	HOST CONTROL OF COPIA RETROTRANSPOSITION RATE IN DROSOPHILA MELANOGASTER	I	557	24/08/00	13:35	HB	L	12	8	12
Gonzáles, W. L.	999	DO HOST PLANT TRAITS AND GALLING INSECTS AFFECT THE ABUNDANCE OF ISSUS SP. ON COLLIGUAJA ODORIFERA ALONG AN ALTITUDINAL GRADIENT?	I	252	22/08/00	16:30	CC		6	PS	6
González, W. L.	1539	AN EXOTIC APHID SPECIES IS FAVOURED BY ADJACENT TROPHIC LEVELS: HOST PLANT AND NATURAL ENEMY IMPACT ON CEREAL APHID COMPETITION	I	388	22/08/00	16:30	CC		8	PS	8
González Audino, P.	667	COPULATION PHEROMONE OF THE VECTOR OF CHAGAS DISEASE, TRIATOMA infestans: IDENTIFICATION AND BIOASSAY	I	169	22/08/00	16:30	CC		4	PS	4
González, A.	1331	INFLUENCE OF INSECTICIDES ON THE SPIDERS COMMUNITY IN A SOY CULTIVATION (BUENOS AIRES, ARGENTINA)	I	336	22/08/00	16:30	CC		7	PS	7
Gonzalez, L.M.	612	PHEROMONE-BASED MASS TRAPPING OF THE BANANA WEEVIL, COSMOPOLITES SORDIDUS & THE WEST INDIAN SUGARCANE WEEVIL, METAMASIUS HEMIPTERUS IN BANANA & PLANTAIN	I	155	24/08/00	11:05	Bol	S	4	6	4
Gonzalez, M. T.	408	THE SOCIEDAD COLOMBIANA DE ENTOMOLOGIA PRESERVING BIODIVERSITY	I	104	23/08/00	11:05	HB	C	3	3	3
González, M. T. G.	3329	IN VITRO DEVELOPMENT OF COFFEE BERRY BORER (HYPOTHENEMUS HAMPEI) IN AN FREEZE DRY DIET	II	841	22/08/00	16:30	CC		18	PS	18
González, N	2987	TRIATOMINES AND OTHER ARTHROPODS IN BIRD NESTS IN NATIVE AND MENNONITE COMMUNITIES OF THE PARAGUAYAN CHACO	II	754	22/08/00	16:30	CC		15	PS	15
González, N.	3154	MORPHOMETRIC DIFFERENCES OF TRIATOMA INFESTANS FROM THE EASTERN AND WESTERN REGIONS OF PARAGUAY	II	796	23/08/00	16:30	CC		16	PS	16
González, N.	2958	ISOENZYMATIC CHARACTERIZATION OF TRIATOMA INFESTANS POPULATIONS FROM EASTERN AND WESTERN REGIONS OF PARAGUAY	II	746	21/08/00	16:30	CC		15	PS	15

Sub-titles: (HB=Hotel Bourbon) - (HM=Hotel Mabu) - (CC=Convention Center) - (Bol=Foz Boulevard) - (PS=Poster Session) - (PL=Plenary Lecturer)

AUTHOR	Nº	TITLE	Book	Page	Date	Time	Local	Room	Session	Symp	New Session
González, N.	1256	USE AND PERSPECTIVES OF BOTANICAL PESTICIDES IN CUBA	I	317	24/08/00	11:05	HM	N	7	7	7
Gonzalez, R. H.	108	THE POTENTIAL EFFECT OF UNITED STATES LEGISLATION,THE FOOD QUALITY PROTECTION ACT,ON INTERNATIONAL TRADE. THE CASE OF CHILE	I	28	23/08/00	10:15	HB	A	2	5	2
Gonzalez, R. H.	2545	STATUS OF CODLING MOTH MANAGEMENT AND CURRENT CONTROL PROGRAMS: SOUTHERN HEMISPHERE	II	643	21/08/00	13:50	HB	B	14	2	14
González, S.	1331	INFLUENCE OF INSECTICIDES ON THE SPIDERS COMMUNITY IN A SOY CULTIVATION (BUENOS AIRES, ARGENTINA)	I	336	22/08/00	16:30	CC		7	PS	7
González-Castillo, M. P.	37	LIFE TABLES OF THE RED MITE, EOTETRANYCHUS LEWISI (ACARI: TETRANYCHIDAE)	I	10	22/08/00	16:30	CC		1	PS	1
Goolsby, J.	3960	REVIEWING A MULTI-AGENCY BIOLOGICAL CONTROL PROGRAM FOR BEMISIA ARGENTIFOLII IN THE SOUTHWEST UNITED STATES: FOREIGN EXPLORATION, MASS CULTURE & EVALUATIONS	II	999	22/08/00	16:30	CC		22	PS	22
Goolsby, J.	3959	REVIEWING A MULTI-AGENCY BIOLOGICAL CONTROL PROGRAM FOR BEMISIA ARGENTIFOLII IN THE SOUTHWEST UNITED STATES: ESTABLISHING, CONSERVING & AUGMENTING NEW PARASITOIDS & EVALUATING THEIR IMPACT	II	999	22/08/00	16:30	CC		22	PS	22
Goolsby, J. A.	3839	MOLECULAR SYSTEMATICS OF FERGUSONINA SPP. (DIPTERA: FERGUSONINIDAE): HOST SPECIFICITY, HOST-USE EVOLUTION, AND IMPLICATIONS FOR BIOCONTROL OF MELALEUCA QUINQUENERVA IN THE FLORIDA EVERGLADES	II	969	25/08/00	16:30	CC		21	PS	21
Gorayeb, I. S.	337	STUDY OF SIMULIIDAE (DIPTERA: NEMATOCERA) AND ITS BREEDING AREAS IN A STREAM OF THE MUNICIPAL DISTRICT OF "SANTO ANTÔNIO DO TAUÁ", STATE OF PARÁ, EASTERN AMAZONIA, BRAZIL	I	85	25/08/00	16:30	CC		2	PS	2
Gorb, S. N.	3113	ELYTRA-TO-BODY BINDING MECHANISM IN COELOMETOPINE TENEBRIONID BEETLES (INSECTA: COLEOPTERA): ADAPTATIONS TO FLIGHTLESSNESS AND TAXONOMIC IMPLICATIONS	II	785	21/08/00	16:30	CC		16	PS	16
Gorbet, D. W.	2635	DEVELOPMENT OF A METHOD OF RISK ASSESSMENT TO FACILITATE INTEGRATED MANAGEMENT OF SPOTTED WILT DISEASE OF PEANUT IN GEORGIA	II	666	22/08/00	16:30	CC		14	PS	14
Gorbet, D. W.	2566	SUCCESSES WITH PEANUT IPM IN THE SOUTHEASTERN UNITED STATES THROUGH INTERDISCIPLINARY APPROACHES	II	648	22/08/00	14:50	HB	B	14	4	14
Gorbet, D. W.	2828	EFFECTS OF INFECTION BY THE PARASITIC NEMATODE THRIPINEMA FUSCUM ON FRANKLINIELLA FUSCA POPULATION DYNAMICS AND TOSPOVIRUS EPIDEMIOLOGY IN PEANUT	II	714	25/08/00	16:30	CC		14	PS	14
Gordh, G.	3892	AZADIRACHTIN AND OTHER PLANT-DERIVED INSECTICIDES	II	982	23/08/00	10:45	HB	J	22	4	22
Gormley, L.	1811	INSECTS IN THE TROPICAL LAND-USE MOSAIC – THE IMPACT OF AGRICULTURAL AND FOREST DEVELOPMENT	I	457	21/08/00	9:50	HB	M	10	1	10
Gornostaev, N. G.	2267	INCOMPLETE DOMINANCE OF SOME MORPHOLOGICAL CHARACTERS IN HYBRIDS OF DROSOPHILA VIRILIS GROUP	I	572	22/08/00	16:30	CC		12	PS	12
Gorosito, N. B.	3487	DEMOGRAPHY OF CAMPONOTUS PUNCTULATUS ANTS ALONG A GRADIENT OF AGRICULTURAL DISTURBANCE AND THROUGH TIME	II	880	24/08/00	16:30	CC		19	PS	19
Gosset, D.	2401	MORPHINE EXTRACTION IN NECROPHAGOUS INSECTS REMAINS FOR DETERMINING ANTE-MORTEM OPIATE INTOXICATION	II	607	21/08/00	16:30	CC		13	PS	13
Gosset, D.	2400	IMMUNOHISTOCHEMICAL CONTRIBUTION TO THE STUDY OF MORPHINE METABOLISM IN CALLIPHORIDAE LARVAE AND IMPLICATIONS IN FORENSIC ENTOMOTOXICOLOGY	II	606	21/08/00	16:30	CC		13	PS	13
Gothro, P. W.	2035	THE BENEFICIAL NEMATODE, HETERORHABDITIS MARELATUS : ITS PROMISE IN BIOCONTROL OF PESTS IN NURSERY AND FIELD CROPS	I	513	21/08/00	16:30	CC		11	PS	11
Goto, H.	3137	MORPHOLOGY OF MYCANGIA OF CNESTUS MURAYAMAI (COLEOPTERA: SCOLYTIDAE)	II	791	22/08/00	16:30	CC		16	PS	16
Goto, S. G.	2252	A NOVEL GENE UP-REGULATED DURING RECOVERY FROM COLD-SHOCK IN DROSOPHILA	I	568	22/08/00	16:30	CC		12	PS	12
Gotoh, T.	248	IS WOLBACHIA INFECTION RESPONSIBLE FOR REPRODUCTIVE INCOMPATIBILITY IN THE SPIDER MITE, TETRANYCHUS KANZAWAI (ACARI: TETRANYCHIDAE)?	I	63	22/08/00	16:30	CC		2	PS	2
Gotoh, T.	705	INCREASE OF TRAP CATCHES BY A COMBINATION OF MALE SEX PHEROMONES AND FLORAL ATTRACTANT IN LONGHORN BEETLE, ANAGLYPTUS SUBFASCIATUS (COLEOPTERA: CERAMBYCIDAE)	I	178	24/08/00	16:30	CC		4	PS	4
Goud, F.	2577	ECOLOGY OF GENETICALLY TRANSFORMED FOST PLANTS AND NATURAL ENEMIES	II	651	23/08/00	15:00	HB	B	14	5	14
Goud, Y. S.	332	ATTRACTION OF SHOOT BORER, CHILO INFUSCATELLUS, DAMAGED SUGARCANE TO THE BRACONID COTESIA FLAVIPES	I	84	24/08/00	16:30	CC		2	PS	2
Goud, Y. S.	723	EFFECT OF BUCCAL CAVITY SECRETIONS OF PARASITISED AND UNPARASITISED CHILO INFUSCATELLUS LARVAE ON THE SYNOMONAL ACTIVITY OF SUGRACANE PLANT	I	183	25/08/00	16:30	CC		4	PS	4
Goudoudaki, S.	2327	LIFE CYCLE, MORPHOLOGICAL AND GENETIC VARIATION IN CLONES OF MYZUS PERSICAE (HOMOPTERA: APHIDIDAE)	I	587	25/08/00	16:30	CC		12	PS	12
Gouinguené, S.	671	VARIATION AND SPECIFICITY OF HERBIVORE-INDUCED PLANT ODORS AS FORAGING CUES FOR PARASITOIDS	I	170	23/08/00	16:30	CC		4	PS	4
Gouinguené, S.	1422	IS IT FEASIBLE TO INCREASE THE ATTRACTIVENESS OF CROP PLANTS TO PARASITOIDS?	I	359	21/08/00	10:50	HM	O	8	1	8
Gôukon, K.	3653	WHY DO MALE AND FEMLAE PSEUDOXENOS IWATAI (STYLOPIDAE) EXTRUDE AT DEFINITE POSISITONS ON THE HOST METASOMA?	II	922	23/08/00	15:35	HB	E	21	5	21
Gould, J.	2733	BIOLOGY OF SWEET POTATO WHITEFLY, (HOMOPTERA: ALEYRODIDAE) ON TRANSGENIC TOBACCO AND INTERACTIONS WITH A PARASITE	II	690	23/08/00	16:30	CC		14	PS	14
Gould, J.	3959	REVIEWING A MULTI-AGENCY BIOLOGICAL CONTROL PROGRAM FOR BEMISIA ARGENTIFOLII IN THE SOUTHWEST UNITED STATES: ESTABLISHING, CONSERVING & AUGMENTING NEW PARASITOIDS & EVALUATING THEIR IMPACT	II	999	22/08/00	16:30	CC		22	PS	22
Goulson, D.	357	SPATIAL AND TEMPORAL DISTRIBUTIONS OF PREDATORY INVERTEBRATES WITHIN, AND DISPERSING FROM, OVERWINTERING REFUGES IN UK CEREAL FIELDS	I	90	25/08/00	16:30	CC		2	PS	2
Goulson, D.	3496	IMPACT OF ALIEN SOCIAL BEES ON TASMANIAN FLORA AND FAUNA	II	882	23/08/00	16:30	CC		19	PS	19
Goulson, D.	3555	EFFICIENT FORAGING BY BUMBLEBEES: THE ROLE OF REPELLENT SCENT MARKS	II	897	25/08/00	16:30	CC		19	PS	19
Goulson, D.	3602	EVIDENCE FOR HANDEDNESS IN BUMBLEBEES	II	909	23/08/00	16:30	CC		20	PS	20
Goulson, D.	674	CHEMICAL VARIATION AND ITS FUNCTIONAL SIGNIFICANCE IN GRASS-CUTTING ANT ALARM PHEROMONES	I	170	23/08/00	16:30	CC		4	PS	4
Goulson, D.	3601	FIELD MARGINS ARE POTENTIALLY VALUABLE HABITATS FOR FORAGING BUMBLEBEES	II	909	23/08/00	16:30	CC		20	PS	20
Goulson, D.	2274	MOLECULAR ANALYSIS OF THE EVOLUTIONARY DYNAMICS OF THE AFRICAN QUEEN BUTTERFLY DANAUS CHRYSIPPUS.	I	574	23/08/00	16:30	CC		12	PS	12
Goussain Jr, M. M.	1576	INFLUENCE OF TEMPERATURE ON THE WEIGHT OF LARVAE AND ADULTS OF CHRYSOPERLA EXTERNA (NEUROPTERA: CHRYSOPIDAE) FED ON SCHIZAPHIS GRAMINUM (HEMIPTERA: APHIDIDAE)	I	397	24/08/00	16:30	CC		8	PS	8
Govender, P.	3497	A NATIONAL PERSPECTIVE OF FOREST TREE PESTS IN SOUTH AFRICA	II	883	23/08/00	16:30	CC		19	PS	19

Sub-titles: (HB=Hotel Bourbon) - (HM=Hotel Mabu) - (CC=Convention Center) - (Bol=Foz Boulevard) - (PS=Poster Session) - (PL=Plenary Lecturer)

AUTHOR	Nº	TITLE	Book	Page	Date	Time	Local	Room	Session	Symp	New Session
Govender, P.	1894	ASSOCIATIONS OF INSECTS AND PATHOGENS RESULTING IN DISEASE AND DAMAGE TO PLANTATION GROWN EUCALYPTUS IN THE TROPICS AND SOUTHERN HEMISPHERE	I	477	26/08/00	15:35	HB	M	10	10	10
Govind, S.	2350	CELLULAR IMMUNITY IN DROSOPHILA	II	594	23/08/00	9:45	HB	I	13	4	13
Goytía, W.	1904	THE EFFECT OF THE INTRODUCTION OF A PINUS CARIBAEA PLANTATION ON THE ANT'S POPULATIONS OF VENEZUELAN SAVANNAS	I	480	21/08/00	16:30	CC		10	PS	10
Grace, J. K.	3395	DISTRIBUTION AND MANAGEMENT OF TERMITES IN HAWAII	II	857	21/08/00	13:45	HM	Q	19	1	19
Grace, J. K.	3502	GENETIC VARIABILITY AND POPULATION STRUCTURE OF THE FORMOSAN SUBTERRANEAN TERMITE IN HAWAII	II	884	23/08/00	16:30	CC		19	PS	19
Gracioli, L. F.	3138	HISTOLOGICAL AND MORPHOMETRICAL ANALYSES ON MANDIBULAR GLANDS OF MONO- AND POLYGYNIC COLONY MELIPONA BICOLOR QUEENS	II	792	22/08/00	16:30	CC	~	16	PS	16
Graciolli, G.	3139	COMPARATIVE MORPHOLOGY OF IMMATURE STAGES OF NOCTILIOSTREBLA AITKENI AND PARADYSCHIRIA FUSCA (DIPTERA: STREBLIDAE)	II	792	22/08/00	16:30	CC		16	PS	16
Graciolli, G.	1078	BATFLIES OF THE FISHBAT NOCTILIO LEPORINUS (MAMMALIA: CHIROPTERA): EFFECTS OF HOST SEX, SIZE, DEVELOPMENTAL STAGE AND SEASON	I	272	23/08/00	16:30	CC		6	PS	6
Graciolli, G.	3775	BATFLIES (DIPTERA: STREBLIDAE AND NYCTERIBIIDAE) OF PARANA STATE, BRAZIL	II	953	24/08/00	16:30	CC		21	PS	21
Graether, S. P.	3283	WHEN YOU CAN'T FLY TO BRAZIL: SURVIVING WINTER WITH ANTIFREEZE PROTEIN GENES	II	829	23/08/00	11:05	HB	K	18	4	18
Graham, L. A.	3283	WHEN YOU CAN'T FLY TO BRAZIL: SURVIVING WINTER WITH ANTIFREEZE PROTEIN GENES	II	829	23/08/00	11:05	HB	K	18	4	18
Gramajo, M. C.	1000	COMPARISON OF SENSITIVITY TO COLD IN SOUTH AMERICAN FRUIT FLY AND MEDFLY (DIPTERA: TEPHRITIDAE)	I	252	22/08/00	16:30	CC		6	PS	6
Granados, R. R.	2389	MOLECULAR STRUCTURE OF THE PERITROPHIC MEMBRANE AND ITS IMPLICATION FOR INSECT CONTROL	II	604	26/08/00	10:35	HB	I	13	10	13
Granara de Willink, M. C.	3776	COCCOIDEA AFFECTING ORNAMENTAL PLANTS IN ARGENTINA	II	953	23/08/00	16:30	CC		21	PS	21
Granetto, F.	3492	THE USE OF HONEYBEES (APIS MELLIFERA) AS INDICATORS FOR THE PRESENCE OF THE PHYTOPATHOGEN BACTERIUM ERWINIA AMYLOVORA IN THE ENVIRONMENT	II	881	22/08/00	16:30	CC		19	PS	19
Grangeiro, T. B.	1404	INSECTICIDAL ACTIVITY AND MOLECULAR TARGETS OF LEGUME LECTINS ON THE PEA APHID, ACYRTHOSIPHON PISUM	I	354	25/08/00	16:30	CC		7	PS	7
Granger, N. A.	3285	INTERACTION OF ENDOCRINE SYSTEM AT LARVAL-PUPAL METAMORPHOSIS	II	830	23/08/00	13:35	HB	K	18	5	18
Granger, N. A.	3330	CONTROL OF JUVENILE HORMONE SYNTHESIS BY THE CORPUS ALLATUM	II	841	22/08/00	16:30	CC		18	PS	18
Grass, M.Y.	328	BASIL-TOMATO INTERCROPPING EFFECT ON MACROSIPHUM EUPHORBIAE (HEMIPTERA: APHIDIDAE) ABUNDANCE	I	83	24/08/00	16:30	CC		2	PS	2
Gratz, N.	2931	THE WORLD HEALTH ORGANIZATION'S PESTICIDE EVALUATION PROGRAM: GLOBAL MOSQUITO CONTROL	II	740	25/08/00	14:00	Bol	R	15	10	15
Gratz, N. G.	2936	BITING FLY REPELLENTS, PAST, PRESENT AND FUTURE	II	741	25/08/00	15:15	Bol	R	15	10	15
Grau, Y.	2342	DROSOPHILA METABOTROPIC GLUTAMATE RECEPTORS: STRUCTURE AND FUNCTIONS	II	592	21/08/00	13:35	HB	I	13	2	13
Gravena, S.	249	EFFICIENCY OF THE INSECTICIDE ACTARA (THIAMETOXAN) ON CONTROL OF SHARPSHOOTER VECTORS OF XYLELLA FASTIDIOSA ON CITRUS	I	63	22/08/00	16:30	CC		2	PS	2
Gravena, S.	250	EFFICIENCY OF THE INSECTICIDE TEMIK 150 (ALDICARB) ON CONTROL OF SHARPSHOOTER VECTORS OF XYLELLA FASTIDIOSA ON CITRUS	I	64	22/08/00	16:30	CC		2	PS	2
Gravena, S.	251	EFFICIENCY OF THE INSECTICIDE WINNER (IMIDACLOPRID) ON CONTROL OF SOME CITRUS PESTS AND SELECTIVITY TO NATURAL ENEMIES	I	64	22/08/00	16:30	CC		2	PS	2
Gravena, S.	672	ATTRACTIVITY OF PROTEIN HIDROLISATE AND SUGARCANE MOLASSES ON ADULT FRUIT FLIES ANASTREPHA SP. AND CERATITIS CAPITATA (DIPTERA:TEPHRITIDAE) ON CITRUS ORCHARD	I	170	23/08/00	16:30	CC		4	PS	4
Gravena, S.	1616	INTRODUCTION OF THE PARASITOID AGENIASPIS CITRICOLA FOR THE BIOLOGICAL CONTROL OF CITRUS LEAFMINER PHYLLOCNISTIS CITRELLA IN BRAZIL	I	407	24/08/00	16:30	CC		8	PS	8
Gravena, S.	2584	PROBLEMS OF CITRUS IPM IN BRAZIL: CVC, LEPROSIS AND CANKER	II	653	24/08/00	13:35	HB	B	14	7	14
Gray, D. A.	1739	SEXUAL SELECTION, SPECIES ISOLATION, AND CHARACTER DISPLACEMENT IN MALE SONG AND FEMALE PREFERENCE FOR SONG IN THE FIELD CRICKET GRYLLUS TEXENSIS	I	438	23/08/00	10:30	HB	F	9	3	9
Gray, D. A.	1759	WHAT IS SEXY ABOUT FIELD CRICKET COURTSHIP SONG?	I	443	21/08/00	16:30	CC		9	PS	9
Gray, K.	2903	SPATIAL AND TEMPORAL HETEROGENEITY IN DENGUE VIRUS TRANSMISSION AND AEDES AEGYPTI POPULATION DENSITIES IN IQUITOS, PERU	II	733	23/08/00	14:35	Bol	R	15	6	15
Gray, M. E.	159	CROP ROTATION COLLAPSES AS A VIABLE PEST MANAGEMENT STRATEGY FOR WESTERN CORN ROOTWORMS, DIABROTICA VIRGIFERA VIRGIFERA LECONTE, IN THE EASTERN CORN BELT OF THE USA	I	41	26/08/00	14:05	HB	A	2	11	2
Grazia, J.	3633	PHYLOGENETIC ANALYSIS OF PENTATOMOIDEA	II	917	22/08/00	11:05	HB	E	21	3	21
Grazia, J.	3761	ON THE GENUS PARAMECOCEPHALA (HETEROPTERA, PENTATOMIDAE, PENTATOMINI)	II	949	22/08/00	16:30	CC		21	PS	21
Grazia, J.	3763	REVISION OF TAUROCERUS AMYOT & SERVILLE, 1843 (HETEROPTERA, PENTATOMIDAE, PENTATOMINI)	II	950	22/08/00	16:30	CC		21	PS	21
Grazia, J.	3764	CLADISTIC ANALYSIS OF GENUS SERDIA (HETEROPTERA: PENTATOMIDAE: PENTATOMINI)	II	950	22/08/00	16:30	CC		21	PS	21
Grazia, J.	3840	DESCRIPTION OF THE NYMPHS AND ADULT GENITALIA OF ACROSTERNUM (CHINAVIA) UBICUM (HETEROPTERA, PENTATOMIDAE)	II	969	25/08/00	16:30	CC		21	PS	21
Graziani, F.	3041	FEMALE STERILE MUTATIONS AND EGG CHAMBER DEVELOPMENT IN DROSOPHILA MELANOGASTER	II	767	21/08/00	15:00	HB	G	16	1	16
Graziani, F.	2372	EXPRESSION OF CARDIOCHILES NIGRICEPS POLYDNAVIRUS IN PARASITIZED HELIOTHIS VIRESCENS LARVAE AND INDUCED HOST FUNCTIONAL ALTERATIONS	II	599	24/08/00	14:05	HB	I	13	7	13
Grbic, M.	3069	SHIFTS IN THE LIFE HISTORY OF PARASITIC WASPS CORRELATE WITH ALTERATIONS IN EARLY DEVELOPMENT	II	774	24/08/00	10:45	HB	G	16	6	16
Grbic, M.	3295	SHIFTS IN THE LIFE HISTORY OF PARASITIC WASPS CORRELATE WITH ALTERATIONS IN EARLY DEVELOPMENT	II	832	25/08/00	14:30	HB	K	18	6	18
Greany, P. D.	1435	LABORATORY PRODUCTION AND FIELD EVALUATION OF HYMEMOPTEROUS ECTOPARASITOIDS REARED ON ARTIFICIAL DIETS	I	362	21/08/00	15:50	HM	O	8	2	8
Greatorex, E. C.	2253	POSSIBILITIES OF HOST ADAPTATION IN THE CABBAGE APHID, BREVICORYNE BRASSICAE	I	569	22/08/00	16:30	CC		12	PS	12
Greco, N.	311	EVALUATION OF POSSIBLE PLANT ASSOCIATIONS WITH STRAWBERRY: EFFECT ON THE TWO-SPOTTED MITE IN THE LABORATORY	I	79	24/08/00	16:30	CC		2	PS	2
Green, E. D.	3140	THE EXTERNAL MICROMORPHOLOGY OF THE EAR MITE OTODECTES CYNOTIS (ACARI : PSOROPTIDAE) AS REVEALED BY SCANNING ELECTRON MICROSCOPY	II	792	22/08/00	16:30	CC		16	PS	16
Green, E. D.	3141	THE FUNCTIONAL MICROMORPHOLOGY OF THE WARTHOG LOUSE (HAEMATOPINUS PHACOCHOERI) AS REVEALED BY SCANNING ELECTRON MICROSCOPY	II	792	22/08/00	16:30	CC		16	PS	16
Green, E. D.	3127	DUNG BEETLE SPIRACLES: DIFFERENT APPROACHES TO THE SAME PROBLEM	II	789	22/08/00	16:30	CC		16	PS	16
Green, W. M.	3944	TRANSGENIC COTTON COTTON, AN ALTERNATIVE TO CONVENTIONAL (NON-TRANSGENIC) COTTON FOR SOUTH AFRICA	II	995	21/08/00	16:30	CC		22	PS	22
Greenberg, S. M.	1448	QUALITY CONTROL IN AUTOMATED MASS REARING	I	365	22/08/00	15:35	HM	O	8	4	8
Greene, E.	2190	PHENOTYPIC VARIATION IN LARVAL DEVELOPMENT AND EVOLUTION: POLYMORPHISM, POLYPHENISM, AND DEVELOPMENTAL REACTION NORMS	I	553	21/08/00	16:30	CC		12	PS	12

Sub-titles: (HB=Hotel Bourbon) - (HM=Hotel Mabu) - (CC=Convention Center) - (Bol=Foz Boulevard) - (PS=Poster Session) - (PL=Plenary Lecturer)

AUTHOR	Nº	TITLE	Book	Page	Date	Time	Local	Room	Session	Symp	New Session
Greenfield, M. D.	1714	PARADOX(ES) OF THE LEK: CAN GENETIC VARIANCE OF SEXUALLY SELECTED TRAITS BE MAINTAINED BY GENOTYPE • ENVIRONMENT INTERACTION?	I	432	21/08/00	14:10	HB	F	9	1	9
Greenfield, M. D.	1741	EVOLUTION OF ULTRASONIC SIGNALING IN LEPIDOPTERA: DISCRIMINATION OF MATING CALLS FROM BAT ECHOLOCATION SIGNALS AND THE EXPLOITATION OF ANTI-PREDATOR RECEIVER BIAS BY SEXUAL ADVERTISEMENT	I	439	23/08/00	11:00	HB	F	9	3	9
Greenland, J.	1684	CLASSICAL BIOLOGICAL CONTROL OF THE SPINY BLACKFLY, ALEUROCANTHUS SPINIFERUS (HEM.: ALEYRODIDAE), AN ECONOMIC STUDY	I	424	25/08/00	16:30	CC		8	PS	8
Greenlee, K. J.	3085	BODY SIZE AND TRACHEAL FUNCTION IN GRASSHOPPERS	II	778	25/08/00	13:35	HB	G	16	8	16
Greenlee, K. J.	2437	RESPIRATORY CHANGES THROUGHOUT ONTOGENY IN THE AMERICAN LOCUST, SCHISTOCERCA AMERICANA	II	616	22/08/00	16:30	CC		13	PS	13
Greenwood, D. R.	580	PHEROMONE BINDING PROTEINS: STRUCTURAL, FUNCTIONAL AND GENETIC IMPERATIVES IN TORTRICID MOTHS	I	147	21/08/00	15:00	Bol	S	4	1	4
Gregg, P. C.	140	DISTANT NATIVE HOSTS IN SEMI-ARID REGIONS AS A SOURCE OF PEST INFESTATIONS IN CROPPING AREAS: THE AUSTRALIAN EXPERIENCE	I	36	25/08/00	11:00	HB	A	2	9	2
Gregg, P. C.	687	THE EFFECTS OF HOST PLANT ODOURS ON THE CALLING BEHAVIOUR, EGG MATURATION AND MATING SUCCESS OF THE COTTON BOLLWORM, HELICOVERPA ARMIGERA (HÜBNER) (LEPIDOPTERA: NOCTUIDAE)	I	174	23/08/00	16:30	CC		4	PS	4
Gregg, P. C.	148	POLLEN AS A MARKER FOR LONG-DISTANCE MIGRATION AND LOCAL MOVEMENT OF HELICOVERPA MOTHS IN AUSTRALIA	I	38	25/08/00	14:45	HB	A	2	9	2
Grégoire, J. C.	1839	PREDATORS AND PARASITOIDS FOR CONTROLLING INSECT PESTS OF FORESTS	I	464	23/08/00	10:05	HB	M	10	4	10
Gregório, E. A.	3112	SCANNING AND TRANSMISSION ELECTRON MICROSCOPY OF THE MANDIBULAR GLAND IN THE SUGARCANE BORER DIATRAEA SACCHARALIS LEPIDOPTERA: PYRALIDAE)	II	785	21/08/00	16:30	CC		16	PS	16
Gregório, E. A.	1608	MORPHOLOGICAL AND QUANTITATIVE STUDIES OF THE HEMOCYTES IN DIATRAEA SACCHARALIS (LEPIDOPTERA: PYRALIDAE) LARVAE PARASITIZED BY COTESIA FLAVIPES (HYMENOPTERA: BRACONIDAE)	I	405	23/08/00	16:30	CC		8	PS	8
Gregório, E. A.	3180	MORPHOLOGICAL ASPECTS OF THE NURSE CELL DEATH IN THE DIATRAEA SACCHARALIS (LEPIDOPTERA: PYRALIDAE) OVARIAN FOLLICLES	II	802	24/08/00	16:30	CC		16	PS	16
Gregório, E. A.	3181	SUB-CELLULAR STRUCTURES OF THE OOCYTE CYTOPLASM IN THE VITELLOGENIC FOLLICLES OF Diatraea saccharalis (LEPIDOPTERA: PYRALIDAE) REVEALED BY ZIO TECHNIQUE	II	802	24/08/00	16:30	CC		16	PS	16
Gregório, E. A.	3192	ULTRASTRUCTURE OF THE LYONET'S GLAND IN DIATRAEA SACCHARALIS (LEPIDOPTERA: PYRALIDAE) LARVAE	II	805	25/08/00	16:30	CC		16	PS	16
Gremigni, V.	3037	OVARIAN FOLLICLE DIFFERENTIATION IN INSECT OVARIOLES	II	766	21/08/00	11:30	HB	G	16	1	16
Grenier, S.	1426	ARTIFICIAL DIETS FOR REARING PREDATORS AND PARASITOIDS OF GREENHOUSE PEST INSECTS	I	360	21/08/00	13:35	HM	O	8	2	8
Grenier, S.	1541	REARING IN ARTIFICIAL CONDITIONS AS A TOOL FOR PHYSIOLOGICAL OR BEHAVIOURAL STUDIES OF EGG PARASITOID INSECTS	I	389	22/08/00	16:30	CC		8	PS	13
Grenier, S.	1665	FOOD AND CARCASS ANALYSES OF THE PREDATORY BUG HARMONIA AXYRIDIS (COLEOPTERA: COCCINELLIDAE) AS REFERENCES FOR THE ELABORATION OF ARTIFICIAL DIETS	I	420	25/08/00	16:30	CC		8	PS	8
Grenier, S.	1536	DEVELOPMENT OF TRICHOGRAMMA PRETIOSUM (HYMENOPTERA: TRICHOGRAMMATIDAE) IN ARTIFICIAL DIET, FOCUSING ON PROTEIN UTILIZATION	I	387	22/08/00	16:30	CC		8	PS	8
Grenier, S.	1540	STABILITY OF THE WOLBACHIA TRANSFER FROM TRICHOGRAMMA PRETIOSUM TO T. DENDROLIMI	I	388	22/08/00	16:30	CC		8	PS	8
Grewal, P. S.	2701	INTEGRATED PEST MANAGEMENT OF SCARABS IN NORTH AMERICA	II	682	22/08/00	16:30	CC		14	PS	14
Grewal, P. S.	2701	INTEGRATED PEST MANAGEMENT OF SCARABS IN NORTH AMERICA	II	682	22/08/00	16:30	CC		14	PS	14
Grez, A. A.	1001	PLANT PATCH SHAPE AND SURROUNDING VEGETATION AFFECT THE POPULATION DYNAMICS OF PREDATORY AND HERBIVOROUS INSECTS	I	253	22/08/00	16:30	CC		6	PS	6
Grieco, J. P.	3011	A PROBABILITY MODEL OF VECTOR BEHAVIOR: EFFECTS OF DDT AND DELTAMETHRIN REPELLENCY, IRRITANCY, AND TOXICITY IN MALARIA CONTROL	II	760	24/08/00	16:30	CC		15	PS	15
Grieco, J.P.	2957	A PROBABILITY MODEL OF VECTOR BEHAVIOR: EFFECTS OF DDT AND DELTAMETHRIN REPELLENCY, IRRITANCY, AND TOXICITY IN MALARIA CONTROL	II	746	21/08/00	16:30	CC		15	PS	15
Griepink, F.A. C.	717	FEMALE SEX PHEROMONE OF CASTNIA LICUS (LEPIDOPTERA:CASTNIIDEA): IDENTIFICATION AND FIELD APPLICATION	I	181	24/08/00	16:30	CC		4	PS	4
Grieshop, M. J. D.	799	ASPECTS OF THE ECOLOGY OF THE WHEAT STEM SAWFLY (HYMENOPTERA: CEPHIDAE) IN NORTH AMERICA	I	202	21/08/00	10:05	HB	D	6	1	6
Griffin, R. L.	3921	INTERNATIONAL HARMONIZATION OF PHYTOSANITARY MEASURES	II	990	25/08/00	16:05	HB	H	22	8	22
Griffin, R. L.	3899	THE EFFECT OF ACCELERATED INTERNATIONAL TRADE ON PROSPECTS FOR IPM	II	984	23/08/00	15:05	HB	H	22	5	22
Grignola, C.	368	FRUIT FLY (DIPTERA:TEPHRITIDAE) QUARANTINE PROCEDURES FOR EXPORT OF AVOCADOS FROM ARGENTINA TO CHILE	I	93	25/08/00	16:30	CC		2	PS	2
Grigulis, K.	1154	MODELLING THE POPULATION INTERACTIONS BETWEEN THE CROWN WEEVIL MOGULONES LARVATUS AND ITS HOST PLANT ECHIUM PLANTAGINEUM	I	291	25/08/00	16:30	CC		6	PS	6
Grillet, M. E.	509	BLACK FLIES (DIPTERA: SIMULIIDAE) FROM THE GRAND SAVANNA REGION OF VENEZUELA	I	129	23/08/00	16:30	CC		3	PS	3
Grillet, M. E.	2254	CYTOTAXONOMY AND HOMOSEQUENTIAL SPECIES OF THE SIMULIUM PERFLAVUM SPECIES GROUP (DIPTERA: SIMULIIDAE) FROM BRAZIL AND VENEZUELA	I	569	22/08/00	16:30	CC		12	PS	12
Grilli, M. P.	139	REGIONAL MOVEMENT OF THE PLANTHOPPER, DELPHACODES KUSCHELI, VECTOR OF MAIZE ROUGH DWARF VIRUS IN CENTRAL ARGENTINA	I	36	25/08/00	10:45	HB	A	2	9	2
Grimmelikhuijzen, C. J. P.	2340	REVERSED PHARMACOLOGY IN INSECTS: FINDING NOVEL ORPHAN G PROTEIN-COUPLED RECEPTORS AND THEIR LIGANDS	II	591	21/08/00	10:55	HB	I	13	1	13
Grimmelikhuijzen, C. J. P.	2341	STRATEGIES FOR FINDING NOVEL INSECT NEUROHORMONE RECEPTORS AND THEIR LIGANDS, USING THE POTENTIALS OF THE BERKELEY "DROSOPHILA GENOME PROJECT".	II	591	21/08/00	11:30	HB	I	13	1	13
Grimshaw, J. F.	3937	NORTHERN AUSTRALIA QUARANTINE STRATEGY, AUSTRALIA'S FRONTLINE OF DEFENCE	II	994	21/08/00	16:30	CC		22	PS	22
Gromenko, V. A.	2420	PROTEINASE INHIBITORS IN THE MIDGUT OF THE COCKROACH	II	611	21/08/00	16:30	CC		13	PS	13
Groot, A. T.	591	MULTIPLE MATINGS AND EFFECTS ON FECUNDITY AND ATTRACTION IN LYGOCORIS PABULINUS	I	150	22/08/00	11:50	Bol	S	4	2	4
Groot, P. de	1929	AZADIRACHTIN FROM THE NEEM TREE: AN EFFECTIVE NATURAL PRODUCT FOR FOREST INSECT PEST MANAGEMENT	I	486	22/08/00	16:30	CC		10	PS	10
Grootaert, P.	1912	BEETLES, SPIDERS AND FLIES AS BIO-INDICATORS IN FORESTS: A LARGE SCALE RESEARCH PROJECT IN FLANDERS (BELGIUM)	I	482	21/08/00	16:30	CC		10	PS	10
Grootaert, P.	1977	DEAD WOOD AND BEETLES: A CASE STUDY IN FLANDERS (BELGIUM)	I	498	25/08/00	16:20	HB	M	10	8	10
Grootaert, P.	567	BEETLE DIVERSITY AND FOREST CHARACTERISTICS IN FLANDERS (BELGIUM)	I	143	25/08/00	16:30	CC		3	PS	3
Gross, C. L.	95	INSECT POLLINATION IN AUSTRALIA – CURRENT ISSUES AND DIRECTIONS FOR THE 21ST CENTURY	I	25	22/08/00	11:00	HB	A	2	3	2
Grosser, P. M.	3919	REGULATORY REQUIREMENTS FOR QUARANTINE PESTS: BARRIER TO TRADE OR GOOD BUSINESS PRACTICE?	II	989	25/08/00	15:35	HB	H	22	8	22
Grossi de Sá, M. F.	2063	EFFECTS IN VITRO AND IN VIVO OF SOYBEAN KUNITZ TRYPSIN INHIBITORS AGAINST THE BOOL WEEVIL ANTHONOMUS GRANDIS	I	520	22/08/00	16:30	CC		11	PS	11

Sub-titles: (HB=Hotel Bourbon) - (HM=Hotel Mabu) - (CC=Convention Center) - (Bol=Foz Boulevard) - (PS=Poster Session) - (PL=Plenary Lecturer)

AUTHOR	Nº	TITLE	Book	Page	Date	Time	Local	Room	Session	Symp	New Session
Grossi de Sá, M. F.	2119	CHARACTERIZATION OF THE PROTEOLYTIC ACTIVITY OF ANTHONOMUS GRANDIS AND ISOLATION OF CDNAS ENCODING SERINE AND CYSTEINE PROTEASES	I	534	24/08/00	16:30	CC		11	PS	11
Grossi De Sá, M. F.	2132	CARACTERIZATION OF NEW STRAINS OF BACILLUS THURINGIENSIS TOXIC AGAINST BOLL WEVILL, ANTHONOMUS GRANDIS	I	538	24/08/00	16:30	CC		11	PS	11
Grossi de Sá, M. F.	2152	CLONING AND HETEROLOGOUS EXPRESSION OF A BACILLUS THURINGIENSIS PROTEIN TOXIC AGAINST THE FALL ARMYWORM	I	543	25/08/00	16:30	CC		11	PS	11
Grossi de Sá, M. F.	299	BIONOMY OF THE BOLL WEVILL REARED ON ARTIFICIAL DIET	I	76	24/08/00	16:30	CC		2	PS	2
Grosso, M. L. de	405	SOCIEDAD ENTOMOLÓGICA ARGENTINA AND THE PURSUIT OF ENTOMOLOGY	I	103	23/08/00	10:05	HB	C	3	3	3
Grosso, M. L. de	2978	PHLEBOTOMINAE SAND FLIES IN TUCUMAN, ARGENTINA	II	751	22/08/00	16:30	CC		15	PS	15
Grosso, M. L. de	2988	PHLEBOTOMINAE SAND FLIES AND LEISHMANIASIS IN ARGENTINA	II	754	23/08/00	16:30	CC		15	PS	15
Grostal, P.	1516	DIET OF GENERALIST PREDATOR AFFECTS AVOIDANCE BEHAVIOUR OF PREY	I	382	21/08/00	16:30	CC		8	PS	8
Grout, T. G.	2589	NON-TARGET EFFECTS OF PESTICIDES ON BENEFICIAL INSECTS	II	654	24/08/00	14:50	HB	B	14	7	14
Grube, S.	3498	DETERMINING THE ACTIVITY OF HARVESTER TERMITES IN THE ETOSHA NATIONAL PARK, NAMIBIA	II	883	23/08/00	16:30	CC		19	PS	19
Gruia, M.	907	COMMUNITIES OF SOIL COLLEMBOLA ON THE NORTH AND SOUTH FACING SLOPES OF A MEDITERRANEAN VALLEY	I	229	23/08/00	16:30	CC		6	PS	6
Gruner, D. S.	1923	ARBOREAL ARTHROPOD COMMUNITY STRUCTURE ACROSS FOUR MILLION YEARS OF ECOSYSTEM DEVELOPMENT IN HAWAII	I	485	22/08/00	16:30	CC		10	PS	10
Grützmacher, A. D.	1531	PARASITISM OF EGGS OF APPLE LEAF ROLLER BONAGOTA CRANAODES (LEPIDOPTERA: TORTRICIDAE) BY TRICHOGRAMMA SP. IN FIELD CONDITIONS	I	386	22/08/00	16:30	CC		8	PS	8
Grützmacher, A. D.	2702	STRATEGY OF SEED TREATMENT FOR RATIONALIZATION OF CHEMICAL CONTROL OF ORYZOPHAGUS ORYZAE ON FLOODED RICE	II	682	22/08/00	16:30	CC		14	PS	14
Grützmacher, A. D.	2703	INFLUENCE OF LIBERTY LINK IRRIGATED RICE TECHNOLOGY ON ORYZOPHAGUS ORYZAE (COLEOPTERA: CURCULIONIDAE)	II	683	22/08/00	16:30	CC		14	PS	14
Grützmacher, A. D.	2744	FOLIAR SPRAY STRATEGY FOR RATIONAL CHEMICAL CONTROL OF ORYZOPHAGUS ORYZAE ON FLOODED RICE	II	693	23/08/00	16:30	CC		14	PS	14
Grützmacher, D. D.	521	OCCURENCE OF LEAF-CUTTING ANTS IN DIFFERENT REGIONS OF RIO GRANDE DO SUL STATE	I	132	23/08/00	16:30	CC		3	PS	3
Gu, H.	1542	CONSEQUENCES OF INBREEDING AND HYBRIDIZATION IN THE GREGARIOUS PARASITOID COTESIA GLOMERATA	I	389	22/08/00	16:30	CC		8	PS	8
Gu, H.	947	FLIGHT PERIODICITIES IN MIGRANT MOTHS	I	239	24/08/00	11:45	HB	F	6	3	6
Guajará, M.	1924	DISTRIBUTION OF EUPHALERUS SP (HEMIPTERA: PSYLLIDAE) IN STATE OF RIO DE JANEIRO, BRAZIL	I	485	22/08/00	16:30	CC		10	PS	10
Guajará, M.	1925	THE ASSOCIATED FAUNA COMPOSITION AT THE EUPHALERUS SP (HEMIPTERA:PSYLLIDAE), IN SEROPÉDICA, RJ, BRAZIL	I	485	22/08/00	16:30	CC		10	PS	10
Gualdoni, C. M.	1002	RESPONSES OF AQUATIC INSECTS TO AN ENVIRONMENTAL STRESS GRADIENT	I	253	22/08/00	16:30	CC		6	PS	6
Guaman, I.	291	INSECT PESTS ON MACADAMIANUT TREES IN COLONIA SAN JUAN DE YAPACANI, SANTA CRUZ DISTRICT, BOLIVIA	I	74	23/08/00	16:30	CC		2	PS	2
Guangxue, Z.	2802	THEORY OF MUTUALISTIC PLANT PROTECTION (MPP) AND ITS PRACTICE: MAINLY REGARDING COTTON APHID MANAGEMENT BY SURROUNDING MARGINAL ALFAFA ZONE	II	707	24/08/00	16:30	CC		14	PS	14
Guardia, L.	3816	PHYLOGENETIC STUDIES OF THE SUBFAMILY ERIOPINAE (LEPIDOPTERA: NOCTUIDAE): FIRST RESULTS	II	963	24/08/00	16:30	CC		21	PS	21
Gubler, D. J.	2881	THE INFLUENCE OF URBANIZATION ON VECTOR-BORNE DISEASES.	II	727	22/08/00	9:35	Bol	R	15	3	15
Guedes, J. V. C.	1755	BEHAVIOR OF HEDYPATHES BETULINUS (COL., CERAMBYCIDAE) ON ILEX PARAGUARIENSIS	I	442	21/08/00	16:30	CC		9	PS	9
Guedes, J. V. C.	2704	EFFECTS OF INSECTICIDE THIAMETHOXAM ON STERNECHUS SUBSIGNATUS (COL., CURCULIONIDAE) IN SOYBEAN	II	683	22/08/00	16:30	CC		14	PS	14
Guedes, R. N.	375	STRESS BY SUBLETHAL DOSES OF PYRETHROIDS ON THE DEVELOPMENT, SURVIVAL AND WEIGHT OF SUPPUTIUS CINCTICEPS (HETEROPTERA: PENTATOMIDAE)	I	95	22/08/00	16:30	CC		2	PS	2
Guedes, R. N. C.	180	SUBLETHAL EFFECTS OF ABAMECTIN SUPPRESSING COLONIES OF THE LEAF-CUTTING ANT ACROMYRMEX SUBTERRANEUS SUBTERRANEUS	I	46	21/08/00	16:30	CC		2	PS	2
Guedes, R. N. C.	1401	CARTAP RESISTANCE AND SYNERGISM IN POPULATIONS OF TUTA ABSOLUTA (LEPIDOPTERA: GELECHIIDAE)	I	353	25/08/00	16:30	CC		7	PS	7
Guedes, R. N. C.	1402	INSECTICIDE RESISTANCE IN POPULATIONS OF TUTA ABSOLUTA (LEPIDOPTERA: GELECHIIDAE)	I	354	25/08/00	16:30	CC		7	PS	7
Guedes, R. N. C.	1926	PATTERNS OF SPECIES RICHNESS AND ABUNDANCE OF DEFOLIATOR LEPIDOPTERA ASSOCIATED WITH EUCALYPTUS GRANDIS IN BRAZIL AND HOW THEY RELATE TO PLANT AGE	I	485	22/08/00	16:30	CC		10	PS	10
Guedes, R. N. C.	1232	RESISTANCE AND SYNERGISM TO ORGANOSPHOSPHATE INSECTICIDES IN POPULATIONS OF LEUCOPTERA COFFEELLA (LEPIDOPTERA: LYONETIIDAE)	I	311	21/08/00	16:05	HM	N	7	2	7
Guedes, R. N. C.	1275	RECENT ADVANCES IN PESTICIDE RESISTANCE MANAGEMENT PROGRAMS IN BRAZIL	I	322	25/08/00	13:35	HM	N	7	10	7
Guedes, R. N. C.	4059	STORED GRAIN PESTS RESISTANCE TO PESTICIDES IN BRAZIL: EVOLUTION AND FUTURE	II	1025	25/08/00	11:15	HB	J	23	10	23
Guedes, R. N. C.	998	EFFECT OF CATERPILLARS AND DEFOLIATION IN OVIPOSICION OF PLUTELLA XYLOSTELLA	I	252	22/08/00	16:30	CC		6	PS	6
Guedes, R. N. C.	1398	PATTERNS OF ANSWER OF THE ENTOMOFAUNA OF THE CANOPY OF THE BEAN PLANT TO THE IMIDACLOPRID APPLICATION	I	353	25/08/00	16:30	CC		7	PS	7
Guedes, R. N. C.	1984	EFFECT OF FEEDING ON THREE EUCALYPTUS SPECIES ON THE DEVELOPMENT OF BRONTOCORIS TABIDUS (HET.: PENTATOMIDAE) FED WITH TENEBRIO MOLITOR (COL.: TENEBRIONIDAE)	I	500	25/08/00	16:30	CC		10	PS	10
Guedes, R. N. C.	4079	EFFECT OF THE SPRAYING TEMPERATURE ON THE DEGRADATION AND BIOLOGICAL EFFECTIVENESS OF PIRIMIPHOS-METHYL ON STORED GRAINS	II	1030	22/08/00	16:30	CC		23	PS	23
Guedes, R. N. C.	4108	MODELLING POPULATION GROWTH OF RHYZOPERTHA DOMINICA (COLEOPTERA: BOSTRICHIDAE) ON STORED WHEAT	II	1037	25/08/00	16:30	CC		23	PS	23
Guedes, R. N. C.	710	CONVENTIONAL SAMPLING PLAN FOR VECTORIAL INSECTS OF VIROSES, PREDATORS AND PARASITOIDS IN TOMATO	I	179	24/08/00	16:30	CC		4	PS	4
Guerenstein, P.	583	SENSORY AND BEHAVIOURAL RESPONSES OF TRIATOMINE BUGS TO ODOURS OF VERTEBRATE HOSTS AND TO CONSPECIFIC SEMIOCHEMICALS	I	148	22/08/00	10:05	Bol	S	4	2	4
Guerin, P. M.	2	COLD RECEPTORS ON THE BODY SURFACE OF THE TROPICAL BONT TICK AMBLYOMMA VARIEGATUM	I	1	24/08/00	14:05	HB	F	1	1	1
Guerin, P. M.	583	SENSORY AND BEHAVIOURAL RESPONSES OF TRIATOMINE BUGS TO ODOURS OF VERTEBRATE HOSTS AND TO CONSPECIFIC SEMIOCHEMICALS	I	148	22/08/00	10:05	Bol	S	4	2	4
Guerin, P. M.	2438	RESPONSES OF THE TROPICAL BONT TICK AMBLYOMMA VARIEGATUM TO ITS AGGREGATION-ATTACHMENT-PHEROMONE AND TO HOST ODOUR ON A SERVOSPHERE	II	616	22/08/00	16:30	CC		13	PS	13
Guerino-Matteoni, A. C.	3142	EXOCRINE TEGUMENTARY GLANDS OF BOMBUS MORIO (HYMENOPTERA, APIDAE) FEMALES: A MORPHOLOGICAL STUDY	II	793	22/08/00	16:30	CC		16	PS	16
Guerra, R.	3531	BEHAVIOURAL RESPONSES OF THE HONEY BEE TO ALARM-SCENTS AT THE FOOD SOURCE	II	891	24/08/00	16:30	CC		19	PS	19
Guerra, W. D.	2093	FIELD TRIAL WITH THE ENTOMOPATHOGENIC FUNGUS METARHIZIUM ANISOPLIAE VAR. ACRIDUM AGAINST BANDS OF THE GRASSHOPPER RHAMMATOCERUS SCHISTOCERCOIDES IN BRAZIL	I	528	23/08/00	16:30	CC		11	PS	11
Guerreiro, J. C.	4178	INFLUENCE OF TEMPERATURE ON DEVELOPMENT OF IMMATURE Pentilia egena MULSANT (COLEOPTERA : COCCINELLIDAE)	II	1055	22/08/00	16:30	CC		Erratum	PS	8

Sub-titles: (HB=Hotel Bourbon) - (HM=Hotel Mabu) - (CC=Convention Center) - (Bol=Foz Boulevard) - (PS=Poster Session) - (PL=Plenary Lecturer)

AUTHOR	N°	TITLE	Book	Page	Date	Time	Local	Room	Session	Symp	New Session
Guerrero, F.	2344	DIFFERENTIAL ACTIVATION OF AN INSECT G PROTEIN-COUPLED PEPTIDE RECEPTOR BY INSECTATACHYKININ-LIKE AGONISTS	II	592	21/08/00	14:35	HB	I	13	2	13
Guerrero, J. C. H.	402	ABUNDANCE, DIVERSITY AND SEASONALITY OF ARTHROPODA ASSOCIATED WITH THE SAPOTACEAE AND LECITHIDACEAE TREE CANOPIES AT THE ADOLPHO DUCKE FOREST RESERVE, MANAUS, AMAZONAS, BRAZIL. PRELIMINARY FINDING.	I	102	22/08/00	16:20	HB	C	3	2	3
Guerrieri, E.	1451	HOST SELECTION STRATEGIES BY THE APHID PARASITOID APHIDIUS ERVI	I	366	23/08/00	13:35	HM	O	8	6	8
Guerrieri, E.	1421	APHID-INDUCED PLANT VOLATILES INFLUENCING PARASITOID BEHAVIOUR	I	359	21/08/00	10:35	HM	O	8	1	8
Guerrieri, F. J.	506	FUNCTIONAL BIODIVERSITY AMONGST DIFFERENT MICROSITES IN A PATAGONIAN STEPPE, SOUTHERN ARGENTINA	I	128	23/08/00	16:30	CC		3	PS	3
Guey, C. F.	3198	ANTENNATION AND SEXUALLY DIMORPHIC ANTENNAE OF THE BLISTER BEETLE, EPICAUTA HIRTICONIS	II	807	25/08/00	16:30	CC		16	PS	16
Guglielmino, C. R.	2230	POLYMORPHIC MICROSATELLITE MARKERS TO ASSESS THE GENETIC VARIABILITY IN THE MEDITERRANEAN FRUIT FLY, CERATITIS CAPITATA, SPECIES RANGE	I	563	21/08/00	16:30	CC		12	PS	12
Guillaud, J.	1665	FOOD AND CARCASS ANALYSES OF THE PREDATORY BUG HARMONIA AXYRIDIS (COLEOPTERA: COCCINELLIDAE) AS REFERENCES FOR THE ELABORATION OF ARTIFICIAL DIETS	I	420	25/08/00	16:30	CC		8	PS	8
Guillaud, J.	1536	DEVELOPMENT OF TRICHOGRAMMA PRETIOSUM (HYMENOPTERA: TRICHOGRAMMATIDAE) IN ARTIFICIAL DIET, FOCUSING ON PROTEIN UTILIZATION	I	387	22/08/00	16:30	CC		8	PS	8
Guillet, S.	3331	MULTIPLE PATERNITY, DISPERSAL MODES AND GENETIC STRUCTURE ASSOCIATED WITH DIFFERENT REPRODUCTIVE STRATEGIES IN FORFICULA AURICULARIA (DERMAPTERA)	II	841	22/08/00	16:30	CC		18	PS	18
Guillet, S.	3777	DERMAPTERAN LIFE HISTORY EVOLUTION AND PHYLOGENY WITH SPECIAL REFERENCE TO THE FORFICULIDAE FAMILY	II	953	23/08/00	16:30	CC		21	PS	21
Guilton, M.	2025	VERTICAL TRANSMISSION OF CpGV AND IMPROVEMENTS FOR CONTROL OF CYDIA POMONELLA L., POSSIBLE EXTENSION TO CYDIA SPLENDANA (HÜBNER) IN APPLES, PEARS, WALNUTS AND CHESNUT CROPS	I	511	24/08/00	15:00	HM	P	11	7	11
Guimarães, A. N.	256	PERFORMANCE OF CERATITIS CAPITATA (DIPTERA, TEPHRITIDAE) ON FRUITS: COMPARISON OF TWO LABORATORY POPULATIONS	I	65	23/08/00	16:30	CC		2	PS	2
Guimarães, F. R.	2151	LARVAL PARASITOIDS AND PATHOGENS OF SPODOPTERA FRUGIPERDA (LEPIDOPTERA: NOCTUIDAE) IN FOUR CITIES IN PARAÍBA	I	542	25/08/00	16:30	CC		11	PS	11
Guimarães, J. A.	1764	DOES THE FRUIT SIZE INFLUENCE THE PARASITISM OF FRUGIVOROUS LARVAE BY EUCOILINAE SPECIES?	I	444	22/08/00	16:30	CC		9	PS	8
Guimarães, M. A.	1950	MONITORING OF LEPIDOPTERA DEFOLIATORS OF EUCALYPTUS IN NIQUELÂNDIA, STATE OF GOIÁS, BRAZIL	I	491	23/08/00	16:30	CC		10	PS	10
Guler, N.	1927	CRYPTORHYNCHUS LAPATHI ATTACKING POPLARS IN TURKEY	I	486	22/08/00	16:30	CC		10	PS	10
Gunning, R. V.	1231	ROLE OF ESTERASES IN RESISTANCE TO PYRETHROIDS IN LEPIDOPTERA	I	311	21/08/00	15:35	HM	N	7	2	7
Gunning, R. V.	1332	METABOLIC RESISTANCE TO PYRETHROIDS IN AUSTRALIAN HELICOVERPA SPECIES	I	336	22/08/00	16:30	CC		7	PS	7
Gunning, R. V.	1333	METABOLIC MECHANISM OF RESISTANCE TO IMIDACLOPRID IN BEMISIA TABACI, IN AUSTRALIA	I	336	22/08/00	16:30	CC		7	PS	7
Gunning, R. V.	1312	RESISTANCE MECHANISM TO BUPROFEZIN IN B-TYPE BEMISIA TABACI (HEMIPTERA: ALEYRODIDAE) IN AUSTRALIA	I	331	21/08/00	16:30	CC		7	PS	7
Guo, H.	4048	THE INFORMATION OF URBAN MEDICAL INSECTS MANAGEMENT SYSTEM	II	1022	24/08/00	11:00	HB	J	23	8	23
Guo, H.	1572	HOW THE EFFICIENCY OF A PREDATOR VARIES WITH RICE VARIETY: FORAGING BEHAVIOR, POPULATION INCREASE AND FUNCTIONAL RESPONSE +B201	I	396	23/08/00	16:30	CC		8	PS	8
Guo, T.	3028	THE DISCOVERY OF NATURAL FOCI OF TSUTSUGAMUSHI DISEASE IN SOUTHERN SHANXI PROVINCE, NORTH CHINA, AND ITS ZOO-EPIDEMIOLOGIC FEATURES	II	764	25/08/00	16:30	CC		15	PS	15
Guo, Y.	4048	THE INFORMATION OF URBAN MEDICAL INSECTS MANAGEMENT SYSTEM	II	1022	24/08/00	11:00	HB	J	23	8	23
Guo, Y.	150	MIGRATION AND DIAPAUSE OF HELICOVERPA ARMIGERA IN CHINA	I	39	25/08/00	15:15	HB	A	2	9	2
Guo, Y.	1215	THE CAAS ENTOMOLOGICAL RADAR	I	306	25/08/00	16:30	CC		6	PS	6
Gupta, S. K.	507	EXPLORATION AND DIVERSITY OF INDIAN MITE FAUNA(ACARI) AND INDICATIONS OF UNEXPLORED AREAS FOR FUTURE STUDY	I	128	23/08/00	16:30	CC		3	PS	3
Gupta, S. K.	1543	UPDATING THE KNOWLEDGE OF INDIAN PHYTOSEIID MITES (ACARI) AND HIGHLIGHTING THE POTENTIALLY IMPORTANT INDIGENOUS PREDATORY SPECIES FOR BIOCONTROL PROGRAMME	I	389	22/08/00	16:30	CC		8	PS	8
Gurr, G. M.	154	INTERACTIONS BETWEEN PREDATOR SPECIES, THEIR PREY AND THE HOST PLANT	I	40	26/08/00	10:35	HB	A	2	10	2
Gurr, G. M.	1424	ADDING FLORAL RESOURCES TO AGRO-ECOSYSTEMS: MANAGING THE CONSEQUENCES FOR THIRD AND FOURTH TROPHIC LEVELS	I	359	21/08/00	11:20	HM	O	8	1	8
Gurrea Sanz, M. P.	1914	VARIATIONS IN THE SPECIES COMPOSITION OF CURCULIONOIDEA IN NATURAL AND PLANTED FORESTS OF CENTRAL SPAIN	I	482	21/08/00	16:30	CC		10	PS	10
Gurrea, M. P.	4077	PARSIMONY ANALYSIS OF ENDEMICITY AND ITS APPLICATION TO DETECT HIGH ENDEMISM AREAS USING COMBINED DATA FROM INSECTS, VERTEBRATES, AND PLANTS, FROM THE IBERIAN PENINSULA	II	1029	21/08/00	16:30	CC		23	PS	23
Gurrea, P.	1003	PHENOLOGICAL INTERACTIONS BETWEEN THE WEEVILS EXAPION SPP. AND LEPIDAPION SPP. AND THE GENISTEAE IN CENTRAL SPAIN (SW EUROPE)	I	253	22/08/00	16:30	CC		6	PS	6
Gurrea, P.	3599	AREAS OF HIGH ENDEMICITY IN THE IBERIAN PENINSULA (SOUTH-WEST EUROPE): ESTIMATION OF POPULATIONS OF OTIORHYNCHUS IN THE PYRENEES (SPAIN)	II	908	23/08/00	16:30	CC		20	PS	20
Gürtler, R. E.	2925	A LONGITUDINAL PAIRED TRIAL OF TWO SENSING DEVICES FOR DETECTING PERIDOMESTIC POPULATIONS OF TRIATOMA INFESTANS (HEMIPTERA: REDUVIIDAE) IN RURAL NORTHWESTERN ARGENTINA	II	738	25/08/00	10:50	Bol	R	15	9	15
Gürtler, R. E.	2973	POPULATION DYNAMICS OF TRIATOMA INFESTANS (HEMIPTERA: REDUVIIDAE), VECTOR OF CHAGAS DISEASE, IN EXPERIMENTAL HUTS UNDER NATURAL CLIMATIC CONDITIONS	II	750	22/08/00	16:30	CC		15	PS	15
Gusmão, M. R.	673	ECONOMIC INJURY LEVEL AND SEQUENCIAL SAMPLING FOR BEMISIA TABACI IN TOMATO	I	170	23/08/00	16:30	CC		4	PS	4
Gusmão, M. R.	710	CONVENTIONAL SAMPLING PLAN FOR VECTORIAL INSECTS OF VIROSES, PREDATORS AND PARASITOIDS IN TOMATO	I	179	24/08/00	16:30	CC		4	PS	4
Gusmão, M. R.	1045	EFFECTS OF TRICHOMES AND CRISTALIFEROUS IDIOBLASTS DENSITIES, CONCENTRATIONS OF MINERALS AND WEATHER ON THE BEMISIA ARGENTIFOLII IN TOMATO	I	264	23/08/00	16:30	CC		6	PS	6
Gusukuma Minuto, L.	3977	ESTABLISHING A SUSTAINABLE MANAGEMENT PROGRAM FOR DIAMONDBACK MOTH	II	1004	23/08/00	16:30	CC		22	PS	22
Gut, L.	2552	MANAGEMENT OF CODLING MOTH WITH MASS TRAPPING, ATTRACT AND KILL, AND MATING DISRUPTION	II	645	21/08/00	15:50	HB	B	14	2	14
Gut, L.	2636	MANAGEMENT OF CODLING MOTH WITH MASS TRAPPING, ATTRACT AND KILL, AND MATING DISRUPTION	II	666	21/08/00	16:30	CC		14	PS	14
Gut, L. J.	107	FOUR -YEARS OF FQPA: IPM CHALLENGES FOR THE US APPLE INDUSTRY	I	28	23/08/00	9:55	HB	A	2	5	2
Gut, L. J.	2544	STATUS OF CODLING MOTH MANAGEMENT AND CURRENT CONTROL PROGRAMS: NORTHERN HEMISPHERE	II	643	21/08/00	13:35	HB	B	14	2	14
Gutierrez, A. P.	859	BOTTOM-UP AND TOP-DOWN REGULATION OF INSECT POPULATIONS	I	217	25/08/00	11:20	HB	D	6	7	6
Gutierrez, A. P.	2176	BIO-ECONOMICS OF FITNESS: EXAMINING GOD'S UTILITY FUNCTION	I	549	21/08/00	15:35	HB	L	12	2	12
Gutierrez, A. P.	2574	HOST PLANTS / HERBIVORES / NATURAL ENEMIES: MODELING THE DYNAMICS OF TRITROPHIC INTERACTIONS	II	650	23/08/00	13:30	HB	B	14	5	14
Gutierrez, A. P.	2705	PHYSIOLOGICALLY-BASED TRITROPHIC METAPOPULATION MODELS IN IPM	II	683	22/08/00	16:30	CC		14	PS	14

Sub-titles: (HB=Hotel Bourbon) - (HM=Hotel Mabu) - (CC=Convention Center) - (Bol=Foz Boulevard) - (PS=Poster Session) - (PL=Plenary Lecturer)

AUTHOR	Nº	TITLE	Book	Page	Date	Time	Local	Room	Session	Symp	New Session
H. E. Laurentin	1004	SPATIAL DISTRIBUTION OF INMATURE STAGES OF THE SWEETPOTATO WHITEFLY (BEMISIA TABACI) IN SESAME (SESAMUM INDICUM)	I	253	22/08/00	16:30	CC		6	PS	6
Haack, R. A.	763	THE EXOTIC FOREST PEST INFORMATION SYSTEM FOR NORTH AMERICA	I	193	23/08/00	11:05	Bol	T	5	4	5
Haack, R. A.	1833	THE UNITED STATES RESPONSE TO TWO RECENT INTRODUCTIONS: ANOPLOPHORA GLABRIPENNIS (CERAMBYCIDAE) AND TOMICUS PINIPERDA (SCOLYTIDAE)	I	462	22/08/00	14:05	HB	M	10	3	10
Haack, R. A.	1928	THE EXOTIC FOREST PEST INFORMATION SYSTEM FOR NORTH AMERICA	I	486	22/08/00	16:30	CC		10	PS	5
Haber, W. A.	791	DEVELOPING ELECTRONIC FIELD GUIDES: FIRST RESULTS USING COSTA RICAN BUTTERFLIES AND MASSACHUSETTS AQUATIC MACROINVERTEBRATES	I	200	23/08/00	16:30	CC		5	PS	5
Haber, W. A.	1179	ALTITUDINAL MIGRATIONS OF BUTTERFLIES AND OTHER INSECTS IN NORTHWESTERN COSTA RICA: ECOLOGY AND CONSERVATION	I	297	24/08/00	11:00	HB	F	6	3	6
Habib, M. E. M.	2115	PATHOLOGY AND SUSCEPTIBILITY STUDIES ON URBANUS ACAWOIOS (LEPIDOPTERA: HESPERIIDAE) LARVAE INFECTED BY BACILLUS THURINGIENSIS VAR. KURSTAKI (H-3A:3B)	I	533	24/08/00	16:30	CC		11	PS	11
Habib, M. E. M.	3323	BIOLOGICAL INFORMATIONS ABOUT THE DEVELOPMENT OF URBANUS ACAWOIOS (LEPIDOPTERA: HESPERIIDAE)	II	839	21/08/00	16:30	CC		18	PS	18
Habib, M. E. M.	1005	COMPARATIVE BIOLOGY OF ANAGASTA KUEHNIELLA (LEPIDOPTERA, PYRALIDAE) FED ON THREE DIFFERENT DIETS BASED ON WHEAT GRAINS	I	254	22/08/00	16:30	CC		6	PS	6
Habib, M. E. M.	916	EFFECT OF LARVAL DIETS ON THE SENSIVITY OF ANAGASTA KUEHNIELLA (LEPIDOPTERA, PYRALIDAE) TO MICROWAVES RADIATION (2.450 MHz)	I	231	21/08/00	16:30	CC		6	PS	6
Habib, M. E. M.	3954	TOLERANCE OF BRACON HEBETOR (HYMENOPTERA: BRACONIDAE) TO MICROWAVE RADIATION (2450 MHz).	II	998	22/08/00	16:30	CC		22	PS	22
Habiba, D. B.	4062	LABORATORY AND FIELD STUDIES ON LARVAL CONTROL OF CULEX QUINQUEFASCIATUS MOSQUITOES INHABITING URBAN AND SUBURBAN DHAKA, BANGLADESH	II	1026	22/08/00	16:30	CC		23	PS	23
Habibe, T. C.	3244	EXPERIMENTAL TRANSMISSION OF "STICKY DISEASE" OF PAPAYA BY BEMISIA ARGENTIFOLLI	II	819	25/08/00	16:30	CC		17	PS	17
Habibi, J.	3332	INGESTION AND DIGESTION OF GREEN FLUORESCENT PROTEIN BY THE WESTERN TARNISHED PLANT BUG, LYGUS HESPERUS	II	841	22/08/00	16:30	CC		18	PS	18
Haddad, M. L.	2763	DETERMINATION OF THE OPTIMAL AND UPPER THRESHOLD OF TEMPERATURE FOR THE DEVELOPMENT OF SELENASPIDUS ARTICULATUS IN CITRUS	II	698	23/08/00	16:30	CC		14	PS	14
Haeusler, R.	1976	DEADWOOD IN COMMERCIAL FORESTS: A SOURCE OF INCREASED BIODIVERSITY AND OF OUTBREAKS OF PEST SPECIES?	I	498	25/08/00	16:30	CC		10	PS	10
Haeusler, R.	4078	HUMIDITY PREFERENCE AND WATER LOSS IN LARVAE OF THE BROWN HOUSE MOTH (HOFMANNOPHILA PSEUDOSPRETELLA)	II	1030	22/08/00	16:30	CC		23	PS	23
Hafez, S. M.	1520	RESPONSE OF THE PREDACIOUS MITE, AMBLYSEIUS CYDNODACTYLON TO INCREASING PREY DENSITY OF THE TWO SPOTTED SPIDER MITE, TETRANYCHUS URTICAE IN ABSENCE OR PRESENCE OF NYMPHS OF TOBACCO WHITE FLY, BEMESIA TABACI (ACARI: PHYTOSEIIDAE)	I	383	21/08/00	16:30	CC		8	PS	8
Hagstrum, D. W.	4039	STORED GRAIN ADVISOR PRO: A DECISION SUPPORT SYSTEM FOR INSECT MANAGEMENT IN COMMERCIAL GRAIN STORES	II	1020	23/08/00	14:45	HB	J	23	7	23
Haile, A. T.	1544	SURVEY FOR NATIVE TRICHOGRAMMATID SPECIES IN KENYA	I	389	22/08/00	16:30	CC		8	PS	8
Haile, A. T.	1660	EFFECT OF NEEM PRODUCTS APPLIED AS SPRAYS TO PARASITISED HOST EGGS ON ADULT EMERGENCE AND LONGEVITY OF TRICHOGRAMMA SP. NR. MWANZAI	I	418	25/08/00	16:30	CC		8	PS	8
Hails, R. S.	2074	PHENOTYPIC VARIATION BETWEEN GENOTYPIC VARIANTS OF A NUCLEOPOLYHEDROVIRUS INFECTING PINE BEAUTY MOTH, PANOLIS FLAMMEA	I	523	23/08/00	16:30	CC		11	PS	11
Hails, R. S.	2289	SEX-BIASED PARASITISM IN INSECTS	I	578	23/08/00	16:30	CC		12	PS	12
Hails, R. S.	2414	HERITABILITY OF IMMUNE FUNCTION IN THE CATERPILLAR, SPODOPTERA LITTORALIS	II	610	21/08/00	16:30	CC		13	PS	13
Hails, R. S.	2164	COPING WITH CROWDS: THE EVOLUTION OF DENSITY-DEPENDENT RESISTANCE TO PATHOGENS	I	546	25/08/00	16:30	CC		11	PS	11
Hajek, A. E.	2050	REMARKABLE PHYSIOLOGICAL VARIATION AMONG ISOLATES OF THE MITE PATHOGENIC FUNGUS NEOZYGITES FLORIDANA: NUTRITIONAL REQUIREMENTS AND CRYOPRESERVATION	I	517	21/08/00	16:30	CC		11	PS	11
Haji, F. N. P.	2626	INTEGRATED MANAGEMENT OF THE APHID, APHIS GOSSYPII, IN INDIAN CHERRY TREE, IN IRRIGATED AREAS OF THE SÃO FRANCISCO VALLEY	II	663	22/08/00	16:30	CC		14	PS	14
Haji, F. N. P.	1294	EFFECT OF CHEMICAL CONTROL OF BEMISIA ARGENTIFOLII (HEMIPTERA: ALEYRODIDAE) ON THE INCIDENCE OF BEAN GOLDEN MOSAIC VIRUS IN COMMON BEANS AND ITS YIELD	I	327	21/08/00	16:30	CC		7	PS	7
Hajnická, V.	34	INTERACTION OF TICK SALIVA WITH THE HOST IMMUNE MECHANISMS AND ITS SIGNIFICANCE FOR PATHOGEN TRANSMISSION	I	9	22/08/00	16:30	CC		1	PS	1
Hakim, R. S.	3250	TESTIS ECDYSIOTROPIN, AN INSECT GONADOTROPIN THAT INDUCES SYNTHESIS OF ECDYSTEROID	II	821	21/08/00	9:50	HB	K	18	1	18
Halbert, N. R.	3647	MITOCHONDRIAL AND NUCLEAR DNA PHYLOGENETIC ANALYSIS OF STREPSIPTERA	II	921	23/08/00	14:05	HB	E	21	5	21
Halffter, G.	415	INDICATOR GROUPS FOR BIODIVERSITY ASSESSMENT: RESULTS AND PERSPECTIVES OF A STRATEGY.	I	105	23/08/00	14:50	HB	C	3	4	3
Halfpapp, K. H.	663	AN INTUITIVE APPROACH TO SELECTING UTILIZABLE ATTRACTANTS FOR A GENERAL FRUIT-FEEDING PEST: THE FRUITPIERCING MOTH EXPERIENCE	I	168	22/08/00	16:30	CC		4	PS	4
Hall, F. R.	3888	CURRENT STATUS OF BIOPESTICIDES	II	981	23/08/00	9:30	HB	H	22	4	22
Hall, G.	602	MOLECULAR STUDIES ON THE ENDOCRINE REGULATION AND TISSUE LOCALIZATION OF DE NOVO MONOTERPENOID PHEROMONE COMPONENT BIOSYNTHESIS IN PINE BARK BEETLES	I	152	23/08/00	11:25	Bol	S	4	4	4
Hall, J. C.	2339	PEPTIDERGIC OUTPUT OF THE CIRCADIAN CLOCK IN DROSOPHILA.	II	591	21/08/00	10:10	HB	I	13	1	13
Hall, M. J.	757	REAL ENTOMOLOGY ON COMPUTER: USING MULTIMEDIA TO TEACH PRACTICAL SKILLS	I	191	22/08/00	14:35	Bol	T	5	3	5
Hall, M. J.	1765	GOING WALKABOUT: MOVEMENTS OF INDIVIDUAL ADULTS IN A BREEDING POPULATION OF THE SPECKLED BUSHCRICKET, LEPTOPHYES PUNCTATISSIMA	I	445	22/08/00	16:30	CC		9	PS	9
Hall, R. B.	1859	DEPLOYMENT OF TREE RESISTANCE TO INSECTS IN SHORT- ROTATION BIOMASS PLANTATIONS	I	469	24/08/00	14:05	HB	M	10	6	10
Hall, R. D.	2956	SCIENTIFIC UNCERTAINTY VERSUS SPECULATION: FREQUENTLY ATTACKED WEAKNESSES OF FORENSIC ENTOMOLOGY EVIDENCE	II	746	26/08/00	15:30	Bol	R	15	11	15
Hallman, G. J.	403	LATIN AMERICAN ENTOMOLOGICAL SOCIETIES AT THE DAWN OF A NEW CENTURY—A TIME FOR INVENTORY.	I	102	23/08/00	9:35	HB	C	3	3	3
Hallman, G. J.	508	ENTOMOLOGICAL SOCIETIES IN LATIN AMERICA	I	129	23/08/00	16:30	CC		3	PS	3
Hallman, G. J.	3911	IONIZING RADIATION FOR POSTHARVEST PEST MANAGEMENT	II	987	24/08/00	15:30	HB	H	22	6	22
Hallman, G. J.	3925	TOWARD A STANDARD, INTERNATIONAL PROTOCOL FOR RESEARCH TO SURMOUNT QUARANTINE BARRIERS.	II	991	26/08/00	10:00	HB	H	22	8	22
Hamacher, L. S.	4079	EFFECT OF THE SPRAYING TEMPERATURE ON THE DEGRADATION AND BIOLOGICAL EFFECTIVENESS OF PIRIMIPHOS-METHYL ON STORED GRAINS	II	1030	22/08/00	16:30	CC		23	PS	23
Hamada, N.	509	BLACK FLIES (DIPTERA: SIMULIIDAE) FROM THE GRAND SAVANNA REGION OF VENEZUELA	I	129	23/08/00	16:30	CC		3	PS	3
Hamada, N.	510	BLACK FLIES (DIPTERA: SIMULIIDAE) OF FRENCH GUIANA: A PRELIMINARY LIST OVER 50 YEARS AFTER FLOCH AND ABONNENC.	I	129	23/08/00	16:30	CC		3	PS	3

Sub-titles: (HB=Hotel Bourbon) - (HM=Hotel Mabu) - (CC=Convention Center) - (Bol=Foz Boulevard) - (PS=Poster Session) - (PL=Plenary Lecturer)

AUTHOR	Nº	TITLE	Book	Page	Date	Time	Local	Room	Session	Symp	New Session
Hamada, N.	2254	CYTOTAXONOMY AND HOMOSEQUENTIAL SPECIES OF THE SIMULIUM PERFLAVUM SPECIES GROUP (DIPTERA: SIMULIIDAE) FROM BRAZIL AND VENEZUELA	I	569	22/08/00	16:30	CC		12	PS	12
Hamada, N.	2059	OCCURRENCE OF CULICIDAE (DIPTERA) LARVAE IN WATER HELD IN AQUASCYPHA HYDROPHORA (FUNGUS:STEREACEAE) IN CENTRAL AMAZON, BRAZIL	I	519	23/08/00	16:30	CC		11	PS	11
Hamada, N.	1127	TRICHOMYCETES FUNGI (ZYGOMYCOTINA) ASSOCIATED WITH THE DIGESTIVE TRACTS OF BLACK FLY LARVAE (DIPTERA: SIMULIIDAE) IN CENTRAL AMAZONIA, BRAZIL	I	284	24/08/00	16:30	CC		6	PS	6
Hamaguchi, K.	3499	SYMPATRIC AND INTRASPECIFIC QUEEN-SIZE DIMORPHISM ASSOCIATED WITH QUEEN DISPERSAL STRATEGY OF JAPANESE ANT, LEPTOTHORAX SPINOSIOR	II	883	23/08/00	16:30	CC		19	PS	19
Hamard, C.	3956	A BIOTECNICAL METHOD FOR THE CONTROL OF THE OLIVE FLY IN ORGANIC ORCHARDS	II	998	22/08/00	16:30	CC		22	PS	22
Hamilton, G. C.	511	SPATIAL MAPPING OF TWO PEST POPULATIONS IN NEW JERSEY SWEET CORN	I	129	23/08/00	16:30	CC		3	PS	3
Hamilton, G. C.	2071	A COMPARISON OF CARABID SPECIES IN FOUR VEGETATION TYPES	I	522	22/08/00	16:30	CC		11	PS	11
Hammack, T. S.	2911	THE ROLE OF FLIES AS VECTORS OF SALMONELLA IN EGG FARM LAYER HOUSES	II	735	24/08/00	10:50	Bol	R	15	7	15
Hammond, P.	433	COLEOPTERA	I	110	25/08/00	9:35	HB	C	3	7	3
Hammond, P.	402	ABUNDANCE, DIVERSITY AND SEASONALITY OF ARTHROPODA ASSOCIATED WITH THE SAPOTACEAE AND LECITHIDACEAE TREE CANOPIES AT THE ADOLPHO DUCKE FOREST RESERVE, MANAUS, AMAZONAS, BRAZIL. PRELIMINARY FINDING.	I	102	22/08/00	16:20	HB	C	3	2	3
Hammond, P. M.	2330	A MOLECULAR PHYLOGENY OF COLEOPTERA FROM 18S rRNA SEQUENCES	I	588	25/08/00	16:30	CC		12	PS	12
Han, H.	1432	IN VITRO REARING OF TRICHOGRAMMA OSTRINIAE PANG ET CHENS	I	361	21/08/00	15:05	HM	O	8	2	8
Han, K. S.	641	TRIALS OF CONTROLLING LEPIDOPTERAN PESTS WITH SEX PHEROMONES IN KOREAN APPLE AND PEAR ORCHARDS	I	162	21/08/00	16:30	CC		4	PS	4
Han, K. S.	3872	TRIALS OF CONTROLLING LEPIDOPTERAN PESTS WITH SEX PHEROMONES IN KOREAN APPLE AND PEAR ORCHARDS	II	977	21/08/00	11:05	HB	H	22	1	22
Han, S.	1545	AN EDIBLE ALGINATE FORMULATION OF STEINERNEMA CARPOCAPSAE – ITS INSECTICIDAL EFFECT AND MOISTURE-HOLDING PROPERTIES	I	390	22/08/00	16:30	CC		8	PS	8
Han, S.-J.	2269	GRAM-NEGATIVE BACTERIA BINDING PROTEIN, A PATTERN RECOGNITION RECEPTOR FOR LIPOPOLYSACCHARIDE AND b-1,3-GLUCAN, WHICH MEDIATES THE SIGNALING FOR THE INDUCTION OF INNATE IMMUNE GENES IN DROSOPHILA MELANOGASTER CELLS	I	573	22/08/00	16:30	CC		12	PS	12
Han, S-J	2358	GENOMIC STRUCTURE AND ECDYSONE REGULATION OF THE PROPHENOLOXIDASE 1 GENE IN THE MALARIA VECTOR ANOPHELES GAMBIAE	II	596	23/08/00	14:20	HB	I	13	5	13
Hanan, J.	819	MODELLING OF INSECT MOVEMENT AND RELATED BEHAVIOUR IN 3D SPACE: NEW TOOLS, OLD QUESTIONS, BETTER SOLUTIONS?	I	207	22/08/00	11:50	HB	D	6	3	6
Hanan, J. S.	750	SIMULATION OF INSECT MOVEMENT WITH RESPECT TO PLANT ARCHITECTURE AND MORPHOGENESIS	I	189	21/08/00	13:50	Bol	T	5	1	5
Hanan, J. S.	2600	PLANT ARCHITECTURE AND IPM: PROGRESS IN DEVELOPING 'VIRTUAL RICE'	II	657	25/08/00	14:00	HB	B	14	8	14
Hance, T.	3600	OVERWINTERING STRATEGY OF APHIDIUS ERVI (HYMENOPTERA: APHIDIIDAE)	II	908	23/08/00	16:30	CC		20	PS	20
Handel, K.	3074	DORSOVENTRAL PATTERNING IN TRIBOLIUM CASTANEUM	II	776	24/08/00	14:30	HB	G	16	6	16
Handler, A. M.	2219	FRUIT FLY TRANSFORMATION WITH PIGGYBAC: PERSPECTIVES AND CONSIDERATIONS	I	560	25/08/00	14:35	HB	L	12	10	12
Hanks, L. M.	1890	BIOLOGICAL CONTROL OF COLEOPTERAN PESTS OF EUCALYPTUS IN CALIFORNIA	I	476	26/08/00	14:35	HB	M	10	10	10
Hanks, L. M.	1891	DIFFERENTIAL PARASITISM BY AN EGG PARASITOID, AVETIANELLA LONGOI, OF TWO PHORACANTHA SPP. ATTACKING EUCALYPTUS	I	477	26/08/00	14:50	HB	M	10	10	10
Hanna, R.	38	EFFECTS OF CASSAVA CULTIVAR ON ABUNDANCE OF EXOTIC PHYTOSEIID MITES IN AFRICA	I	10	22/08/00	16:30	CC		1	PS	1
Hanna, R.	134	INTEGRATED MANAGEMENT OF SPIDER MITES IN CALIFORNIA VINEYARDS	I	35	24/08/00	15:10	HB	A	2	8	2
Hanna, R.	8	DISPERSAL AND SPREAD OF EXOTIC PHYTOSEIIDS IN AFRICA	I	2	22/08/00	9:55	Bol	U	1	2	1
Hanne, C.	393	MODELLING THE ROLE OF TERMITES IN THE CARBON CYCLE OF NEOTROPICAL FORESTS	I	100	22/08/00	13:50	HB	C	3	2	3
Hanrahan, S.A.	1006	EL NINO, LA NINA AND BROWN LOCUST PLAGUES	I	254	22/08/00	16:30	CC		6	PS	6
Hansen, J.	2554	POSTHARVEST CONTROL OF CODLING MOTH: CHALLENGES AND RECENT ADVANCES	II	645	21/08/00	16:20	HB	B	14	2	14
Hansen, J.	2766	POSTHARVEST CONTROL OF CODLING MOTH: CHALLENGES AND RECENT ADVANCES	II	698	24/08/00	16:30	CC		14	PS	14
Hansen, L. C.	1242	NON-TARGET EFFECTS OF TRANSGENIC INSECTICIDAL CORN – THE MONARCH AND BEYOND	I	314	23/08/00	10:05	HM	N	7	5	7
Hansen, L. S.	3957	TRICHOGRAMMA TURKESTANICA, A CANDIDATE FOR BIOLOGICAL CONTROL OF EPHESTIA KUEHNIELLA IN FLOUR MILLS	II	999	22/08/00	16:30	CC		22	PS	22
Hansen, M. H. H.	2255	HOST GENETICS AND THE CONTROL OF LIFE HISTORY TRAITS IN THE YELLOW FEVER MOSQUITO AEDES AEGYPTI INFECTED WITH NOSEMA ALGERAE MICROSPORIDIA	I	569	22/08/00	16:30	CC		12	PS	12
Hansen, O.	4006	FLEAS (SIPHONAPTERA) – BIOLOGY AND CONTROL	II	1012	21/08/00	11:15	HB	J	23	1	23
Hanson, P. E.	4121	THE DIVERSITY OF THE CHRYSOMELIDAE FAUNA IN COSTA RICA: INSIGHTS FROM A MALAISE TRAPLINE	II	1041	25/08/00	10:00	HM	P	24	2	24
Hansson, B.	712	BEHAVIOURAL AND ELECTROPHYSIOLOGICAL RESPONSES OF SILVER Y MOTH, AUTOGRAPHA GAMMA (LEPIDOPTERA: NOCTUIDAE), TO FLORAL VOLATILES	I	180	24/08/00	16:30	CC		4	PS	4
Hansson, B. S.	2405	THE ANTENNAL LOBE – A FUNCTIONAL OLFACTORY MAP IN NEURAL SPACE?	II	608	21/08/00	16:30	CC		13	PS	13
Hansson, B. S.	3130	THE SUBOESOPHAGEAL GANGLION MODULATES THE OUTPUT INFORMATION IN THE MOTHS OLFACTORY CONDITIONIG	II	790	22/08/00	16:30	CC		16	PS	4
Harada, A. Y.	396	HYMENOPTERA OF LOWER AMAZONIA: WILL THIS BE THE CENTURY WHEN WE GET IT TOGETHER?	I	101	22/08/00	14:35	HB	C	3	2	3
Harada, A. Y.	397	COMPARATIVE ANT SPECIES DIVERSITIES IN INTACT AND LOGGED AMAZONIAN RAINFORESTS	I	101	22/08/00	14:50	HB	C	3	2	3
Harada, A. Y.	1032	COMPARATIVE ANT SPECIES DIVERSITIES IN INTACT AND LOGGED AMAZONIAN RAINFORESTS	I	260	23/08/00	16:30	CC		6	PS	6
Harada, T.	2439	HARDINESS TO LOW OR HIGH TEMPERATURE AND DRYING-OUT IN A WATER STRIDER, AQUARIUS PALUDUM AND A SUBSPECIES, A. P. AMAMIENSIS	II	616	22/08/00	16:30	CC		13	PS	13
Harada, T.	3571	LIFE HISTORY AND EGG DIAPAUSE OF A WATER STRIDER, METROCORIS HISTORIO B.WHITE	II	901	23/08/00	11:05	Bol	U	20	1	20
Hardie, D. C.	3989	RESPONSE OF TRANSGENIC PEAS CONTAINING A SEED SPECIFIC ALPHA-AMYLASE INHIBITOR GENE TO HEAT AND WATER STRESSES	II	1007	24/08/00	16:30	CC		22	PS	22
Hardie, J.	748	VIDEO ANALYSIS OF APHID FLIGHT BEHAVIOUR.	I	189	21/08/00	11:35	Bol	T	5	1	5
Hardie, J.	3307	THE PHOTOPERIODIC RESPONSE IN APHIDS	II	835	25/08/00	10:05	HB	K	18	8	18
Haris, A.	802	SAWFLIES IN EUROPE:DAMAGE AND CONTROL STRATEGIES	I	203	21/08/00	10:50	HB	D	6	1	6
Harjes, P.	3073	BICOID AS A PHYLOGENETIC ADDITION TO THE INSECT BODY PLAN	II	775	24/08/00	14:00	HB	G	16	6	16
Harman, I. T.	784	INVESTIGATING THE WINGBEAT SIGNALS OF MIGRATING INSECTS USING AN INSECT MONITORING RADAR	I	198	21/08/00	16:30	CC		5	PS	5
Harman, I. T.	744	AUTOMATICALLY OPERATING RADARS FOR MONITORING INSECT PEST MIGRATIONS	I	188	21/08/00	9:55	Bol	T	5	1	5
Harper, M. S.	2388	LEPIDOPTERAN PERITROPHIC MEMBRANE STRUCTURE AND EFFECTS OF WHEAT GERM AGGLUTININ ON FORMATION	II	603	26/08/00	10:05	HB	I	13	10	13
Harrell, R. A.	2219	FRUIT FLY TRANSFORMATION WITH PIGGYBAC: PERSPECTIVES AND CONSIDERATIONS	I	560	25/08/00	14:35	HB	L	12	10	12

Sub-titles: (HB=Hotel Bourbon) - (HM=Hotel Mabu) - (CC=Convention Center) - (Bol=Foz Boulevard) - (PS=Poster Session) - (PL=Plenary Lecturer)

AUTHOR	Nº	TITLE	Book	Page	Date	Time	Local	Room	Session	Symp	New Session
Harren, F. J. M.	3086	ACTOGRAPHIC RESPIROMETRY REVEALS THE STRATEGIES OF SPIRACULAR CONTROL OF GAS EXCHANGE IN INSECTS	II	779	25/08/00	14:05	HB	G	16	8	16
Harrington, L. C.	2888	FITNESS ADVANTAGE FOR YELLOW FEVER MOSQUITOES (AEDES AEGYPTI) THAT FEED ON HUMAN BLOOD	II	729	22/08/00	14:05	Bol	R	15	4	15
Harrington, R.	137	A EUROPE-WIDE NETWORK FOR MONITORING FLYING APHIDS 'EXAMINE': ACHIEVEMENTS AND PROSPECTS	I	35	25/08/00	10:05	HB	A	2	9	2
Harrington, R.	3896	THE EFFECT OF CLIMATE CHANGE ON PESTS AND INTEGRATED PEST MANAGEMENT.	II	983	23/08/00	13:35	HB	H	22	5	22
Harrington, R.	147	STUDIES OF APHID MIGRATION USING MICROSATELLITE MARKERS	I	38	25/08/00	14:15	HB	A	2	9	2
Harris , M.	683	EFFECT OF WHEAT INFESTED BY LARVAE OF THE HESSIAN FLY, MAYETIOLA DESTRUCTOR, ON OVIPOSITION BEHAVIOR OF THE HESSIAN FLY FEMALES	I	173	23/08/00	16:30	CC		4	PS	4
Harris, E.	1661	FRUIT FLY BIOLOGICAL CONTROL IN LATIN AMERICA: MINIMIZING THE RISKS POSED BY TEPHRITIDAE IN MEXICO AND CENTRAL AMERICA	I	419	25/08/00	16:30	CC		8	PS	8
Harris, M.	2733	BIOLOGY OF SWEET POTATO WHITEFLY, (HOMOPTERA: ALEYRODIDAE) ON TRANSGENIC TOBACCO AND INTERACTIONS WITH A PARASITE	II	690	23/08/00	16:30	CC		14	PS	14
Harris, M. O.	3335	REPRODUCTIVE POTENTIAL AND RHYTHMS OF THE BLACK-LYRE LEAFROLLER CNEPHASIA JACTATANA (LEPIDOPTERA: TORTRICIDAE), AN IMPORTANT PEST OF KIWIFRUIT IN NEW ZEALAND	II	842	22/08/00	16:30	CC		18	PS	18
Harrison, J. F.	2451	EFFECTS OF ONTOGENY ON THE OXYGEN SENSITIVITY OF JUMPING PERFORMANCE IN THE AMERICAN LOCUST (SCHISTOCERCA AMERICANA)	II	619	23/08/00	16:30	CC		13	PS	13
Harrison, J. F.	3062	FLIGHT RESPIRATION AND ENERGETICS	II	773	23/08/00	14:35	HB	G	16	5	16
Harrison, J. F.	3085	BODY SIZE AND TRACHEAL FUNCTION IN GRASSHOPPERS	II	778	25/08/00	13:35	HB	G	16	8	16
Harrison, J. F.	2437	RESPIRATORY CHANGES THROUGHOUT ONTOGENY IN THE AMERICAN LOCUST, SCHISTOCERCA AMERICANA	II	616	22/08/00	16:30	CC		13	PS	13
Harrison, J. F.	2533	COMPARISON OF ACCLIMATORY AND EVOLUTIONARY CHANGES IN PHYSIOLOGY OF WATER-STRESSED LARVAL MANDUCA SEXTA	II	640	25/08/00	16:30	CC		13	PS	13
Harrison, J. F.	3133	INTERACTION OF OXYGEN TENSION AND TEMPERATURE ON INSECT DEVELOPMENT	II	790	22/08/00	16:30	CC		16	PS	16
Harrison, J. F.	3518	GENETIC MECHANISMS CONTRIBUTING TO DIFFERENCES IN COLONY GROWTH RATES BETWEEN AFRICAN AND EUROPEAN HONEY BEES	II	888	23/08/00	16:30	CC		19	PS	19
Harrison, R. L.	2072	THE USE OF PROTEASES TO ENHANCE THE INSECTICIDAL POTENTIAL OF BACULOVIRUSES	I	523	22/08/00	16:30	CC		11	PS	11
Hart, E. R.	1859	DEPLOYMENT OF TREE RESISTANCE TO INSECTS IN SHORT- ROTATION BIOMASS PLANTATIONS	I	469	24/08/00	14:05	HB	M	10	6	10
Harter, B.	398	HOW FAR NORTH AND SOUTH DOES THE APIFAUNA OF AMAZONIA REACH, ESPECIALLY THE BEE SPECIES VISITING MASS-FLOWERING TREES	I	101	22/08/00	15:05	HB	C	3	2	3
Hartfelder, K.	2440	CASTE-SPECIFIC DIFFERENCES IN ECDYSTEROID TITERS IN EARLY LARVAL STAGES OF THE BUMBLE BEE BOMBUS TERRESTRIS	II	616	22/08/00	16:30	CC		13	PS	13
Hartfelder, K.	2187	DIFFERENTIAL DISPLAY PCR REVEALS ECDYSTEROID-RESPONSIVE GENES IN THE OVARY OF HONEY BEE WORKER LARVAE	I	552	22/08/00	15:35	HB	L	12	4	12
Hartfelder, K.	3032	A HIGH JUVENILE HORMONE TITER IS REQUIRED FOR ORGANIZING THE ACTIN CYTOSKELETON AND PREVENTING CELL DEATH IN LARVAL OVARIES OF THE HONEY BEE, APIS MELLIFERA	II	765	21/08/00	10:15	HB	G	16	1	16
Hartley, S. E.	1867	ECOLOGY AND MANAGEMENT OF DEFOLIATING PESTS OF CONIFERS IN NORTHERN BRITAIN	I	471	25/08/00	9:35	HB	M	10	7	10
Hartman, D.	1326	EFFECTS OF TRANSGENIC HYBRID MAIZE ON ADULT WESTERN CORN ROOTWORM EMERGENCE AND ROOT RATINGS	I	335	22/08/00	16:30	CC		7	PS	7
Hartmann, T.	4130	CHEMICAL DEFENSE IN NEOTROPICAL LEAF BEETLES	II	1043	25/08/00	14:40	HM	P	24	2	24
Hartung, J.	3224	TRANSMISSION OF CITRUS PATHOGENS FOREIGN TO THE U.S. BY ARTHROPODS ENDEMIC TO THE U.S. CONDUCTED UNDER HIGH QUARANTINE CONTAINMENT	II	814	22/08/00	16:30	CC		17	PS	17
Harvey, J. A.	1007	ADAPTIVE CASTE MANIPULATION BY A POLEMBRYONIC PARASITOID WASP	I	254	22/08/00	16:30	CC		6	PS	6
Harvey, J. A.	1118	LINKING MULTITROPHIC INTERACTIONS ABOVE-BELOWGROUND	I	282	24/08/00	16:30	CC		6	PS	6
Harvey, J. A.	3068	REGULATION OF CASTE FATE IN POLYEMBRYONIC WASPS	II	774	24/08/00	10:30	HB	G	16	6	16
Harvey, J. A.	2412	REGULATION OF CASTE FATE IN POLYEMBRYONIC WASPS	II	609	21/08/00	16:30	CC		13	PS	13
Harvey, T. L.	3883	MOLECULAR MARKERS IN WHEAT LINKED TO GENES EXPRESSING RESISTANCE TO THE GREENBUG AND THE RUSSIAN WHEAT APHID	II	980	22/08/00	13:35	HB	H	22	3	22
Harvey, T. L.	1334	EFFECT OF WHEAT CURL MITE SOURCES ON TRANSMISSION OF HIGH PLAINS VIRUS	I	337	22/08/00	16:30	CC		7	PS	7
Hasegawa, T.	3265	RECENT PROGRESS IN THE TRANSGENESIS OF SILKWORM, BOMBYX MORI AND APPLICATION TO THE GENOME PROJECT	II	825	22/08/00	10:35	HB	K	18	2	18
Hashido, K.	3167	ISOLATION AND COMPARISON OF MARINER-LIKE SEQUENCES (MLSS) AMONG SOME LEPIDOPTERAN INSECTS AND INVERTEBRATES	II	799	24/08/00	16:30	CC		16	PS	16
Hashido, K.	3264	RELATIONSHIPS BETWEEN THE LOCATION AND THE RADIATION SENSITIVITY OF RETROTRANSPOSONS IN THE GENOME AND THE INSERTION MECHANISM	II	824	22/08/00	10:20	HB	K	18	2	18
Hashimoto, S.	3565	ADHESIVE STRENGTH OF THE GLUE SUBSTANCES IN THE COLLETERIAL GLANDS OF THE JAPANESE WILD SILKMOTHS	II	899	22/08/00	16:30	CC		19	PS	19
Hashimoto, S.	3789	MOLECULAR PHYLOGENY OF THE JAPANESE AND NEW ZEALAND MICROPTERIGIDAE (LEPIDOPTERA) BASED ON MITOCHONDRIAL GENE SEQUENCES	II	956	23/08/00	16:30	CC		21	PS	21
Hashimoto, Y.	2222	INSECT TRANSGENESIS: BACULOVIRUSES MEET TRANSPOSONS FOR BENEFICIAL INVASIONS	I	561	25/08/00	16:05	HB	L	12	10	12
Haskell, N. H.	2943	TESTING RELIABILITY OF ANIMAL MODELS IN FORENSIC ENTOMOLOGY WITH 50-200 LB. PIGS VS. HUMANS IN TENNESSEE	II	743	26/08/00	10:35	Bol	R	15	11	15
Hassell, M. P.	1493	APPARENT COMPETITION MEDIATED VIA INSECT PARASITOIDS IN HETEROGENEOUS ENVIRONMENTS	I	377	21/08/00	16:30	CC		8	PS	8
Hassell, R. L.	350	WHITEFLIES (HOMOPTERA: ALEYRODIDAE) ON SPECIES OF MEDICINAL HERBAL PLANTS	I	89	25/08/00	16:30	CC		2	PS	2
Hatadani, L. M.	2198	MORPHOLOGICAL CORRELATES OF CHROMOSOME INVERSION GENOTYPES	I	555	23/08/00	14:35	HB	L	12	6	12
Hatakeyama, M.	3380	CLONING OF VITELLOGENIN cDNA OF PERIPLANETA AMERICANA AND ITS STYRUCTURE AND EXPRESSION	II	853	25/08/00	16:30	CC		18	PS	18
Hatcher, P. E.	850	INTERACTIONS BETWEEN ABOVE- AND BELOW-GROUND FUNGAL ENDOPHYTES: EFFECTS ON A LEPIDOPTERAN HERBIVORE	I	215	24/08/00	11:05	HB	D	6	6	6
Hatle, J. D.	1142	A SURVEY OF FECAL FIRING AND HOUSECLEANING IN LEPIDOPTERAN CATERPILLARS	I	288	24/08/00	16:30	CC		6	PS	6
Hatnukade, M.	2706	CONTROL EFFECTS TO THRIPS AND APHIDS USING FOAMED SURFACTANT ON FLOWERS AND VEGETABLES IN GREENHOUSE	II	683	22/08/00	16:30	CC		14	PS	14
Hatnukade, M.	2073	FACTOR ANALYSIS OF SYNERGISTIC EFFECTS BETWEEN ENTOMOPATHOGENIC FUNGUS, METARHIZIUM ANISOPLIAE AND SYNTHETIC INSECTICIDES TO SCRAB GRUBS	I	523	22/08/00	16:30	CC		11	PS	11
Hatnukade, M.	2166	THE SPECIFICITY ANALYZE OF ENTOMOPATHOGENIC FUNGUS BEAUVERIA BRONGNIARTII	I	546	25/08/00	16:30	CC		11	PS	11
Hatta, Y.	291	INSECT PESTS ON MACADAMIANUT TREES IN COLONIA SAN JUAN DE YAPACANI, SANTA CRUZ DISTRICT, BOLIVIA	I	74	23/08/00	16:30	CC		2	PS	2
Hatungh, V.	2589	NON-TARGET EFFECTS OF PESTICIDES ON BENEFICIAL INSECTS	II	654	24/08/00	14:50	HB	B	14	7	14
Hatungh, V.	1461	AUGMENTATION OF PARASITOIDS FOR CONTROL OF CITRUS PESTS IN SOUTHERNFRICA	I	369	22/08/00	10:35	HM	O	8	3	8
Hattori, M.	3419	USE OF SILKWORMS AS THERAPY FOR PERSONS WITH SENILE DEMENTIA	II	863	22/08/00	14:45	HM	Q	19	3	19
Hattori, M.	2504	THE GENOME ORGANIZATION OF BUCHNERA, AN INTRACELLULAR BACTERIAL SYMBIONT OF APHIDS	II	632	24/08/00	16:30	CC		13	PS	13

Sub-titles: (HB=Hotel Bourbon) - (HM=Hotel Mabu) - (CC=Convention Center) - (Bol=Foz Boulevard) - (PS=Poster Session) - (PL=Plenary Lecturer)

AUTHOR	N°	TITLE	Book	Page	Date	Time	Local	Room	Session	Symp	New Session
Haugen, D.	1823	INTRODUCTION AND RELEASE OF RHISSINES TO CONTROL SIREX NOCTILIO IN BRAZIL	I	460	22/08/00	9:35	HB	M	10	2	10
Haughton, A.	1245	UK FIELD-SCALE TRIALS OF GM HERBICIDE TOLERANT CROPS TO DETECT THE ENVIRONMENTAL EFFECTS ON INVERTEBRATE ABUNDANCE AND BIODIVERSITY	I	314	23/08/00	10:50	HM	N	7	5	7
Hauser, C. L.	3697	BUTTERFLIES (PAPILIONOIDEA): NOT ALL CHARACTERS ARE EQUAL	II	933	26/08/00	11:05	HB	E	21	9	21
Hauser, C. L.	776	DEVELOPING AND SHARING DATA GLOBALLY: THE 'GLOBAL BUTTERFLY INFORMATION SYSTEM' – GLOBIS	I	196	24/08/00	14:00	Bol	T	5	5	5
Hauser, F.	2340	REVERSED PHARMACOLOGY IN INSECTS: FINDING NOVEL ORPHAN G PROTEIN-COUPLED RECEPTORS AND THEIR LIGANDS	II	591	21/08/00	10:55	HB	I	13	I	13
Havryluk, J. C.	881	EFFECTS OF DIFFERENT DATES OF SOWING ON COMMON BEAN CULTIVATED ON TILLED AND NON-TILLED SOIL MANAGEMENT SYSTEMS ON THE SEASONAL OCCURRENCY OF PESTS IN PONTA GROSSA-PR	I	223	22/08/00	16:30	CC		6	PS	6
Hawes, C.	1245	UK FIELD-SCALE TRIALS OF GM HERBICIDE TOLERANT CROPS TO DETECT THE ENVIRONMENTAL EFFECTS ON INVERTEBRATE ABUNDANCE AND BIODIVERSITY	I	314	23/08/00	10:50	HM	N	7	5	7
Hawkes, N. J.	1335	ANALYSIS OF THE PROMOTERS OF THE • ESTERASE GENES ASSOCIATED WITH ORGANOPHOSPHATE-RESISTANCE AND –SUSCEPTIBILITY IN TWO STRAINS OF CULEX QUINQUEFASCIATUS	I	337	22/08/00	16:30	CC		7	PS	7
Hawkins, B. A.	1008	TOP-DOWN AND BOTTOM-UP CONTROL OF INSECT POPULATIONS: INTRODUCTION TO THE PROBLEM	I	254	22/08/00	16:30	CC		6	PS	6
Hawley, W. A.	2905	MICROEPIDEMIOLOGY OF MALARIA IN WESTERN KENYA	II	733	23/08/00	15:35	Bol	R	15	6	15
Hawthorne, D.	2233	GENETIC MARKERS IN CONGENERIC HERBIVORES: FINE-SCALE POPULATION STRUCTURE	I	564	21/08/00	16:30	CC		12	PS	12
Hayashi, N.	706	SUITABILITY OF SEVERAL RUTACEOUS PLANTS FOR A PAPILIONID BUTTERFLY, PAPILIO POLYTES	I	178	24/08/00	16:30	CC		4	PS	4
Hazelton, S. R.	2441	MEMBRANE DYNAMICS OF RAPID FLUID TRANSPORT IN THE MALPIGHIAN TUBULES OF THE HOUSE CRICKET, ACHETA DOMESTICUS	II	617	22/08/00	16:30	CC		13	PS	13
Hazelton, S. R.	2511	EXCRETION IN THE HOUSE CRICKET, ACHETA DOMESTICUS: EFFECTS OF SECRETAGOGUES ON MALPIGHIAN TUBULE ELECTROPHYSIOLOGY AND SECRETION RATE	II	634	25/08/00	16:30	CC		13	PS	13
He, J. H.	1505	THE OCCURRENCE OF LEAFMINERS AND THEIR PARASITOIDS ON VEGETABLE CROPS AND WEEDS IN SOUTHEAST CHINA	I	380	21/08/00	16:30	CC		8	PS	8
Headrick, H.	2086	DEVELOPMENT OF ENTOMOPATHOGENIC NEMATODES FOR CONTROL OF OVERWINTERING CODLING MOTH LARVAE	I	526	23/08/00	16:30	CC		11	PS	11
Heard, M.	1245	UK FIELD-SCALE TRIALS OF GM HERBICIDE TOLERANT CROPS TO DETECT THE ENVIRONMENTAL EFFECTS ON INVERTEBRATE ABUNDANCE AND BIODIVERSITY	I	314	23/08/00	10:50	HM	N	7	5	7
Hearfield, M.	17	HOUSE DUST MITE (DERMATOPHAGOIDES PTERONYSSINUS) MORTALITY IN OCCUPIED BEDS AND HEATED AND UNHEATED CARPET	I	5	21/08/00	16:30	CC		1	PS	1
Heath, M. A.	2256	EXPLORING THE MITOCHONDRIAL GENOME OF ANASTREPHA SUSPENSA	I	569	22/08/00	16:30	CC		12	PS	12
Heath, R. R.	90	OBTAINING INTERNATIONAL CONSENSUS AND APPROVAL ON DETECTION TRAPPING EQUIPMENT, PROTOCOLS, AND PROCEDURES	I	24	21/08/00	15:35	HB	A	2	2	2
Heath, R. R.	613	FIELD EVALUATION OF FEMALE TARGETED TRAPPING SYSTEMS FOR DETECTION AND USE IN POPULATION SUPPRESSION/ERADICATION OF CERATITIS CAPITATA (DIPTERA: TEPHRITIDAE)	I	155	24/08/00	13:30	Bol	S	4	6	4
Heather, N.	3925	TOWARD A STANDARD, INTERNATIONAL PROTOCOL FOR RESEARCH TO SURMOUNT QUARANTINE BARRIERS.	II	991	26/08/00	10:00	HB	H	22	8	22
Hebling, M. J. A.	2122	PIPERONYL DERIVATES BASED ON SESAMIN AND THEIR INHIBITION OF THE SYMBIOTIC FUNGUS OF LEAF-CUTTING ANTS	I	535	24/08/00	16:30	CC		11	PS	11
Hebling, M. J. A.	2149	ENZYME PRODUCTION BY THE FUNGUS SYMBIOTIC WITH THE ANT MYCETAROTES PARALLELUS	I	542	25/08/00	16:30	CC		11	PS	11
Hebling, M. J. A.	3547	OBSERVATIONS ON BROOD CARE BEHAVIOR OF THE LEAF-CUTTING ANT ATTA SEXDENS (HYMENOPTERA: FORMICIDAE)	II	895	25/08/00	16:30	CC		19	PS	19
Hebling, M. J. A.	3433	GROWTH INHIBITION OF THE SYMBIOTIC FUNGUS OF ATTA SEXDENS, BY NATURAL PRODUCTS AND SYNTHETIC COMPOUNDS	II	867	23/08/00	11:35	HM	Q	19	4	19
Hebling, M. J. A.	728	POLYSACCHARIDASES IN NESTS OF THE LEAF-CUTTING ANT ATTA SEXDENS	I	184	25/08/00	16:30	CC		4	PS	4
Heckel, D. G.	1262	RESISTANCE IN DIAMONDBACK MOTH: LESSONS FROM THE HELIOTHINES	I	319	24/08/00	14:35	HM	N	7	8	7
Heckel, D. G.	3263	LINKING LEPIDOPTERAN GENOMES WITH ANCHOR LOCI	II	824	22/08/00	10:05	HB	K	18	2	18
Heddi, A.	1540	STABILITY OF THE WOLBACHIA TRANSFER FROM TRICHOGRAMMA PRETIOSUM TO T. DENDROLIMI	I	388	22/08/00	16:30	CC		8	PS	8
Hédouin, V.	2400	IMMUNOHISTOCHEMICAL CONTRIBUTION TO THE STUDY OF MORPHINE METABOLISM IN CALLIPHORIDAE LARVAE AND IMPLICATIONS IN FORENSIC ENTOMOTOXICOLOGY	II	606	21/08/00	16:30	CC		13	PS	13
Hédouin, V.	2401	MORPHINE EXTRACTION IN NECROPHAGOUS INSECTS REMAINS FOR DETERMINING ANTE-MORTEM OPIATE INTOXICATION	II	607	21/08/00	16:30	CC		13	PS	13
Hefetz, A.	2440	CASTE-SPECIFIC DIFFERENCES IN ECDYSTEROID TITERS IN EARLY LARVAL STAGES OF THE BUMBLE BEE BOMBUS TERRESTRIS	II	616	22/08/00	16:30	CC		13	PS	13
Heidger, C. M.	1862	POSSIBILITIES TO UTILIZE TREE RESISTANCE TO INSECTS IN FOREST PEST MANAGEMENT IN CENTRAL AND WESTERN EUROPE	I	469	24/08/00	15:05	HB	M	10	6	10
Heifetz, Y.	3300	CONTROL OF DROSOPHILA REPRODUCTION BY MALE-DERIVED PROTEINS IN THE SEMINAL FLUID	II	833	25/08/00	13:35	HB	K	18	7	18
Heimoana, S. C.	2858	IPM AND EARLY PEST DAMAGE IN COTTON; HOW TO SUCCEED BY DOING NOTHING	II	721	25/08/00	16:30	CC		14	PS	14
Hein, G. L.	1009	DISPERSAL OF AN ERIOPHYID MITE, THE WHEAT CURL MITE, AND ITS IMORTANCE IN DISEASE EPIDEMIOLOGY.	I	255	22/08/00	16:30	CC		6	PS	6
Heinemann, M. B.	3794	INVESTIGATION OF THE VALIDITY OF SPECIES STATUS OF IXODES DIDELPHIDIS (ACARI: IXODIDAE) USING THE SECOND INTERNAL TRANSCRIBED SPACER (ITS2) OF RIBOSOMAL DNA	II	958	23/08/00	16:30	CC		21	PS	21
Heinrichs, E. A.	2569	IPM PROGRAMS FOR RICE	II	649	22/08/00	15:35	HB	B	14	4	14
Heinrichs, E. A.	2607	MANAGING HETEROPTERAN PESTS OF RICE IN THE TROPICS	II	659	26/08/00	11:35	HB	B	14	9	14
Heinrichs, E. A.	2707	PLANT RESISTANCE TO INSECTS IN GLOBAL IPM PROGRAMS	II	684	22/08/00	16:30	CC		14	PS	14
Heinz, K. M.	1462	THE INFLUENCES OF SPATIAL AND TEMPORAL DYNAMICS OF HOST-PARASITOID INTERACTIONS ON APHID BIOLOGICAL CONTROL	I	369	24/08/00	10:35	HM	O	8	7	8
Heinz, K. M.	1546	IMPLEMENTING AN ECOLOGICAL PERSPECTIVE OF HOST-NATURAL ENEMY INTERACTIONS TO AUGMENTATION BIOLOGICAL CONTROL.	I	390	22/08/00	16:30	CC		8	PS	8
Heinz, K. M.	823	INTERSPECIFIC INTERACTIONS AMONG PARASITOIDS IN AGROECOSYSTEMS	I	208	22/08/00	15:35	HB	D	6	4	6
Heinze, J.	1709	FIGHT OR FLIGHT? - ALTERNATIVE REPRODUCTIVE TACTICS IN CARDIOCONDYLA ANTS	I	431	21/08/00	10:55	HB	F	9	I	9
Heirman, A.	1403	SIGNIFICANCE OF UPTAKE AND BINDING IN LEPIDOPTERA AND COLEOPTERA ON TOXICITY OF DIBENZOYLHYDRAZINE ECDYSONE AGONISTS	I	354	25/08/00	16:30	CC		7	PS	7
Helander, M.	848	ENDOPHYTIC FUNGI, HOST PLANT GENOTYPE AND INSECT HERBIVORES	I	214	24/08/00	10:05	HB	D	6	6	6
Held, D. W.	714	HABITUATION OF JAPANESE BEETLES (COLEOPTERA: SCARABAEIDAE) TO AZADIRACHTIN APPLIED AS A FEEDING DETERRENT	I	180	24/08/00	16:30	CC		4	PS	4
Heller, K. G.	1728	DUETTING IN PHANEROPTERID BUSH-CRICKETS	I	435	22/08/00	14:45	HB	F	9	3	9
Hellmich II, R. L.	911	DISPERSAL OF EUROPEAN AND SOUTHWESTERN CORN BORER MOTHS WITHIN AND BETWEEN CORNFIELDS	I	230	21/08/00	16:30	CC		6	PS	6

Sub-titles: (HB=Hotel Bourbon) - (HM=Hotel Mabu) - (CC=Convention Center) - (Bol=Foz Boulevard) - (PS=Poster Session) - (PL=Plenary Lecturer)

AUTHOR	N°	TITLE	Book	Page	Date	Time	Local	Room	Session	Symp	New Session
Hellmich R. L.	252	DEVELOPING PRACTICAL RECOMMENDATIONS FOR MANAGING INSECT RESISTANCE TO BT TRANSGENIC MAIZE	I	64	23/08/00	16:30	CC		2	PS	2
Hellmich R. L.	1286	DEVELOPING PRACTICAL RECOMMENDATIONS FOR MANAGING INSECT RESISTANCE TO BT TRANSGENIC MAIZE	I	325	26/08/00	9:35	HM	N	7	11	7
Hellmich, R. L.	1250	NORTH AMERICAN CORN	I	316	23/08/00	14:35	HM	N	7	6	7
Hellrigl, K.	1010	DISTRIBUTION OF THE HORSE-CHESTNUT LEAFMINER, CAMERARIA OHRIDELLA (LEPIDOPTERA, GRACILLARIIDAE) IN THE REGION SOUTH-TYROL – TRENTINO (NORTH EASTERN ITALY)	I	255	22/08/00	16:30	CC		6	PS	6
Helson, B.	1929	AZADIRACHTIN FROM THE NEEM TREE: AN EFFECTIVE NATURAL PRODUCT FOR FOREST INSECT PEST MANAGEMENT	I	486	22/08/00	16:30	CC		10	PS	10
Helson, B. V.	1857	THE BIOCHEMICAL MECHANISM FOR THE RESISTANCE OF RED MAPLE TREES TO FOREST TENT CATERPILLAR FEEDING	I	468	24/08/00	11:50	HB	M	10	5	10
Helversen, D. von	1726	MATE SAMPLING STRATEGIES AND MATE CHOICE IN THE ORTHOPTERA: IMPLICATIONS OF NEUROETHOLOGICAL STUDIES	I	435	22/08/00	14:15	HB	F	9	3	9
Helversen, O. V.	1727	THE FUNCTION OF COURTSHIP IN GRASSHOPPERS RELATED TO CHORTHIPPUS ALBOMARGINATUS (ORTHOPTERA: GOMPHOCERINAE)	I	435	22/08/00	14:30	HB	F	9	3	9
Helversen, O. von	1726	MATE SAMPLING STRATEGIES AND MATE CHOICE IN THE ORTHOPTERA: IMPLICATIONS OF NEUROETHOLOGICAL STUDIES	I	435	22/08/00	14:15	HB	F	9	3	9
Hemingway J.	1376	DDT- AND ORGANOPHOSPHATE-RESISTANCE IN ANOPHELES GAMBIAE MEDIATED BY GLUTATHIONE S-TRANSFERASE GENES	I	347	24/08/00	16:30	CC		7	PS	7
Hemingway, J.	3012	A THREE-YEAR FIELD EVALUATION OF THE IMPACT OF ROTATIONS AND MOSAIC AS RESISTANCE MANAGEMENT STRATEGIES IN ANOPHELES ALBIMANUS IN SOUTHERN MEXICO	II	760	24/08/00	16:30	CC		15	PS	15
Hemingway, J.	351	MOLECULAR CHARACTERISATION AND QUANTITATION OF THE AMPLIFIED CARBOXYLESTERASE GENE ASSOCIATED WITH ORGANOPHOSPHORUS INSECTICIDE RESISTANCE IN THE BROWN PLANTHOPPER, NILAPARVATA LUGENS	I	89	25/08/00	16:30	CC		2	PS	2
Hemingway, J.	1281	INSECTICIDE RESISTANCE MANAGEMENT APPLICATION TO THE CONTROL OF MALARIA VECTORS	I	323	25/08/00	15:20	HM	N	7	10	7
Hemingway, J.	2999	COMPARISON OF VECTORIAL CAPACITY IN INSECTICIDE RESISTANT AND SUSCEPTIBLE CULEX QUINQUEFASCIATUS FROM FILARIASIS ENDEMIC SRI LANKAN FIELD POPULATIONS	II	757	23/08/00	16:30	CC		15	PS	15
Hemingway, J.	1335	ANALYSIS OF THE PROMOTERS OF THE • ESTERASE GENES ASSOCIATED WITH ORGANOPHOSPHATE-RESISTANCE AND –SUSCEPTIBILITY IN TWO STRAINS OF CULEX QUINQUEFASCIATUS	I	337	22/08/00	16:30	CC		7	PS	7
Hemingway, J.	1381	RESISTANCE MECHANISMS IN ANOPHELES ALBIMANUS DURING A LARGE-SCALE FIELD TRIAL USING A SINGLE INSECTICIDE, ROTATION AND MOSAIC STRATEGIES IN MEXICO	I	348	24/08/00	16:30	CC		7	PS	7
Hemingway, J.	1387	GENETIC MAPPING OF LOCI AFFECTING RESISTANCE TO INSECTICIDES IN ANOPHELES GAMBIAE	I	350	24/08/00	16:30	CC		7	PS	7
Hemingway, J.	1311	CHARACTERISATION OF AMPLIFIED ALDEHYDE OXIDASES FROM INSECTICIDE RESISTANT CULEX QUINQUEFASCIATUS	I	331	21/08/00	16:30	CC		7	PS	7
Henderson, G.	2094	EFFECTS OF VETIVER OIL AND ITS CONSTITUENTS ON COPTOTERMES FORMOSANUS AND ITS SYMBIOTIC FAUNA	I	528	23/08/00	16:30	CC		11	PS	11
Hendrichs, J.	2223	THE INTEGRATED AREA-WIDE APPROACH TO INSECT PEST MANAGEMENT, PROSPECTS FOR ITS APPLICATION TO TSETSE	I	561	25/08/00	9:35	HB	L	12	11	12
Hendrichs, J.	613	FIELD EVALUATION OF FEMALE TARGETED TRAPPING SYSTEMS FOR DETECTION AND USE IN POPULATION SUPPRESSION/ERADICATION OF CERATITIS CAPITATA (DIPTERA: TEPHRITIDAE)	I	155	24/08/00	13:30	Bol	S	4	6	4
Hendrickx, F.	470	RESPONSES OF COLLEMBOLA COMMUNITIES TO LEAD SHOT DEPOSITIONS IN A HEATHLAND ENVIRONMENT	I	119	21/08/00	16:30	CC		3	PS	3
Hendrickx, F.	1903	FOREST SOIL CLASSIFICATION BASED ON COLLEMBOLA FAUNA	I	480	22/08/00	16:30	CC		10	PS	10
Heng-Moss, T. M.	2442	CHARACTERIZATION OF PROTEIN CHANGES IN BUFFALOGRASSES CHALLENGED BY CHINCH BUG FEEDING	II	617	22/08/00	16:30	CC		13	PS	13
Henneberry, T. J.	103	INTERNATIONAL AND NATIONAL RESEARCH PROGRAMS FOR THE DEVELOPMENT OF BEMISIA IPM SYSTEMS	I	27	22/08/00	15:00	HB	A	2	4	2
Henneberry, T. J.	2555	HISTORY AND CURRENT STATUS OF BEMISIA	II	646	22/08/00	9:50	HB	B	14	3	14
Henriques, A. L.	400	THE AMAZONIAN TABANIDAE AND PIPUNCULIDAE (DIPTERA)	I	102	22/08/00	15:50	HB	C	3	2	3
Henriques, A. L.	969	DAILY AND SEASONAL ACTIVITY OF HORSE FLIES (DIPTERA:TABANIDAE) ATTACKING REPTILES: CAIMAN CROCODILUS (ALLIGATORIDAE) AND EUNECTES MURINUS (BOIDAE), IN AN ANTHROPOGENIC CLEARING IN CENTRAL AMAZON, BRAZIL	I	245	22/08/00	16:30	CC		6	PS	6
Henry, T. J.	3632	PHYLOGENY OF THE NEW WORLD PLANT BUG TRIBE CERATOCAPSINI (HETEROPTERA: MIRIDAE: ORTHOTYLINAE)	II	917	22/08/00	10:50	HB	E	21	3	21
Hens, K.	3261	ANGIOTENSIN CONVERTING ENZYME-LIKE ACTIVITY IN THE FLESHFLY NEOBELLIERIA BULLATA	II	824	21/08/00	16:15	HB	K	18	1	18
Heong, K. L.	2205	MIGRATION OF RICE PESTS IN ASIA: GENETICS AND GIS	I	557	24/08/00	11:35	HB	L	12	7	12
Heong, K. L.	2594	OPPORTUNITIES FOR INTEGRATION IN RICE PEST MANAGEMENT RESEARCH	II	655	25/08/00	9:35	HB	B	14	8	14
Hepperle, C.	2187	DIFFERENTIAL DISPLAY PCR REVEALS ECDYSTEROID-RESPONSIVE GENES IN THE OVARY OF HONEY BEE WORKER LARVAE	I	552	22/08/00	15:35	HB	L	12	4	12
Hérard, F.	3916	ASSESSING HOST RANGE OF A GYPSY MOTH PARASITOID: APHANTORHAPHOPSIS SAMARENSIS (DIPTERA: TACHINIDAE)	II	988	25/08/00	14:00	HB	H	22	7	22
Herbert Jr, D. A.	1011	SOUTHERN CORN ROOTWORM: BIOLOGY AND MANAGEMENT IN PEANUT	I	255	22/08/00	16:30	CC		6	PS	6
Herms, D. A.	1860	HORTICULTURAL STRATEGIES FOR DEPLOYMENT OF TREE RESISTANCE TO INSECTS	I	469	24/08/00	14:20	HB	M	10	6	10
Hernández, C.	2077	A PAECILOMYCES FUMOSOROSEUS MUTANT OVERPRODUCING CHITINASE DISPLAYS HIGH VIRULENCE AGAINST BEMISIA TABACI	I	524	22/08/00	16:30	CC		11	PS	11
Hernández, E.	20	FUNCTIONAL RESPONSE OF THE PREDACEOUS, EUSEIUS HIBISCI ON IMMATURE STAGES OF TWO-SPOTTED SPIDER MITE, TETRANYCHUS URTICAE	I	5	21/08/00	16:30	CC		1	PS	1
Hernández, L. M.	394	PATTERNS OF TERMITE DIVERSITY ACROSS RECENTLY ISOLATED LAND-BRIDGE ISLANDS IN FRENCH GUIANA	I	100	22/08/00	14:05	HB	C	3	2	3
Hernández-García, M.	1547	POSSIBILITIES FOR THE USE OF ENCARSIA HISPIDA DE SANTIS (HYMENOPTERA: APHELINIDAE) IN THE BIOLOGICAL CONTROL OF THE SPIRALLING WHITEFLIES ALEURODICUS DISPERSUS RUSSELL AND LECANOIDEUS FLOCCISSIMUS MARTIN ET AL. (HEMIPTERA: ALEYRODIDAE)	I	390	23/08/00	16:30	CC		8	PS	8
Hernández-Luna, C.	2077	A PAECILOMYCES FUMOSOROSEUS MUTANT OVERPRODUCING CHITINASE DISPLAYS HIGH VIRULENCE AGAINST BEMISIA TABACI	I	524	22/08/00	16:30	CC		11	PS	11
Hernández-Suárez, E.	1547	POSSIBILITIES FOR THE USE OF ENCARSIA HISPIDA DE SANTIS (HYMENOPTERA: APHELINIDAE) IN THE BIOLOGICAL CONTROL OF THE SPIRALLING WHITEFLIES ALEURODICUS DISPERSUS RUSSELL AND LECANOIDEUS FLOCCISSIMUS MARTIN ET AL. (HEMIPTERA: ALEYRODIDAE)	I	390	23/08/00	16:30	CC		8	PS	8
Hernández-Suárez, E.	253	CURRENT STUDIES ON THE WHITEFLY FAUNA (HOMOPTERA: ALEYRODIDAE) OF THE CANARY ISLANDS (SPAIN)	I	64	22/08/00	16:30	CC		2	PS	2

Sub-titles: (HB=Hotel Bourbon) - (HM=Hotel Mabu) - (CC=Convention Center) - (Bol=Foz Boulevard) - (PS=Poster Session) - (PL=Plenary Lecturer)

AUTHOR	Nº	TITLE	Book	Page	Date	Time	Local	Room	Session	Symp	New Session
Hernández-Torres, I.	2077	A PAECILOMYCES FUMOSOROSEUS MUTANT OVERPRODUCING CHITINASE DISPLAYS HIGH VIRULENCE AGAINST BEMISIA TABACI	I	524	22/08/00	16:30	CC		11	PS	11
Herren, H. R.	3898	THE EFFECT OF CHANGES IN LAND-USE ON IPM	II	984	23/08/00	14:35	HB	H	22	5	22
Herrera, P.	3236	DELPHACID PLANTHOPPERS AND THE "MAL DE RIO CUARTO" IN MAIZE IN THE NORTH OF ARGENTINA (INSECTA - FULGOROMORPHA)	II	817	23/08/00	16:30	CC		17	PS	17
Herrera, P. S.	563	PRESENCE OF DIURAPHIS NOXIA (HOMOPTERA: APHIDIDAE) COLONIZING BARLEY CROPS IN THE CENTRAL AREA OF THE PROVINCE OF CÓRDOBA (ARGENTINA)	I	142	25/08/00	16:30	CC		3	PS	3
Herrmann, J.	4030	EFFICACY OF CONTROLLED ATMOSPHERES ON CIMEX LECTULARIUS (HET., CIMICIDAE) AND ARGAS REFLEXUS (ACARI, ARGASIDAE)	II	1018	23/08/00	10:00	HB	J	23	6	23
Herzog, D. C.	3958	USE OF TROPICAL AND TRANSGENIC BACILLUS THURINGIENSIS CORN HYBRIDS IN SOUTHEASTERN UNITED STATES GRAIN AND SILAGE PRODUCTION SYSTEMS	II	999	22/08/00	16:30	CC		22	PS	22
Heterick, B. E.	3410	INFLUENCE OF ARGENTINE AND COASTAL BROWN ANT (HYMENOPTERA: FORMICIDAE) INVASIONS ON RICHNESS AND SPECIES COMPOSITION OF ANTS IN GARDENS IN PERTH, AUSTRALIA	II	861	22/08/00	11:05	HM	Q	19	2	19
Hetz, S. K.	3089	SPIRACULAR CONTROL OF ENDOTRACHEAL OXYGEN PARTIAL PRESSURE IN MOTH PUPAE	II	779	25/08/00	15:35	HB	G	16	8	16
Heuvel, J.F.J.M. van den	3212	CHAPERONIN CAMOUFLAGE: AN INTRIGUING PHENOMENON IN THE TRANSMISSION OF LUTEOVIRUSES BY APHIDS	II	811	22/08/00	14:00	Bol	U	17	2	17
Hewson, R. T.	2805	AVENTIS CONTRIBUTION TO INTEGRATED CROP MANAGEMENT (ICM)	II	708	24/08/00	16:30	CC		14	PS	14
Heyer, K.	2168	MICROBIAL CONTROL OF IXODES SCAPULARIS	I	547	25/08/00	16:30	CC		11	PS	11
Hickling, R.	943	INFERRING ACTIVITIES AND POPULATION DENSITY FROM INCIDENTAL SOILBORNE SOUNDS OF WHITE GRUBS	I	238	21/08/00	16:30	CC		6	PS	6
Hicks, B. J.	1867	ECOLOGY AND MANAGEMENT OF DEFOLIATING PESTS OF CONIFERS IN NORTHERN BRITAIN	I	471	25/08/00	9:35	HB	M	10	7	10
Higa, R. V. C.	1960	CTENARYTAINA EUCALYPTI (HEMIPTERA, PSYLLIDAE) HOST EVALUATION	I	494	24/08/00	16:30	CC		10	PS	10
Higaki, M.	1548	DEVELOPMENTAL BIOLOGY OF GYMNOSOMA ROTUNDATA (DIPTERA: TACHINIDAE) PARASITIZING BROWN-WINGED GREEN BUG (HETEROPTERA: PENTATOMIDAE) AND ITS EFFECTS ON REPRODUCTION OF THE HOST	I	390	22/08/00	16:30	CC		8	PS	8
Higby, B.	2539	AREAWIDE MANAGEMENT OF LEPIDOPTEROUS PESTS IN PERENNIAL CROPPING SYSTEMS: OPPORTUNITIES AND CONSTRAINTS	II	642	21/08/00	9:35	HB	B	14	1	14
Higgins, R. A.	254	SOYBEAN STEM BORER IN KANSAS: LIFE HISTORY, SAMPLING, AND SEVERITY OF RECENT INFESTATIONS	I	65	23/08/00	16:30	CC		2	PS	2
Higgins, R. A.	252	DEVELOPING PRACTICAL RECOMMENDATIONS FOR MANAGING INSECT RESISTANCE TO BT TRANSGENIC MAIZE	I	64	23/08/00	16:30	CC		2	PS	2
Higgins, R. A.	1286	DEVELOPING PRACTICAL RECOMMENDATIONS FOR MANAGING INSECT RESISTANCE TO BT TRANSGENIC MAIZE	I	325	26/08/00	9:35	HM	N	7	11	7
Higgins, R. A.	911	DISPERSAL OF EUROPEAN AND SOUTHWESTERN CORN BORER MOTHS WITHIN AND BETWEEN CORNFIELDS	I	230	21/08/00	16:30	CC		6	PS	6
Higgins, T. J. V.	3989	RESPONSE OF TRANSGENIC PEAS CONTAINING A SEED SPECIFIC ALPHA-AMYLASE INHIBITOR GENE TO HEAT AND WATER STRESSES	II	1007	24/08/00	16:30	CC		22	PS	22
Higgs, S.	2354	THE ROLE OF INNATE IMMUNE PEPTIDES TO REDUCE PARASITE DEVELOPMENT IN AEDES AEGYPTI	II	595	23/08/00	11:05	HB	I	13	4	13
Hightower, A.	2905	MICROEPIDEMIOLOGY OF MALARIA IN WESTERN KENYA	II	733	23/08/00	15:35	Bol	R	15	6	15
Higley, L. G.	2611	MANAGING HETEROPTERAN PESTS: FROM THEORY TO PRACTICAL IMPLEMENTATION	II	660	26/08/00	15:00	HB	B	14	9	14
Higley, L. G.	1340	OSTRINIA NUBILALIS ADULT MOVEMENT AND RESISTANCE MANAGEMENT	I	338	22/08/00	16:30	CC		7	PS	7
Higuchi, H.	588	A PHEROMONE COMPONENT OF THE BEAN BUG, RIPTORTUS CLAVATUS, ATTRACTS AN EGG PARASITOID, OOENCYRTUS NEZARAE	I	149	22/08/00	11:05	Bol	S	4	2	4
Hilário, S. D.	972	NECTAR AND POLLEN COLLECTION PATTERNS OF MELIPONA BICOLOR BICOLOR (HYMENOPTERA, APIDAE, MELIPONINAE)	I	245	22/08/00	16:30	CC		6	PS	6
Hilário, S. D.	1012	CIRCADIAN RHYTHMS ON NECTAR AND POLLEN COLLECTION BY FORAGERS OF MELIPONA BICOLOR BICOLOR (HYMENOPTERA, APIDAE, MELIPONINAE)	I	255	22/08/00	16:30	CC		6	PS	6
Hilbeck, A.	1241	ECOLOGICAL IMPLICATIONS OF THE LARGE-SCALE PRODUCTION OF INSECTICIDAL, TRANSGENIC PLANTS	I	313	23/08/00	9:35	HM	N	7	5	7
Hildebrand, J. G.	669	IDENTIFICATION OF HOSTPLANT VOLATILES ATTRACTIVE TO THE SPHINX MOTH, MANDUCA SEXTA	I	169	22/08/00	16:30	CC		4	PS	4
Hildebrand, J. G.	2417	NEURONAL CONTROL OF HEART REVERSAL IN THE HAWKMOTH MANDUCA SEXTA	II	611	21/08/00	16:30	CC		13	PS	13
Hilje, L.	2560	CULTURAL PRACTICES FOR MANAGING WHITEFLIES	II	647	22/08/00	11:35	HB	B	14	3	14
Hilje, L.	105	IMPLEMENTATION AND ADOPTION OF IPM SYSTEMS	I	27	22/08/00	16:00	HB	A	2	4	2
Hilker, M.	1472	THE ROLE OF INDUCED PLANT VOLATILES FOR EGG PARASITOIDS AND THEIR POTENTIAL FOR SEMIOCHEMICAL CONTROL	I	371	26/08/00	10:35	HM	O	8	8	8
Hilker, M.	4129	CHEMICAL SIGNALLING BETWEEN HOST PLANT AND EGG PARASITOID OF A GALERUCINE LEAF BEETLE	II	1043	25/08/00	14:20	HM	P	24	2	24
Hilker, M.	4131	THE ABDOMINAL SHIELDS OF TANSY FEEDING CASSIDINE SPECIES – DEFENCE VERSUS ATTRACTION	II	1043	25/08/00	15:00	HM	P	24	2	24
Hilker, M.	696	THE ROLE OF INDUCED PLANT VOLATILES FOR EGG PARASITOIDS AND THEIR POTENTIAL FOR SEMIOCHEMICAL CONTROL	I	176					4		4
Hilker, M.	697	CHEMICAL SIGNALLING BETWEEN HOST PLANT AND EGG PARASITOID OF A GALERUCINE LEAF BEETLE	I	176					4		4
Hilker, M.	3165	THE ABDOMINAL SHIELDS OF TANSY FEEDING CASSIDINE SPECIES – DEFENCE VERSUS ATTRACTION	II	798					16		16
Hill, J. K.	817	RAPID EVOLUTION OF FLIGHT POTENTIAL IN LEPIDOPTERA	I	207	22/08/00	11:20	HB	D	6	3	6
Hill, R.	3913	ECOLOGICAL RISK-BENEFIT ASSESSMENT FOR BIOLOGICAL CONTROL INTRODUCTIONS: AN AUSTRALASIAN PERSPECTIVE	II	988	25/08/00	10:15	HB	H	22	7	22
Hilton, R.	2539	AREAWIDE MANAGEMENT OF LEPIDOPTEROUS PESTS IN PERENNIAL CROPPING SYSTEMS: OPPORTUNITIES AND CONSTRAINTS	II	642	21/08/00	9:35	HB	B	14	1	14
Hilton, R. J.	119	MULTIPLE USES OF PARTICLE FILMS IN PEAR PEST MANAGEMENT	I	31	23/08/00	15:35	HB	A	2	6	2
Himei, H.	1344	CONTROL OF DIAMONDBACK MOTH (PLUTELLA XYLOSTELLA) BY SPINOSAD AND ITS INFLUENCE ON PARASITIC WASPS	I	339	23/08/00	16:30	CC		7	PS	7
Hino, T.	564	RELATION BETWEEN THE DIVERSITY OF CARABID BEETLES AND DEER, MICE, AND DWARF BAMBOO IN A DECLINING ALPINE FOREST	I	143	25/08/00	16:30	CC		3	PS	3
Hirai, M.	3381	MOLECULAR CLONING OF JUVENILE HORMONE BINDING PROTEINS OF SILKWORM, BOMBYX MORI	II	854	25/08/00	16:30	CC		18	PS	18
Hirai, N.	1549	HOST-PARASITE RELATIONSHIP BETWEEN THE MIGRANT BUTTERFLY, PARANTICA SITA (LEPIDOPTERA: DANAIDAE), AND ITS TACHINID PARASITOID, STURMIA BELLA (DIPTERA: TACHINIDAE), AT THREE HABITATS IN THE KII PENINSULA, CENTRAL JAPAN	I	391	22/08/00	16:30	CC		8	PS	8
Hiraoka, T.	1603	REQUIREMENT OF LIPOPHORIN AND ECDYSTEROID FOR IN VITRO DEVELOPMENT OF A LARVAL ENDOPARASITOID, VENTURIA CANESCENS (HYMENOPTERA: ICHNEUMONIDAE)	I	404	23/08/00	16:30	CC		8	PS	8
Hirata, M.	945	PRELIMIARY EVIDENCE OF GEOGRAPHIC VARATION IN SOCIAL BEHAVIOUR OF HALICTINE BEES FROM HOKKAIDO, JAPAN	I	239	22/08/00	16:30	CC		6	PS	6
Hirayama, C.	685	AMINO ACID SECRETION IN DIGESTIVE JUICE: COUNTERADAPTATION OF HERBIVOROUS INSECTS AGAINST PROTEIN-DENATURING ACTIVITY OF PLANT IRIDOID GLYCOSIDES ACTIVATED BY PLANT BETA-GLUCOSIDASE	I	173	23/08/00	16:30	CC		4	PS	4
Hirayama, C.	2368	LINKAGE OF NUTRITION AND SILK PRODUCTION IN BOMBYX MORI	II	598	24/08/00	10:50	HB	I	13	6	13

Sub-titles: (HB=Hotel Bourbon) - (HM=Hotel Mabu) - (CC=Convention Center) - (Bol=Foz Boulevard) - (PS=Poster Session) - (PL=Plenary Lecturer)

AUTHOR	Nº	TITLE	Book	Page	Date	Time	Local	Room	Session	Symp	New Session
Hiriyama	70	TOXIC AND MUTAGENIC EFFECTS OF A FEW CARBAMATE PESTICIDES ON SILKWORM BOMBYX MORI	I	18	25/08/00	16:30	CC		1	PS	1
Hirokawa, M.	2257	MORPHOLOGY AND GENETICS OF THE NEWLY DISCOVERED INTERSEX IN THE SILKWORM, BOMBYX MORI	I	570	22/08/00	16:30	CC		12	PS	12
Hirokawa, M.	2516	CDNA CLONING AND EXPRESSION ANALYSIS OF REL PROTEINS FROM BOMBYX MORI	II	635	25/08/00	16:30	CC		13	PS	13
Hiromori, H.	2073	FACTOR ANALYSIS OF SYNERGISTIC EFFECTS BETWEEN ENTOMOPATHOGENIC FUNGUS, METARHIZIUM ANISOPLIAE AND SYNTHETIC INSECTICIDES TO SCRAB GRUBS	I	523	22/08/00	16:30	CC		11	PS	11
Hiromori, H.	2166	THE SPECIFICITY ANALYZE OF ENTOMOPATHOGENIC FUNGUS BEAUVERIA BRONGNIARTII	I	546	25/08/00	16:30	CC		11	PS	11
Hiromori, H.	2706	CONTROL EFFECTS TO THRIPS AND APHIDS USING FOAMED SURFACTANT ON FLOWERS AND VEGETABLES IN GREENHOUSE	II	683	22/08/00	16:30	CC		14	PS	14
Hirose, E.	2112	COMPATIBILITY OF ENTOMOPATOGENIC FUNGI WITH NEONICOTINOIDS INSECTICIDES	I	533	23/08/00	16:30	CC		11	PS	11
Hirose, Y.	144	HABITAT RELATIONSHIPS BETWEEN MOBILE INSECT PESTS AND THEIR NATURAL ENEMIES IN DIVERSIFIED AGROECOSYSTEMS: A BASIS FOR FORCASTING AND MANAGING THESE PESTS AND NATURAL ENEMIES	I	37	25/08/00	13:30	HB	A	2	9	2
Hirukawa, Y.	3264	RELATIONSHIPS BETWEEN THE LOCATION AND THE RADIATION SENSITIVITY OF RETROTRANSPOSONS IN THE GENOME AND THE INSERTION MECHANISM	II	824	22/08/00	10:20	HB	K	18	2	18
Hjaltén, J.	1865	INHERITANCE PATTERN OF RESISTANCE TRAITS IN HYBRID WILLOWS: EFFECTS ON HERBIVORES AND PATHOGENS	I	470	24/08/00	16:05	HB	M	10	6	10
Ho, C. M.	2258	DIFFERENTIATION AND IDENTIFICATION OF AEDES AEGYPTI POPULATIONS IN TAIWAN	I	570	22/08/00	16:30	CC		12	PS	12
Ho, H.-Y.	585	IDENTIFICATION OF SEX PHEROMONES OF ECONOMICALLY IMPORTANT STINK BUG PESTS OF AGRICULTURE	I	148	22/08/00	10:35	Bol	S	4	2	4
Hoare, R. J. B.	453	PHYLOGENY AND HOST-PLANT RELATIONSHIPS OF THE PECTINIVALVINAE (LEPIDOPTERA: NEPTICULIDAE)	I	115	26/08/00	13:35	HB	C	3	10	3
Hoch, H.	1746	THE ROLE OF ACOUSTIC COMMUNICATION IN SPECIATION OF PLANTHOPPERS (HEMIPTERA: FULGOROMORPHA)	I	440	23/08/00	13:45	HB	F	9	3	9
Hoch, H.	3589	SUBTERRANEAN SPECIATION – WHAT CAN WE LEARN FROM HAWAIIAN, AUSTRALIAN AND CANARY ISLAND CAVE PLANTHOPPERS (HEMIPTERA: FULGOROMORPHA)?	II	906	25/08/00	11:15	Bol	U	20	3	20
Hoch, H.	3610	EVOLUTION AND SPECIATION OF CIXIIDAE IN THE PACIFIC: A COMPARATIVE STUDY OF HAWAII AND THE GALÁPAGOS ARCHIPELAGO (HEMIPTERA: FULGOROMORPHA)	II	912	21/08/00	9:50	HB	E	21	1	21
Hoch, H.	385	BEFRI, GLOBIS AND THE MSEF INITIATIVES—INTERNATIONAL ENTOMOLOGICAL APPROACHES TO CBD, GTI AND GBIF	I	98	21/08/00	14:45	HB	C	3	1	3
Hoddle, M. S.	39	BIOLOGICAL CONTROL OF OLIGONYCHUS PERSEAE (ACARI: TETRANYCHIDAE) ON AVOCADO: EVALUATING THE EFFICACY OF VARYING RELEASE RATES AND RELEASE FREQUENCY OF NEOSEIULUS CALIFORNICUS (ACARI: PHYTOSEIIDAE)	I	10	23/08/00	16:30	CC		1	PS	1
Hoddle, M. S.	1013	MORTALITY ASSESSMENT OF PESTS WITH OVERLAPPING GENERATIONS: THE USE OF LIFE TABLES IN BIOLOGICAL CONTROL	I	256	22/08/00	16:30	CC		6	PS	6
Hoddle, M. S.	1460	INTRINSIC & EXTRINSIC FACTORS INFLUENCING BIOLOGICAL CONTROL OF BEMISIA ARGENTIFOLII IN GREENHOUSES	I	368	24/08/00	10:05	HM	O	8	7	8
Hodgson, D. J.	1014	DENSITY-DEPENDENT GROWTH OF MONOCLONAL APHID COLONIES AND ITS CONSEQUENCES FOR CLONAL FITNESS	I	256	22/08/00	16:30	CC		6	PS	6
Hodgson, D. J.	2074	PHENOTYPIC VARIATION BETWEEN GENOTYPIC VARIANTS OF A NUCLEOPOLYHEDROVIRUS INFECTING PINE BEAUTY MOTH, PANOLIS FLAMMEA	I	523	23/08/00	16:30	CC		11	PS	11
Hodin, J.	3297	THE ECDYSONE RECEPTOR AND THE PARALLEL EVOLUTION OF PAEDOGENESIS (LARVAL REPRODUCTION) IN TWO SPECIES OF GALL MIDGES (DIPTERA: CECIDOMYIIDAE)	II	833	25/08/00	15:05	HB	K	18	6	18
Hoelmer, K.	804	FOREIGN EXPLORATION FOR SAWFLY NATURAL ENEMIES	I	203	21/08/00	11:20	HB	D	6	1	6
Hoelmer, K.	3959	REVIEWING A MULTI-AGENCY BIOLOGICAL CONTROL PROGRAM FOR BEMISIA ARGENTIFOLII IN THE SOUTHWEST UNITED STATES: ESTABLISHING, CONSERVING & AUGMENTING NEW PARASITOIDS & EVALUATING THEIR IMPACT	II	999	22/08/00	16:30	CC		22	PS	22
Hoelmer, K.	3960	REVIEWING A MULTI-AGENCY BIOLOGICAL CONTROL PROGRAM FOR BEMISIA ARGENTIFOLII IN THE SOUTHWEST UNITED STATES: FOREIGN EXPLORATION, MASS CULTURE & EVALUATIONS	II	999	22/08/00	16:30	CC		22	PS	22
Hoelscher, C. E.	1336	DIAZINON AND PYRETHROID RESISTANCE TO THE HORN FLY IN TEXAS	I	337	22/08/00	16:30	CC		7	PS	7
Hofer, D.	1337	THIAMETHOXAM (CRUISERa) AS SEED TREATMENT – VALUE BEYOND INSECT CONTROL	I	337	22/08/00	16:30	CC		7	PS	7
Hofer, D.	341	THIAMETHOXAM USED AS SEED TREATMENT (CRUISER/VADAGE®), OR AS SOIL APPLICATION (ACTARA/PLATINUM®)	I	86	25/08/00	16:30	CC		2	PS	2
Hoffman, N.	83	ERADICATION OF A SCARAB PEST FROM A NATIONAL WILDLIFE REFUGE	I	22	21/08/00	10:50	HB	A	2	1	2
Hoffmann, J.A.	2353	THIOESTER-CONTAINING PROTEINS IN INNATE IMMUNITY OF MOSQUITO ANOPHELES GAMBIAE	II	594	23/08/00	10:45	HB	I	13	4	13
Hoffmann, B. D.	512	MANAGING THE BIODIVESITY OF NORTHERN AUSTRALIA'S SEMI-ARID RANGELANDS: CHANGES IN ANT SPECIES COMPOSITION AND COMMUNITY ORGANISATION TO GRAZING GRADIENTS AND FIRE REGIMES	I	130	23/08/00	16:30	CC		3	PS	3
Hoffmann, G.	4030	EFFICACY OF CONTROLLED ATMOSPHERES ON CIMEX LECTULARIUS (HET., CIMICIDAE) AND ARGAS REFLEXUS (ACARI, ARGASIDAE)	II	1018	23/08/00	10:00	HB	J	23	6	23
Hoffmann, K. H.	2453	HORMONAL REGULATION OF FLIGHT METABOLISM IN A MIGRATORY BUTTERFLY, VANESSA CARDUI (LEPIDOPTERA: NYMPHALIDAE)	II	620	23/08/00	16:30	CC		13	PS	13
Hoffmann, K. H.	2492	JUVENILE HORMONE BIOSYNTHESIS AND REGULATION OF VITELLOGENESIS IN THE FALL ARMYWORM, SPODOPTERA FRUGIPERDA (LEPIDOPTERA: NOCTUIDAE)	II	629	24/08/00	16:30	CC		13	PS	13
Hoffmann, K. H.	1758	INTERSPECIFIC AND INTRASPECIFIC VARIATIONS IN APHID HONEYDEW: IMPACT ON THE MUTUALISM WITH ANTS	I	443	21/08/00	16:30	CC		9	PS	9
Hoffmann, K. H.	3340	A FACTOR FROM THE CRICKET TESTIS THAT INHIBITS OVARIAN ECDYSTEROID BIOSYNTHESIS	II	843	22/08/00	16:30	CC		18	PS	18
Hoffmann, M. P.	1550	INOCULATIVE RELEASES OF TRICHOGRAMMA OSTRINIAE FOR EUROPEAN CORN BORER CONTROL	I	391	22/08/00	16:30	CC		8	PS	8
Hoffmann, M. P.	1680	PERISTENUS PARASITISM OF LYGUS LINEOLARIS IN MULTIPLE PLANT HABITATS	I	423	25/08/00	16:30	CC		8	PS	8
Hoffmann, M. P.	2859	POTENTIAL OF MILLET AS A SWEET CORN COMPANION PLANT: EFFECT ON EUROPEAN CORN BORER AND BENEFICIAL INSECTS	II	722	25/08/00	16:30	CC		14	PS	14
Hoffmann, P.	2444	PSEUDOTUMORS IN THE STICK INSECT (CARAUSIUS MOROSUS) - A MODEL SYSTEM TO STUDY REGULATION OF THE MAINTENANCE OF TISSUE DIFFERENTIATION	II	617	22/08/00	16:30	CC		13	PS	13
Hoffmann, W. C.	162	MANAGEMENT OF MEXICAN CORN ROOTWORM (COLEOPTERA: CHRYSOMELIDAE)	I	42	26/08/00	15:05	HB	A	2	11	2
Hoffmann, W.C.	149	THE USE OF POLLEN SPORES AS NATURAL MARKERS FOR DETERMINING MIGRATION	I	38	25/08/00	15:00	HB	A	2	9	2
Hoffmann-Campo, C. B.	2658	CONTROL OF STERNECHUS SUBSIGNATUS (COL.: CURCULIONIDAE) WITH INSECTICIDES APPLIED ON SOYBEAN PLANTS	II	671	21/08/00	16:30	CC		14	PS	14

Sub-titles: (HB=Hotel Bourbon) - (HM=Hotel Mabu) - (CC=Convention Center) - (Bol=Foz Boulevard) - (PS=Poster Session) - (PL=Plenary Lecturer)

AUTHOR	Nº	TITLE	Book	Page	Date	Time	Local	Room	Session	Symp	New Session
Hoffmann-Campo, C. B.	1114	BIOLOGICAL AND NUTRITIONAL ASPECTS OF NEZARA VIRIDULA (HEMIPTERA:PENTATOMIDAE) ON SOYBEAN GENOTYPES	I	281	22/08/00	16:30	CC		6	PS	6
Hoffmann-Campo, C. B.	711	ROLE OF NEZARA VIRIDULA (HEMIPTERA:PENTATOMIDAE) ON INDUCING THE PRODUCTION OF FLAVONOID IN SOYBEAN GENOTYPES	I	180	21/08/00	16:30	CC		4	PS	4
Hofmann, M.	736	A NEW AUTOMATIC BIOASSAY TO TEST THE ATTRACTION OF HOST STIMULI IN CRAWLING INSECTS	I	186	25/08/00	16:30	CC		4	PS	4
Hofstetter, R. W.	1930	INTERACTIONS BETWEEN BEETLE ATTACK RATE AND PINE TREE DEFENSES PRODUCE POSITIVE DENSITY DEPENDENCE IN DENDROCTONUS FRONTALIS	I	486	22/08/00	16:30	CC		10	PS	10
Hogan, J. R.	2915	MALARIA PARASITE ENCAPSULATION GENES IN ANOPHELES GAMBIAE	II	736	24/08/00	14:05	Bol	R	15	8	15
Hogenhout, S. A.	3212	CHAPERONIN CAMOUFLAGE: AN INTRIGUING PHENOMENON IN THE TRANSMISSION OF LUTEOVIRUSES BY APHIDS	II	811	22/08/00	14:00	Bol	U	17	2	17
Hogsette, J. A.	1551	HYDROTAEA AENESCENS, A LARVAL PREDATOR OF THE HOUSE FLY: A SUMMARY OF RECENT RESERCH	I	391	22/08/00	16:30	CC		8	PS	8
Hohmann, C. L.	1552	EFFECT OF TEMPORARY HOST DEPRIVATION ON THE REPRODUCTION AND SURVIVAL OF WOLBACHIA-INFECTED AND UNINFECTED TRICHOGRAMMA KAYKAI PINTO AND STOUTHAMER (HYMENOPTERA: TRICHOGRAMMATIDAE)	I	391	22/08/00	16:30	CC		8	PS	8
Hohmann, C. L.	1553	SUPERPARASITISM IN ARRHENOTOKOUS AND THELYTOKOUS Trichogramma kaykai PINTO AND STOUTHAMER (HYMENOPTERA: TRICHOGRAMMATIDAE)	I	392	22/08/00	16:30	CC		8	PS	8
Hökfelt, T.	2502	THE DISTRIBUTION OF NPY AND NPY-Y1 RECEPTOR LIKE IMMUNOREACTIVITIES IN THE BRAIN OF TRIATOMA INFESTANS.	II	632	24/08/00	16:30	CC		13	PS	13
Holland, J. M.	357	SPATIAL AND TEMPORAL DISTRIBUTIONS OF PREDATORY INVERTEBRATES WITHIN, AND DISPERSING FROM, OVERWINTERING REFUGES IN UK CEREAL FIELDS	I	90	25/08/00	16:30	CC		2	PS	2
Holland, J. M.	3601	FIELD MARGINS ARE POTENTIALLY VALUABLE HABITATS FOR FORAGING BUMBLEBEES	II	909	23/08/00	16:30	CC		20	PS	20
Hölldobler, B.	1768	COOPERATION AND DIVISION OF LABOR BETWEEN UNRELATED INDIVIDUALS IN THE ANT PACHYCONDYLA 'INVERSA'	I	445	22/08/00	16:30	CC		9	PS	9
Holler, T.	1661	FRUIT FLY BIOLOGICAL CONTROL IN LATIN AMERICA: MINIMIZING THE RISKS POSED BY TEPHRITIDAE IN MEXICO AND CENTRAL AMERICA	I	419	25/08/00	16:30	CC		8	PS	8
Holloway, J. W.	1338	MANAGING INSECTICIDE RESISTANCE IN AUSTRALIAN HELICOVERPA ARMIGERA	I	338	22/08/00	16:30	CC		7	PS	7
Holloway, J. W.	2708	COMPARISONS OF INSECTICIDE EFFICACY AGAINST HELICOVERPA ARMIGERA IN CONVENTIONAL VERSUS TRANSGENIC COTTON	II	684	23/08/00	16:30	CC		14	PS	14
Holmes, S. P.	2443	CLONING AND DEVELOPMENTAL EXPRESSION OF A LYMNOKININ-LIKE RECEPTOR FROM THE CATTLE FEVER TICK, Boophilus microplus (ACARI: IXODIDAE)	II	617	22/08/00	16:30	CC		13	PS	13
Holmstrom, K.	511	SPATIAL MAPPING OF TWO PEST POPULATIONS IN NEW JERSEY SWEET CORN	I	129	23/08/00	16:30	CC		3	PS	3
Holst, N.	4018	ANALYSING THE IMPACT OF TERETRIUS NIGRESCENS ON PROSTEPHANUS TRUNCATUS IN MAIZE STORES IN WEST AFRICA	II	1015	22/08/00	10:30	HB	J	23	3	23
Holst, N.	4037	MODELLING AS A TOOL FOR INTEGRATED PEST MANAGEMENT IN THE RURAL MAIZE STORE ECOSYSTEM	II	1019	23/08/00	13:45	HB	J	23	7	23
Holst, N.	4047	SIMPLE EVALUATION PROCEDURES AS IPM TOOLS FOR STORED MAIZE IN WEST AFRICA	II	1022	24/08/00	10:45	HB	J	23	8	23
Holt, H.	2049	BT COTTON: RELATIONSHIP BETWEEN BIOEFFICACY, GENE EXPRESSION AND PROTEIN	I	517	21/08/00	16:30	CC		11	PS	11
Holt, J.	1329	EXPLORING THE INFLUENCE OF INSECTICIDE ON INSECT PEST-PREDATOR INTERACTIONS USING A THEORETICAL TWO-FIELD MODEL	I	335	22/08/00	16:30	CC		7	PS	7
Holt, J.	3491	THE EFFECTS OF ELECTRICAL FIELDS ON THE BEHAVIOUR OF ANTS	II	881	22/08/00	16:30	CC		19	PS	19
Holtmann, M.	2444	PSEUDOTUMORS IN THE STICK INSECT (CARAUSIUS MOROSUS) - A MODEL SYSTEM TO STUDY REGULATION OF THE MAINTENANCE OF TISSUE DIFFERENTIATION	II	617	22/08/00	16:30	CC		13	PS	13
Holts, A. M.	1627	COLLECTS AND IDENTIFICATION OF RACES OF TRICHOGRAMMA IN COMMERCIAL FIELDS OF TOMATO, IN DIFFERENT ALTITUDE	I	410	24/08/00	16:30	CC		8	PS	8
Holzapfel, C. M.	3320	INVASION OF THE TEMPERATE ZONE AND THE EVOLUTION OF PHOTOPERIODIC TIME MEASUREMENT	II	838	21/08/00	16:30	CC		18	PS	18
Holzenthal, R. W.	3688	THE HIGHER LEVEL PHYLOGENY OF TRICHOPTERA WITH AN EMPHASIS ON THE RELATIONSHIPS AMONG SUBORDERS	II	931	25/08/00	15:50	HB	E	21	8	21
Honda, H.	3875	DEVELOPMENT OF A STRAIN OF THE SMALLER TEA TORTRIX, ADOXOPHYES HONMAI (LEPIDOPTERA: TORTRICIDAE) RESISTANT TO A MATING DISRUPTANT IN JAPAN	II	978	21/08/00	14:30	HB	H	22	1	22
Honda, H.	1677	HOST LOCATION BEHAVIOR OF THE PARASITOID FLY, EXORISTA JAPONICA (DIPTERA: TACHINIDAE)	I	423	25/08/00	16:30	CC		8	PS	8
Honda, K.	706	SUITABILITY OF SEVERAL RUTACEOUS PLANTS FOR A PAPILIONID BUTTERFLY, PAPILIO POLYTES	I	178	24/08/00	16:30	CC		4	PS	4
Honda, K.	3226	COMPARISON OF RIBOSOMAL DNA BY PCR-RFLP ANALYSIS AMONG LOCAL CLONES OF FOXGLOBE APHID, AULACORTHUM SOLANI, WHICH SHOW DIFFERENT TRANSMISSION EFFICIENCY OF SOYBEAN DWARF LUTEOVIRUS	II	814	22/08/00	16:30	CC		17	PS	17
Hon•k, A.	2716	DEVELOPMENTAL RATE ISOMORPHY IN INSECTS AND MITES	II	686	23/08/00	16:30	CC		14	PS	14
Hong, W.	3778	A TAXONOMIC STUDY ON SUBFAMILY MYCOMYINAE FROM CHINA (DIPTERA: MYCETOPHILIDAE)	II	954	23/08/00	16:30	CC		21	PS	21
Honiball, S. J.	3625	WEEVILS AS VECTORS OF PLANT PATHOGENS: A CASE STUDY ON AMARANTH IN SOUTH AFRICA	II	915	21/08/00	15:50	HB	E	21	2	21
Hontebeyne, M.	2961	TRIATOMINES SPECIES (HEMIPTERA, REDUVIIDAE, TRIATOMINAE) AND TRYPANOSOMA CRUZI IN FRENCH GUYANA	II	747	21/08/00	16:30	CC		15	PS	15
Hood, C. W.	3924	INSTABILITY IN PHYTOSANITARY MARKET ACCESS: IDENTIFYING CAUSES AND MANAGING EFFECTS	II	990	26/08/00	9:45	HB	H	22	8	22
Hook, A. W.	1015	BIOLOGICAL NOTES ON THE NEOTROPICAL MUD-DAUBER WASP, TRYPOXYLON MANNI (HYMENOPTERA: SPHECIDAE)	I	256	23/08/00	16:30	CC		6	PS	6
Hooper-Bui, L. M.	3554	NUTRIENT DISTRIBUTION IN SOLENOPSIS INVICTA	II	897	25/08/00	16:30	CC		19	PS	19
Hooper-Bùi, L. M.	3500	NUTRIENT FLOW AND NUTRITIONAL HEIRARCHY IN ANTS	II	883	23/08/00	16:30	CC		19	PS	19
Hopkins, D. C.	2624	INTEGRATED CONTROL OF MEDITERRANEAN SNAILS IN SOUTHERN AUSTRALIA, INCLUDING THE USE OF PARASITIC SARCOPHAGID FLIES	II	663	21/08/00	16:30	CC		14	PS	14
Hopkins, T. L.	2388	LEPIDOPTERAN PERITROPHIC MEMBRANE STRUCTURE AND EFFECTS OF WHEAT GERM AGGLUTININ ON FORMATION	II	603	26/08/00	10:05	HB	I	13	10	13
Hopkins, T. L.	2385	OXIDATIVE CONJUGATION OF CATECHOLS FOR INSECT CUTICLE SCLEROTIZATION	II	603	25/08/00	15:20	HB	I	13	9	13
Hopkins, T. L.	2454	OXIDATIVE CONJUGATION OF CATECHOLS FOR INSECT CUTICLE SCLEROTIZATION	II	620	23/08/00	16:30	CC		13	PS	13
Hopper, K.	3914	RISK ASSESSMENT PROCEDURES FOR BIOCONTROL INTRODUCTIONS IN SOUTHERN SOUTH AMERICA AND A PROTOCOL FOR PREDICTING PARASITOID POST - INTRODUCTION HOST RANGE	II	988	25/08/00	11:00	HB	H	22	7	22
Höppner, G.	1684	CLASSICAL BIOLOGICAL CONTROL OF THE SPINY BLACKFLY, ALEUROCANTHUS SPINIFERUS (HEM.: ALEYRODIDAE), AN ECONOMIC STUDY	I	424	25/08/00	16:30	CC		8	PS	8
Hopwood, J. A.	2990	MALARIA AND MOSQUITOES: PARASITE-INDUCED APOPTOSIS REDUCES VECTOR REPRODUCTIVE FITNESS AND MAY ENHANCE TRANSMISSION	II	754	23/08/00	16:30	CC		15	PS	15
Hora, R. R.	1723	FUNCTIONAL POLYGYNY IN ECTATOMMA TUBERCULATUM (HYMENOPTERA: FORMICIDAE).	I	434	22/08/00	10:20	HB	F	9	2	9
Horak, M.	3693	OLETHREUTINE PHYLOGENY FROM AN AUSTRALIAN PERSPECTIVE (LEPIDOPTERA, TORTRICIDAE	II	932	26/08/00	10:05	HB	E	21	9	21

Sub-titles: (HB=Hotel Bourbon) - (HM=Hotel Mabu) - (CC=Convention Center) - (Bol=Foz Boulevard) - (PS=Poster Session) - (PL=Plenary Lecturer)

AUTHOR	N°	TITLE	Book	Page	Date	Time	Local	Room	Session	Symp	New Session
Horak, M.	3779	CHARACTER EVALUATION AND PHYCITINE PHYLOGENY (LEPIDOPTERA, PYRALIDAE)	II	954	23/08/00	16:30	CC		21	PS	21
Horák, P.	74	NUMBER OF PREY NECESSARY FOR COMPLETING DEVELOPMENT OF CHEYLETUS ERUDITUS (ACARINA: CHEYLETIDAE)	I	19	25/08/00	16:30	CC		1	PS	1
Horman, R. E.	3289	PHOTOAFFINITY LABELED NON-STEROIDAL ECDYSONE AGONIST AS A TOOL TO STUDY LIGAND-ECDYSONE RECEPTOR COMPLEX INTERACTION	II	831	23/08/00	15:35	HB	K	18	5	18
Horn, C.	4000	UNIVERSAL TRANSFORMATION SYSTEM FOR TRANSGENIC ARTHROPODS	II	1009	25/08/00	16:30	CC		22	PS	22
Horner, J. D.	829	SPECIATION IN GALL-INDUCING INSECTS	I	210	23/08/00	10:35	HB	D	6	5	6
Hörnschemeyer, T.	3682	WING-BASE MORPHOLOGY AND THE EVOLUTION OF THE HOLOMETABOLA	II	930	25/08/00	14:20	HB	E	21	8	21
Horodyski, F.	3048	DEVELOPMENTAL REGULATION AND FUNCTIONS FOR FLRFAMIDE PEPTIDES IN MANDUCA SEXTA	II	769	22/08/00	11:35	HB	G	16	2	16
Horowitz, A. R.	1271	BIORATIONAL AGENTS -- MECHANISM AND IMPORTANCE IN INTEGRATED PEST MANAGEMENT (IPM) AND INSECTICIDE RESISTANCE MANAGEMENT (IRM) PROGRAMS	I	321	25/08/00	10:35	HM	N	7	9	7
Horowitz, A. R.	1842	BIORATIONAL AGENTS – MECHANISM AND IMPORTANCE IN INTEGRATED PEST MANAGEMENT (IPM) AND INSECTICIDE RESISTANCE MANAGEMENT (IRM) PROGRAMS	I	464	23/08/00	11:35	HB	M	10	4	10
Horowitz, A. R.	1342	NOVALURON (RIMON EC-10), A NOVEL IGR FOR CONTROLLING AGRICULTURAL INSECT PESTS	I	339	23/08/00	16:30	CC		7	PS	7
Horowitz, A. R.	1277	PROGRESSIVE INSECTICIDE RESISTANCE MANAGEMENT PROGRAMS IN THE ISRAELI AGRICULTURAL ECOSYSTEM	I	322	25/08/00	14:20	HM	N	7	10	7
Horowitz, A. R.	2557	OVERVIEW OF INSECTICIDAL CONTROL AND RESISTANCE MANAGEMENT	II	646	22/08/00	10:35	HB	B	14	3	14
Hort, C. A.	2784	FIELD STUDY TO COMPARE AN INTEGRATED FLEA CONTROL TREATMENT OF CAPSTAR AND PROGRAM TO ADVANTAGE USED ALONE AGAINST THE CAT FLEA (SIPHONAPTERA: PULICIDAE)	II	703	24/08/00	16:30	CC		14	PS	14
Horta, M. A. P.	1016	COMMUNITY OF INSECTS FROM PAEPALANTHUS BROMELIOIDES: A NEW PHYTOTELMATA PLANT	I	256	23/08/00	16:30	CC		6	PS	6
Horta, M. A. P.	1017	A POSSIBLE CASE OF MIMICRY BETWEEN AN INSECT AND A TADPOLE	I	257	23/08/00	16:30	CC		6	PS	6
Hosaka, H.	1351	BAS 620 H - A NEW GRAMINICIDE FOR POST-EMERGENCE GRASS CONTROL IN BROADLEAF CROPS	I	341	23/08/00	16:30	CC		7	PS	7
Hosaka, H.	1350	BAS 620 H - A NEW GRAMINICIDE FOR POST-EMERGENCE GRASS CONTROL IN BROADLEAF CROPS	I	341	23/08/00	16:30	CC		7	PS	7
Hoshizaki, S.	2142	TRANSINFECTION OF WOLBACHIA ENDOSYMBIONTS AMONG THREE SPECIES OF LEPIDOPTERAN INSECTS	I	540	25/08/00	16:30	CC		11	PS	11
Hoskovec, M.	733	IDENTIFICATION OF CAMERARIA OHRIDELLA SEX PHEROMONE AND ITS POSSIBLE USE IN HORSE CHESTNUT PROTECTION	I	185	25/08/00	16:30	CC		4	PS	4
Hosoya, T.	3719	PHYLOGENY AND SEXUAL DIMORPHISM OF STAG BEETLES (COLEOPTERA, LUCANIDAE)	II	939	21/08/00	16:30	CC		21	PS	21
Hossain, M. I.	4062	LABORATORY AND FIELD STUDIES ON LARVAL CONTROL OF CULEX QUINQUEFASCIATUS MOSQUITOES INHABITING URBAN AND SUBURBAN DHAKA, BANGLADESH	II	1026	22/08/00	16:30	CC		23	PS	23
Hossain, M. S.	2710	TWO YEARS OF AREAWIDE MATING DISRUPTION APPLICATION FOR SUCCESSFUL CONTROL OF ORIENTAL FRUIT MOTH GRAPHOLITA MOLESTA (LEPIDOPTERA: TORTRICIDAE) IN VICTORIA, AUSTRALIA	II	684	22/08/00	16:30	CC		14	PS	14
Hossini, E.	962	INVESTIGATION ON HOST PREFERENCE OF PSUEDODENDROTHRIPS MORI (THYS; THRIPIDAE) ON FOUR VARIETIES OF MULBERRY IN THE FIELD AND LABORATORY	I	243	23/08/00	16:30	CC		6	PS	6
Hou, R. F.	2407	DETERMINATION AND DISTRIBUTION OF FEMALE-SPECIFIC PROTEINS IN THE BROWN PLANTHOPPER, NILAPARVATA LUGENS	II	608	21/08/00	16:30	CC		13	PS	13
Hou, X.	4080	LABORATORY AND GRANARY TRIALS USING PEA PROTEIN TO CONTROL STORED-PRODUCT INSECTS	II	1030	22/08/00	16:30	CC		23	PS	23
Houck, M. A.	10	DISPERSAL OF AN EMERGING INFECTIOUS AGENT: POTENTIAL ROLE OF MITES	I	3	22/08/00	10:45	Bol	U	1	2	1
Houck, M. A.	12	EVOLUTION OF PARASITISM IN THE ASTIGMATA: THE ROLE OF PHORESY	I	3	22/08/00	11:25	Bol	U	1	2	1
Hovorka, O.	733	IDENTIFICATION OF CAMERARIA OHRIDELLA SEX PHEROMONE AND ITS POSSIBLE USE IN HORSE CHESTNUT PROTECTION	I	185	25/08/00	16:30	CC		4	PS	4
Howard, J.J.	4102	THE SEASONAL ABUNDANCE AND CONTROL OF CHRYSOMYA MEGACEPHALA INFESTING DRYING FISH IN SOUTH-WEST INDIA	II	1036	24/08/00	16:30	CC		23	PS	23
Howarth, F. G.	3591	PROTECTING DARKNESS: CONSERVATION BIOLOGY OF CAVE-DWELLING ARTHROPODS	II	906	25/08/00	14:00	Bol	U	20	3	20
Howden, H. F.	3669	SYSTEMATICS AND BIOLOGY OF THE NEW WORLD CERATOCANTHINAE (COLEOPTERA: SCARABAEIDAE)	II	926	24/08/00	14:05	HB	E	21	7	21
Howse, P. E.	674	CHEMICAL VARIATION AND ITS FUNCTIONAL SIGNIFICANCE IN GRASS-CUTTING ANT ALARM PHEROMONES	I	170	23/08/00	16:30	CC		4	PS	4
Hoy, M. A.	1	PHYTOSEIIDS AS MANIPULATORS OF SEX: WOLBACHIA, PARAHAPLOIDY AND GENOMIC IMPRINTING	I	1	24/08/00	13:35	HB	F	1	1	1
Hoy, M. A.	1436	SCIENTIFIC, SOCIAL, POLITICAL AND ETHICAL ISSUES FOR CLASSICAL BIOLOGICAL CONTROL IN THE COMING MILLENNIUM	I	362	22/08/00	9:35	HM	O	8		
Hoy, M. A.	2898	WOLBACHIA AND GENETIC MANIPULATION OF PREDATORY MITES	II	731	23/08/00	10:20	Bol	R	15	5	15
Hoy, M. A.	2989	DEPLOYING TRANSGENIC ARTHROPODS IN IPM PROGRAMS: RISK ANALYSES	II	754	23/08/00	16:30	CC		15	PS	15
Hoyo, M. L. Del	3436	HONEY BEE TOLERANCE AGAINST VARROA JACOBSONI IN ARGENTINA	II	867	24/08/00	9:50	HM	Q	19	5	19
Hrdy, I.	733	IDENTIFICATION OF CAMERARIA OHRIDELLA SEX PHEROMONE AND ITS POSSIBLE USE IN HORSE CHESTNUT PROTECTION	I	185	25/08/00	16:30	CC		4	PS	4
Hrdy, I.	2709	POTENTIAL OF JUVENOIDS IN BAIT TECHNOLOGY FOR THE MANAGEMENT OF SUBTERRANEAN TERMITES (ISOPTERA) – LABORATORY AND FIELD STUDIES WITH A CARBAMATE DERIVATIVE (W-328)	II	684	22/08/00	16:30	CC		14	PS	14
Hrdy, I.	4022	JUVENOGENS - INSECT HORMONOGENIC COMPOUNDS	II	1016	22/08/00	13:45	HB	J	23	4	23
Hrdy, I.	2024	CONTROL OF THE CODLING MOTH WITH CpGV DISSEMINATED BY MEANS OF PHEROMONE STATIONS: 5 YEARS OF FIELD TRIALS	I	511	24/08/00	14:30	HM	P	11	7	11
Hsiao, W. F.	1018	PRELIMINARY STUDY OF LIFE HISTORY OF TORTOISE BEETLE, ASPIDOMORPH MILIARIS (COLEOPTERA: HRYSOMELIDAE)	I	257	23/08/00	16:30	CC		6	PS	6
Hsu, E. L.	1339	THE STUDIES OF THE INSECTICIDE SUSCEPTIBILITY AND DETOXIFICATION ENZYMES OF APIS CERANA AND APIS MELLIFERA	I	338	22/08/00	16:30	CC		7	PS	7
Hsu, E. L.	2258	DIFFERENTIATION AND IDENTIFICATION OF AEDES AEGYPTI POPULATIONS IN TAIWAN	I	570	22/08/00	16:30	CC		12	PS	12
Hsu, M. H.	1766	EFFECTS OF MATING FREQUENCY ON FEMALE REPRODUCTIVE OUTPUT IN THE CAT FLEA, CTENOCEPHALIDES FELIS (SIPHONAPTERA: PULICIDAE)	I	445	22/08/00	16:30	CC		9	PS	9
Hu, J. S.	1554	DEVELOPMENT OF AN ARTIFICIAL DIET FOR REARING EDOVUM PUTTLERI, AN EGG PARASITOID OF THE COLORADO POTATO BEETLE, LEPTINOTARSA DECEMLINEATA	I	392	22/08/00	16:30	CC		8	PS	8
Hu, J. S.	2431	TIMING AND ECDYSTEROID REGULATION OF THE MOLT IN LAST INSTAR GREENHOUSE AND SILVERLEAF WHITEFLIES	II	614	23/08/00	16:30	CC		13	PS	13
Hu, S. Q.	40	THE CAPTURE EFFECT OF PREDACEOUS MITE AMBLYSEIUS ORIENTALIS TO THE RED MITE PANONYCHUS CITRI AT DIFFERENT TEMPERATURES	I	10	23/08/00	16:30	CC		1	PS	1
Hu, X. P.	3542	A PILOT TEST FOR AREA WIDE MANAGEMENT OF THE FORMOSAN SUBTERRANEAN TERMITE IN THE FRENCH QUARTER, NEW ORLEANS, LOUISIANA	II	894	24/08/00	16:30	CC		19	PS	19
Hua, Y. J.	3501	MOLECULAR CLONING OF A PROTHORACICOSTATIC PEPTIDE (PTSP) IN THE LARVAL BRAIN OF THE SILKWORM, BOMBYX MORI	II	884	23/08/00	16:30	CC		19	PS	18
Huang, Z. R.	3424	MULTIPURPOSE UTILIZATION OF SERICULTURAL RESOURCES IN CHINA	II	864	22/08/00	16:00	HM	Q	19	3	19

Sub-titles: (HB=Hotel Bourbon) - (HM=Hotel Mabu) - (CC=Convention Center) - (Bol=Foz Boulevard) - (PS=Poster Session) - (PL=Plenary Lecturer)

AUTHOR	Nº	TITLE	Book	Page	Date	Time	Local	Room	Session	Symp	New Session
Hubert, J.	41	THE CARBOHYDRAZES OF THREE ACAROID MITES (ACARI: ACARIDIDA) – PRELIMINARY RESULTS	I	11	23/08/00	16:30	CC		1	PS	1
Hubert, J.	42	THE FOOD INTERACTIONS BETWEEN THREE ACAROID MITES (ACARI: ACARIDIDA) AND SOME MICROMYCETES	I	11	23/08/00	16:30	CC		1	PS	1
Hubert, J.	43	THE EFFECT OF STARVATION ON METABOLIC RATE AND MICROANATOMY OF GALUMNA ELIMATA (ACARI: ORIBATIDA)	I	11	23/08/00	16:30	CC		1	PS	1
Hubert, J.	1180	FEEDING AND METABOLIC RATE OF GALUMNA ELIMATA (ACARI: ORIBATIDA) UNDER DIFFERENT TEMPERATURES	I	297	25/08/00	16:30	CC		6	PS	6
Huc, A.	1649	BEMISIA TABACI BIOTYPE B (HEMIPTERA: ALEYRODIDAE) AND ITS PARASITOIDS: GUADELOUPE ISLAND AS A REPRESENTATIVE SITE OF THE CARIBBEAN	I	416	24/08/00	16:30	CC		8	PS	8
Huddleston, E. W.	289	DO INVERSIONS INCREASE SPRAY DRIFT	I	73	23/08/00	16:30	CC		2	PS	2
Hudson, P. J.	2053	ENTOMOPATHOGENIC NEMATODES AS BIOLOGICAL CONTROL AGENTS OF INSECT PESTS: A CLEARER UNDERSTANDING	I	518	21/08/00	16:30	CC		11	PS	11
Hudson, P. J.	2054	MODELS OF ENTOMOPATHOGENIC NEMATODES FOR BIOLOGICAL CONTROL	I	518	21/08/00	16:30	CC		11	PS	11
Hudson, W.	1019	FLIGHT PATTERNS OF AN ASIAN AMBROSIA BEETLE, XYLOSANDRUS CRASSIUSCULUS, IN TREE NURSERIES IN GEORGIA AND NORTH FLORIDA, USA	I	257	23/08/00	16:30	CC		6	PS	6
Huelsenbeck, J. P.	3646	BIAS IN ESTIMATING PHYLOGENY WHEN RATES OF SUBSTITUTION VARY AMONG LINEAGES: WHY IS THE STREPSIPTERA PROBLEM SO DIFFICULT?	II	921	23/08/00	13:50	HB	E	21	5	21
Huesing, J. E.	3332	INGESTION AND DIGESTION OF GREEN FLUORESCENT PROTEIN BY THE WESTERN TARNISHED PLANT BUG, LYGUS HESPERUS	II	841	22/08/00	16:30	CC		18	PS	18
Huet, H.	2075	DIFFERENTIAL TRANSMISSION OF ZUCCHINI YELLOW MOSAIC VIRUS AND TURNIP MOSAIC MOSAIC VIRUS BY MYZUS PERISCAE AND BREVICORYNE BRASSICAE	I	523	22/08/00	16:30	CC		11	PS	11
Hugar, P. S.	2085	BIOEFFICACY AND PERSISTENCE OF NPV AGAINST SPODOPTERA LITURA ON COTTON SPRAYED AT DIFFERENT TIMINGS OF THE DAY	I	526	23/08/00	16:30	CC		11	PS	11
Hughes, D.	1555	A DISCUSSION ON THE PRELIMINARY OBSERVATIONS OF THE RELATIONSHIP BETWEEN XENOS VESPARUM ROSSI AND ITS HOST POLISTES DOMINULUS CHRIST (HYMENOPTERA)	I	392	22/08/00	16:30	CC		8	PS	8
Hughes, D.	3652	INITIAL OBSERVATIONS OF THE STREPSIPTERAN XENOS VESPARUM IN THE PAPER WASP POLISTES DOMINULUS	II	922	23/08/00	15:20	HB	E	21	5	21
Hughes, J.	3491	THE EFFECTS OF ELECTRICAL FIELDS ON THE BEHAVIOUR OF ANTS	II	881	22/08/00	16:30	CC		19	PS	19
Hughes, M.	511	SPATIAL MAPPING OF TWO PEST POPULATIONS IN NEW JERSEY SWEET CORN	I	129	23/08/00	16:30	CC		3	PS	3
Hughes, W. O. H.	674	CHEMICAL VARIATION AND ITS FUNCTIONAL SIGNIFICANCE IN GRASS-CUTTING ANT ALARM PHEROMONES	I	170	23/08/00	16:30	CC		4	PS	4
Hull, L. A.	2779	THE EFFECT OF A PLANT GROWTH REGULATOR (APOGEE) ON INSECT PESTS OF PEAR AND APPLE	II	702	25/08/00	16:30	CC		14	PS	14
Hulshof, J.	1556	THE EFFECT OF ALTERNATIVE FOOD ON ORIUS LAEVIGATUS, ITS PREY FRANKLINIELLA OCCIDENTALIS AND THEIR INTERACTION	I	392	22/08/00	16:30	CC		8	PS	8
Hultmark, D.	2352	THE IMMUNE RESPONSE IN DROSOPHILA, AND ITS REGULATION	II	594	23/08/00	10:25	HB	I	13	4	13
Humber, R. A.	2050	REMARKABLE PHYSIOLOGICAL VARIATION AMONG ISOLATES OF THE MITE PATHOGENIC FUNGUS NEOZYGITES FLORIDANA: NUTRITIONAL REQUIREMENTS AND CRYOPRESERVATION	I	517	21/08/00	16:30	CC		11	PS	11
Hunt, D. W. A.	3905	PHYSICAL BARRIERS FOR INSECT PESTS IN VEGETABLES AND SMALL FRUITS	II	986	24/08/00	11:05	HB	H	22	6	22
Hunt, J. H.	2185	DEVELOPMENT AND THE EVOLUTION OF CASTES IN SOCIAL WASPS	I	552	22/08/00	14:35	HB	L	12	4	12
Hunt, J. H.	3508	DOES EATING MORE MAKE YOU TOUGH? THE EFFECT OF NUTRITION ON THE DEVELOPMENT OF SOCIAL WASPS	II	885	23/08/00	16:30	CC		19	PS	19
Hunt, R. H.	2264	MOLECULAR IDENTIFICATION OF THE ANOPHELES FUNESTUS GROUP IN SOUTHERN AFRICA	I	571	22/08/00	16:30	CC		12	PS	12
Hunt, T. E.	1340	OSTRINIA NUBILALIS ADULT MOVEMENT AND RESISTANCE MANAGEMENT	I	338	22/08/00	16:30	CC		7	PS	7
Hunter, D. M.	142	LOCUST FORECASTING AND PREVENTIVE CONTROL IN AUSTRALIA	I	37	25/08/00	11:30	HB	A	2	9	2
Hunter, D. M.	1020	USE OF THE FUNGUS METARHIZIUM ANISOPLIAE TO CONTROL LOCUSTS IN AUSTRALIA	I	257	23/08/00	16:30	CC		6	PS	6
Hunter, G.	1972	UNDERSTANDING THE INTRODUCTION AND SPREAD OF SIREX NOCTILIO IN THE SOUTHERN HEMISPHERE	I	497	25/08/00	16:30	CC		10	PS	10
Hurd, H.	2990	MALARIA AND MOSQUITOES: PARASITE-INDUCED APOPTOSIS REDUCES VECTOR REPRODUCTIVE FITNESS AND MAY ENHANCE TRANSMISSION	II	754	23/08/00	16:30	CC		15	PS	15
Hurd, H.	1569	EFFECT OF THE FILARIAL PARASITE WUCHERERIA BANCROFTI (NEMATODA: FILARIDAE) ON THE REPRODUCTION OF CULEX QUINQUEFASCIATUS (DIPTERA:CULICIDAE)	I	396	23/08/00	16:30	CC		8	PS	8
Hurd, H.	3218	THE EFFECT OF MALARIA INFECTION ON MOSQUITO VITELLOGENESIS	II	812	22/08/00	16:30	CC		17	PS	17
Hurd, H.	2396	CELLULAR IMMUNE RESPONSE OF THE MOSQUITO CULEX QUINQUEFASCIATUS (DIPTERA-CULICIDAE) TO CANDIDA ALBICANS INFECTION.	II	605	21/08/00	16:30	CC		13	PS	13
Hurst, G.	2900	SYMBIONT-MEDIATED MALE-KILLING AND THE POTENCIAL BIOTECHNOLOGICAL APPLICATIONS	II	732	23/08/00	10:50	Bol	R	15	5	15
Husseneder, C.	3502	GENETIC VARIABILITY AND POPULATION STRUCTURE OF THE FORMOSAN SUBTERRANEAN TERMITE IN HAWAII	II	884	23/08/00	16:30	CC		19	PS	19
Hutmacher, R. B.	2695	INFLUENCE OF COTTON NITROGEN FERTILITY ON COTTON APHID, APHIS GOSSYPII, POPULATION DYNAMICS IN CALIFORNIA	II	681	22/08/00	16:30	CC		14	PS	14
Huttinger , E.	785	HOW MIGRATION AFFECTS ECOLOGICAL DIVERSIFICATION OF APIS DORSATA POPULATION. AN APPROACH BY SELF-ORGANIZING MAPS PROCESSING	I	198	21/08/00	16:30	CC		5	PS	5
Huxham, K. A.	3937	NORTHERN AUSTRALIA QUARANTINE STRATEGY, AUSTRALIA'S FRONTLINE OF DEFENCE	II	994	21/08/00	16:30	CC		22	PS	22
Huybrechts, R.	3261	ANGIOTENSIN CONVERTING ENZYME-LIKE ACTIVITY IN THE FLESHFLY NEOBELLIERIA BULLATA	II	824	21/08/00	16:15	HB	K	18	1	18
Hwang, J. J.	2975	EFFECT OF TEMPERATURE AND GREGARINES INFECTION ON DISTRIBUTION OF AEDES ALBOPICTUS AND AEDES AEGYPTI IN TAIWAN	II	751	22/08/00	16:30	CC		15	PS	15
Hwang, S. J.	2445	COMPARATIVE ANALYSIS OF STORAGE PROTEIN GENE OF FALL WEBWORM, HYPHANTRIA CUNEA	II	618	22/08/00	16:30	CC		13	PS	13
Hyodo, F.	559	SPECIES DIVERSITY AND FUNCTIONAL DIVERSITY OF TERMITES IN EASTERN ASIA	I	141	25/08/00	16:30	CC		3	PS	3
Iamandei, M.	2041	THE EXPERIMENTAL TRIALS WITH THE VIRAL PRODUCT "Inf-Hc" FOR DENSITY CONTROL OF PEST POPULATIONS OF HYPHANTRIA CUNEA	I	515	21/08/00	16:30	CC		11	PS	11
Iamandei, M.	1847	A NEW VIRAL PRODUCT "Inf-Ld" USED IN THE CONTROL OF POPULATIONS DENSITY OF LYMANTRIA DISPAR L. AND EUPROCTIS CHRYSORRHOEA	I	466	23/08/00	15:35	HB	M	10	4	10
Iatrou, K.	2222	INSECT TRANSGENESIS: BACULOVIRUSES MEET TRANSPOSONS FOR BENEFICIAL INVASIONS	I	561	25/08/00	16:05	HB	L	12	10	12
Iatrou, K.	3304	GENE REGULATION DURING OVARIAN DEVELOPMENT IN THE SILKMOTH	II	834	25/08/00	15:35	HB	K	18	7	18
Ibañez, A.	531	INSECT INDUCED GALL DIVERSITY IN COIBA NATIONAL PARK (PANAMA)	I	134	24/08/00	16:30	CC		3	PS	3
Ibáñez-Bernal, S.	485	SOCIEDAD MEXICANA DE ENTOMOLOGIA, A.C.	I	123	22/08/00	16:30	CC		3	PS	3
Ibarra, F.	712	BEHAVIOURAL AND ELECTROPHYSIOLOGICAL RESPONSES OF SILVER Y MOTH, AUTOGRAPHA GAMMA (LEPIDOPTERA: NOCTUIDAE), TO FLORAL VOLATILES	I	180	24/08/00	16:30	CC		4	PS	4
Ibarra, F.	725	POLLINATOR ATTRACTION BY PHEROMONE-MIMICKING VOLATILES IN AUSTRALIAN AND EUROPEAN ORCHIDS	I	183	25/08/00	16:30	CC		4	PS	4
Ibarra, F.	627	IDENTIFICATION OF FEMALE AND MALE SEX PHEROMONES IN THE SOLITARY BEE OSMIA RUFA (HYMENOPTERA: MEGACHILIDAE)	I	159	21/08/00	16:30	CC		4	PS	4

Sub-titles: (HB=Hotel Bourbon) - (HM=Hotel Mabu) - (CC=Convention Center) - (Bol=Foz Boulevard) - (PS=Poster Session) - (PL=Plenary Lecturer)

AUTHOR	Nº	TITLE	Book	Page	Date	Time	Local	Room	Session	Symp	New Session
Ichihara, N.	3312	MOLECULAR BIOLOGY OF INSECT CLOCKS FOR PHOTOPERIODISM	II	836	25/08/00	14:00	HB	K	18	8	18
Ichihara, N.	3557	PHOTOPERIODIC CLOCK-ENDOCRINE SWITCH AXIS IN DIAPAUSE REGULATION IN SILKMOTH	II	897	24/08/00	16:30	CC		19	PS	19
Ichikawa, N.	4081	HONEY-CROP MODIFIES THE CLASSICAL CONDIGIONING OF PROBOSCIS EXTENTION REFLEX (PER) IN HONEYBEES	II	1030	22/08/00	16:30	CC		23	PS	23
Ichiki, R.	1655	A MICRO-OVIPAROUS TACHINID PEXOPSIS PILOSA (DIPTERA: TACHINIDAE) PARASITIC ON SCARABAEID BEETLES IN JAPAN	I	417	24/08/00	16:30	CC		8	PS	8
Ichinose, K.	4156	FOOD PRODUCTION SEASONALLY ADJUSTED FOR THE BROOD REARING IN THE LEAF-CUTTING ANT, ACROMYRMEX BALZANI	II	1050	21/08/00	16:30	CC		Erratum	PS	2
Ichinose, R.	3961	INSECTICIDAL ACTIVITY OF A NOVEL INSECT PEST CONTROL AGENT, CHROMAFENOZIDE	II	1000	22/08/00	16:30	CC		22	PS	22
Ichinose, R.	2726	MODE OF ACTION AND CHARACTARISTICS OF A NOVEL INSECT PEST CONTROL AGENT, CHROMAFENOZIDE	II	688	23/08/00	16:30	CC		14	PS	14
Ieuma, I.	1622	BIOLOGICAL DATA OF SOME NATURAL ENEMIES OF THE SOURSOP BORER CERCONOTA ANONELLA (LEPIDOPTERA: OECOPHORIDAE) IN PLANALTINA, FEDERAL DISCTRICT, BRAZIL	I	409	24/08/00	16:30	CC		8	PS	8
Ieuma, I. M.	1021	MAJOR PESTS OF SOURSOP (ANNONA MURICATA) IN BRAZILIAN CERRADOS REGION AND THEIR NATURAL ENEMIES	I	258	23/08/00	16:30	CC		6	PS	6
Ide, S.	255	FIRST RECORD OF OCCURRENCE OF APHIS SPIRAECOLA (HEMIPTERA: APHIDIDAE) ON IXORA COCCINEA AND I. COCCINEA VAR. COMPACTA (RUBIACEAE)	I	65	23/08/00	16:30	CC		2	PS	2
Ide, S.	1767	CLADISTIC ANALYSIS OF NEOTROPICAL GENERA OF PHILEURINI (COLEOPTERA, SCARABAEIDAE, DYNASTINAE)	I	445	22/08/00	16:30	CC		9	PS	9
Ide, S.	3143	MORPHOLOGY OF THE LARVA AND OBSERVATIONS ON BIOLOGY OF PLATYPUS MUTATUS (COLEOPTERA, CURCULIONIDAE, PLATYPODINAE)	II	793	24/08/00	16:30	CC		16	PS	16
Ide, S.	3144	DESCRIPTION OF FINAL LARVAL INSTAR AND PUPA OF CURINUS COERULEUS (COLEOPTERA, COCCINELLIDAE, CHILOCORINAE), A PREDATOR OF ALEUROTHRIXUS SP. (HEMIPTERA, ALEYRODIDAE) AND NOTES ON THE ASSOCIATED BIOCOENOSIS	II	793	23/08/00	16:30	CC		16	PS	16
Ide, S.	1832	CERTIFICATION OF EXPORTED CHILEAN FOREST PRODUCTS. ADVANCES IN THE MANAGEMENT OF ENTOMOLOGICAL RISKS	I	462	22/08/00	13:35	HB	M	10	3	10
Ide, S.	1882	RISK TO SOUTH AMERICAN RADIATA PINE RESOURCES BY THE PINE SHOOT MOTH, RHYACIONIA BUOLIANA	I	474	26/08/00	10:05	HB	M	10	9	10
Iede, E. T.	1823	INTRODUCTION AND RELEASE OF RHISSINES TO CONTROL SIREX NOCTILIO IN BRAZIL	I	460	22/08/00	9:35	HB	M	10	2	10
Iede, E. T.	1881	SIREX NOCTILIO IN SOUTH AMERICA: DISTRIBUTION, MONITORING AND CONTROL	I	474	26/08/00	9:35	HB	M	10	9	10
Iersel, M. W. van	301	SUBIRRIGATION APPLICATION OF IMIDACLOPRID FOR CONTROL OF BEMISIA ARGENTIFOLII	I	76	24/08/00	16:30	CC		2	PS	2
Igarashi, S.	2771	AGRONOMICAL EFFICACY OF DIFFERENT FORMULATIONS AND MIXTURES OF THE INSECTICIDE LAMBDACYHALOTHRIN FOR THE CONTROL OF PERILEUCOPTERA COFFEELLA, ON COFFEE CROP THROUGH FOLIAR SPRAY	II	700	24/08/00	16:30	CC		14	PS	14
Igarashi, S.	2772	AGRONOMICAL EFFICACY OF THE PRODUCTS CYPROCONAZOLE AND THIAMETHOXAM IN THE CONTROL OF HEMILEIA VASTATRIX, PERILEUCOPTERA COFFEELLA AND QUESADA GIGAS, THROUGH APPLICATION IN THE SOIL	II	700	24/08/00	16:30	CC		14	PS	14
Iglesias, M. S.	3125	DESCRIPTION OF THE PREIMAGINAL INSTARS OF PARAVELIA CORRENTINA (HETEROPTERA: VELIIDAE)	II	788	22/08/00	16:30	CC		16	PS	16
Ignatowicz, S.	3923	QUARANTINE PESTS AND INTERRUPTED TRADE: EXPERIENCES FROM POLAND AND SOME OTHER COUNTRIES	II	990	26/08/00	9:30	HB	H	22	8	22
Ignatowicz, S.	4012	RADIATION DISINFESTATION OF GRAIN AND OTHER STORED PRODUCTS AS A TECHNOLOGY FOR METHYL BROMIDE SUBSTITUTION	II	1013	21/08/00	15:15	HB	J	23	2	23
Ignatowicz, S.	4082	CONTROL OF HOUSE FLIES WITH LARVICIDE AND POISON BAITS	II	1031	22/08/00	16:30	CC		23	PS	23
Ignell, R.	675	JUVENILE HORMONE – ITS EFFECT ON AGGREGATION BEHAVIOUR AND CENTRAL NERVOUS PROCESSING OF AGGREGATION PHEROMONES IN THE DESERT LOCUST	I	171	23/08/00	16:30	CC		4	PS	4
Igre-Barcic, J.	258	GIANT BLACK BARK PEACH APHID PTEROCHLOROIDES PERSICAE (HOMOPTERA: LACNIDAE)	I	66	23/08/00	16:30	CC		2	PS	2
Igre-Barcic, J.	2864	CITRUS WHITEFLY, DIALEURODES CITRI (HOMOPTERA: ALEYRODIDAE) IN ADRIATIC REGION OF CROATIA	II	723	25/08/00	16:30	CC		14	PS	14
Ikeda, K.	2076	MOLECULAR CHARACTERIZATION OF BOMBYX MORI CYTOPLASMIC POLYHEDROSIS VIRUS SEGMENT	I	524	22/08/00	16:30	CC		11	PS	11
Ikeda, S.	2439	HARDINESS TO LOW OR HIGH TEMPERATURE AND DRYING-OUT IN A WATER STRIDER, AQUARIUS PALUDUM AND A SUBSPECIES, A. P. AMAMIENSIS	II	616	22/08/00	16:30	CC		13	PS	13
Il'ichev, A. L.	676	AREAWIDE MAPPING OF MAJOR PESTS ABUNDANCE WITH THE SEX PHEROMONE TRAPS AND MASS-TRAPPING IN HOT SPOTS ON VEGETABLES IN THE FORMER SOVIET UNION	I	171	23/08/00	16:30	CC		4	PS	4
Il'ichev, A. L.	1128	THE BLACK LIGHT TRAP FOR MONITORING OF CODLING MOTH CYDIA POMONELLA (LEPIDOPTERA: TORTRICIDAE) IN POME FRUIT ORCHARD UNDER MATING DISRUPTION	I	284	24/08/00	16:30	CC		6	PS	6
Il'ichev, A. L.	2710	TWO YEARS OF AREAWIDE MATING DISRUPTION APPLICATION FOR SUCCESSFUL CONTROL OF ORIENTAL FRUIT MOTH GRAPHOLITA MOLESTA (LEPIDOPTERA: TORTRICIDAE) IN VICTORIA, AUSTRALIA	II	684	22/08/00	16:30	CC		14	PS	14
Imai, C.	3374	PHOTOPERIODIC CONTROL OF SEASONAL DEVELOPMENT IN THE SCUTELLERID BUG, POECILOCORIS LEWISI	II	852	25/08/00	16:30	CC		18	PS	18
Imai, K.	838	HOST PLANT DEFENSE INHIBITING SYNCHRONY WITH ITS FRUIT GALL MIDGE, ASPONDYLIA AUCUBAE	I	212	23/08/00	14:15	HB	D	6	5	6
Imamura, T.	3503	CHEMICAL STRUCTURE AND PROPERTIES OF SILK PROTEINS PRODUCED BY THE SILKWORMS REARED UNDER ARTIFICIAL DIET/ASEPTIC CONDITIONS	II	884	23/08/00	16:30	CC		19	PS	19
Imenes, S. D. L.	3143	MORPHOLOGY OF THE LARVA AND OBSERVATIONS ON BIOLOGY OF PLATYPUS MUTATUS (COLEOPTERA, CURCULIONIDAE, PLATYPODINAE)	II	793	24/08/00	16:30	CC		16	PS	16
Imenes, S. D. L.	255	FIRST RECORD OF OCCURRENCE OF APHIS SPIRAECOLA (HEMIPTERA: APHIDIDAE) ON IXORA COCCINEA AND I. COCCINEA VAR. COMPACTA (RUBIACEAE)	I	65	23/08/00	16:30	CC		2	PS	2
Imperatriz-Fonseca, V. L.	1012	CIRCADIAN RHYTHMS ON NECTAR AND POLLEN COLLECTION BY FORAGERS OF MELIPONA BICOLOR BICOLOR (HYMENOPTERA, APIDAE, MELIPONINAE)	I	255	22/08/00	16:30	CC		6	PS	6
Imperatriz-Fonseca, V. L.	972	NECTAR AND POLLEN COLLECTION PATTERNS OF MELIPONA BICOLOR BICOLOR (HYMENOPTERA, APIDAE, MELIPONINAE)	I	245	22/08/00	16:30	CC		6	PS	6
Imperatriz-Fonseca, V. L.	3322	NESTMATE RECOGNITION IN SCAPTOTRIGONA BIPUNCTATA (HYMENOPTERA, APIDAE, MELIPONINAE)	II	839	21/08/00	16:30	CC		18	PS	18
Imperatriz-Fonseca, V. L.	3363	SEASONAL PARTIAL INACTIVITY IN THE STINGLESS BEE PLEBEIA REMOTA (HYMENOPTERA, APIDAE)	II	849	24/08/00	16:30	CC		18	PS	19
Imperatriz-Fonseca, V. L.	398	HOW FAR NORTH AND SOUTH DOES THE APIFAUNA OF AMAZONIA REACH, ESPECIALLY THE BEE SPECIES VISITING MASS-FLOWERING TREES	I	101	22/08/00	15:05	HB	C	3	2	3
Impithuksa, S.	2650	INSECTICIDE SPRAYING TECHNIQUES FOR CONTROLLING THE DIAMOND BACK MOTH, PLUTELLA XYLOSTELLA ON CHINESE KALE	II	669	21/08/00	16:30	CC		14	PS	14
Inacio Ribeiro, J. R.	1022	BELOSTOMA (HETEROPTERA: BELOSTOMATIDAE) FROM THE STATE OF RIO DE JANEIRO, SE BRAZIL	I	258	23/08/00	16:30	CC		6	PS	6

Sub-titles: (HB=Hotel Bourbon) - (HM=Hotel Mabu) - (CC=Convention Center) - (Bol=Foz Boulevard) - (PS=Poster Session) - (PL=Plenary Lecturer)

AUTHOR	N°	TITLE	Book	Page	Date	Time	Local	Room	Session	Symp	New Session
Inácio, M. L.	1166	POPULATION BEHAVIOUR CHANGES OF THE PROCESSIONARY MOTH (THAUMETOPOEA PITYOCAMPA) IN PORTUGAL	I	294	25/08/00	16:30	CC		6	PS	6
Ingerson-Mahar, J.	2071	A COMPARISON OF CARABID SPECIES IN FOUR VEGETATION TYPES	I	522	22/08/00	16:30	CC		11	PS	11
Inglis, P. W.	2152	CLONING AND HETEROLOGOUS EXPRESSION OF A BACILLUS THURINGIENSIS PROTEIN TOXIC AGAINST THE FALL ARMYWORM	I	543	25/08/00	16:30	CC		11	PS	11
Inglis, P. W.	2156	PHYLOGENY OF PAECILOMYCES SPECIES REVEALED BY ANALYSIS OF RIBOSOMAL RNA ITS SEQUENCES	I	544	25/08/00	16:30	CC		11	PS	11
Inglis, P. W.	2157	PHYLOGENY OF PAECILOMYCES SPECIES REVEALED BY ANALYSIS OF RIBOSOMAL RNA ITS SEQUENCES	I	544	25/08/00	16:30	CC		11	PS	11
Inoue, H.	792	SPECIES INFORMATION DATABASE KONCHU ON JAPANESE, EAST ASIAN AND PACIFIC INSECTS, SPIDERS AND MITES ON INTERNET	I	200	23/08/00	16:30	CC		5	PS	5
Inoue, S.	2439	HARDINESS TO LOW OR HIGH TEMPERATURE AND DRYING-OUT IN A WATER STRIDER, AQUARIUS PALUDUM AND A SUBSPECIES, A. P. AMAMIENSIS	II	616	22/08/00	16:30	CC		13	PS	13
Inoue, T.	1820	CHANGE IN BUTTERFLY COMMUNITY WITH SECONDARY SUCCCESION OF TEMPERATE DECIDUOUS FOREST	I	459	21/08/00	15:50	HB	M	10	1	10
Inoue, T.	3237	INTRA-SPECIES VARIATION OF TOMATO SPOTTED WILT TOSPOVIRUS TRANSMISSION BY THE WESTERN FLOWER THRIPS	II	817	24/08/00	16:30	CC		17	PS	17
Inoue-Nagata, A. K.	3217	A WAY TO DIFFERENTIATE VECTOR SPECIFICITY BY THRIPS IN TOMATO SPOTTED WILT VIRUS TRANSMISSION	II	812	22/08/00	16:30	Bol	U	17	2	17
Introna, F.	2954	THE FORENSIC ENTOMOLOGIST IN THE CONTEXT OF THE FORENSIC PATHOLOGIST'S ROLE	II	745	26/08/00	15:00	Bol	R	15	11	15
Inumaru, S.	3523	MASS-PRODUCTION OF PORCINE INTERLEUKIN-2 IN BOMBYX MORI	II	889	24/08/00	16:30	CC		19	PS	19
Inward, D. J. G.	3677	TOWARDS A MOLECULAR PHYLOGENY OF SCARABAEID DUNG BEETLES	II	928	24/08/00	16:05	HB	E	21	7	21
Inward, D. J. G.	1205	ASSESSING THE HISTORICAL AFFINITIES OF NEOTROPICAL BEETLE FAUNAS AT A JOINT UK BELIZEAN FIELD SITE	I	304	23/08/00	16:30	CC		6	PS	6
Ioannidis, P. M.	1341	DETECTION OF INSECTICIDE RESISTANCE IN PEACH POTATO APHIDS MYZUS PERSICAE AND IN TOBACCO APHIDS MYZUS NICOTIANAE BLACKMAN	I	338	23/08/00	16:30	CC		7	PS	7
Ioffe-Uspensky, I.	4093	LOUSE COMB VERSUS HAND EXAMINATION FOR THE DIAGNOSIS OF HEAD LOUSE INFESTATIONS	II	1033	25/08/00	16:30	CC		23	PS	23
Iracheta, M.	2077	A PAECILOMYCES FUMOSOROSEUS MUTANT OVERPRODUCING CHITINASE DISPLAYS HIGH VIRULENCE AGAINST BEMISIA TABACI	I	524	22/08/00	16:30	CC		11	PS	11
Iracheta, M.	2125	GENETIC VARIABILITY AMONG BEAUVERIA BASSIANA AND PAECILOMYCES FUMOSOROSEUS	I	536	24/08/00	16:30	CC		11	PS	11
Irie, M.	3095	ULTRASTRUCTURES AND MOVEMENTS IN THE SPERMATOZOON OF STAG BEETLES	II	781	26/08/00	11:15	HB	G	16	9	16
Irie, M.	3094	ULTRASTRUCTURE OF DIMORPHIC SPERMATOZOA AND THEIR FERTILIZATION IN CICADIDAE (HEMIPTERA)	II	781	26/08/00	10:50	HB	G	16	9	16
Irie, M.	3096	PHYLOGENETIC RELATIONSHIP ON SPERM ULTRASTRUCTURE OF THE STAG BEETLES (COLEOPTERA-LUCANIDAE)	II	781	26/08/00	11:40	HB	G	16	9	16
Irvin, N.	1424	ADDING FLORAL RESOURCES TO AGRO-ECOSYSTEMS: MANAGING THE CONSEQUENCES FOR THIRD AND FOURTH TROPHIC LEVELS	I	359	21/08/00	11:20	HM	O	8	1	8
Irwin, M. E.	816	THE RELATION OF ATMOSPHERIC FACTORS AND THE DISTRIBUTION OF APHIDS AND OTHER SMALL INSECTS IN THE AIR	I	206	22/08/00	11:05	HB	D	6	3	6
Irwin, M. E.	123	LITTLE UNDERSTOOD AND DIFFICULT TO MANIPULATE, THE OLDEST CLASSICAL TACTIC HAS UNTAPPED POTENTIAL	I	32	24/08/00	9:35	HB	A	2	7	2
Irwin, M. E.	151	SUMMING UP AND GENERAL DISCUSSION	I	39	25/08/00	15:30	HB	A	2	9	2
Irwin, M. E.	501	SYSTEMATICS AND BIOGEOGRAPHY OF THE CYCLOTELINE THEREVINAE (DIPTERA: THEREVIDAE)	I	127	22/08/00	16:30	CC		3	PS	3
Isaac, R. E.	2345	MIMETIC INSECTATACHYKININ ANALOGS: INTERACTION WITH AN EXPRESSED STABLE FLY TACHYKININ-LIKE RECEPTOR AND ACTIVE CONFORMATION	II	592	21/08/00	15:05	HB	I	13	2	13
Isasi , N. T.	1916	NATURAL RESISTANCE OF TEN CUBAN FOREST SPECIES AGAINST TERMITE ATTACK	I	483	22/08/00	16:30	CC		10	PS	10
Isenhour, D. J.	2563	THE UTILIZATION AND VALUE OF TRANSGENIC CROPS WITH RESISTANCE TO INSECTS IN INTEGRATED PEST MANAGEMENT SYSTEMS	II	648	22/08/00	14:05	HB	B	14	4	14
Ishaaya, I.	1271	BIORATIONAL AGENTS – MECHANISM AND IMPORTANCE IN INTEGRATED PEST MANAGEMENT (IPM) AND INSECTICIDE RESISTANCE MANAGEMENT (IRM) PROGRAMS	I	321	25/08/00	10:35	HM	N	7	9	7
Ishaaya, I.	1342	NOVALURON (RIMON EC-10), A NOVEL IGR FOR CONTROLLING AGRICULTURAL INSECT PESTS	I	339	23/08/00	16:30	CC		7	PS	7
Ishaaya, I.	1842	BIORATIONAL AGENTS – MECHANISM AND IMPORTANCE IN INTEGRATED PEST MANAGEMENT (IPM) AND INSECTICIDE RESISTANCE MANAGEMENT (IRM) PROGRAMS	I	464	23/08/00	11:35	HB	M	10	4	10
Ishaaya, I.	1277	PROGRESSIVE INSECTICIDE RESISTANCE MANAGEMENT PROGRAMS IN THE ISRAELI AGRICULTURAL ECOSYSTEM	I	322	25/08/00	14:20	HM	N	7	10	7
Ishibashi, J.	2446	ISOLATION, cDNA CLONING AND MODIFICATION OF DEFENSIN FROM THE COCONUT RHINOCEROS BEETLE, ORYCTES RHINOCEROS	II	618	22/08/00	16:30	CC		13	PS	13
Ishibashi, J.	2356	REGULATION OF TISSUE-SPECIFIC AND LIPOPOLYSACCHARIDE-INDUCIBLE GENE EXPRESSION OF AN ANTIBACTERIAL PROTEIN FROM THE SILKWORM, BOMBYX MORI	II	595	23/08/00	11:45	HB	I	13	4	13
Ishibashi, J.	2516	CDNA CLONING AND EXPRESSION ANALYSIS OF REL PROTEINS FROM BOMBYX MORI	II	635	25/08/00	16:30	CC		13	PS	13
Ishii, M.	1023	THREATENED JAPANESE BUTTERFLIES LISTED BY THE ENVIRONMENT AGENCY OF JAPAN IN 2000	I	258	23/08/00	16:30	CC		6	PS	6
Ishii, M.	1549	HOST-PARASITE RELATIONSHIP BETWEEN THE MIGRANT BUTTERFLY, PARANTICA SITA (LEPIDOPTERA: DANAIDAE), AND ITS TACHINID PARASITOID, STURMIA BELLA (DIPTERA: TACHINIDAE), AT THREE HABITATS IN THE KII PENINSULA, CENTRAL JAPAN	I	391	22/08/00	16:30	CC		8	PS	8
Ishijima, S.	3095	ULTRASTRUCTURES AND MOVEMENTS IN THE SPERMATOZOON OF STAG BEETLES	II	781	26/08/00	11:15	HB	G	16	9	16
Ishikawa, H.	2142	TRANSINFECTION OF WOLBACHIA ENDOSYMBIONTS AMONG THREE SPECIES OF LEPIDOPTERAN INSECTS	I	540	25/08/00	16:30	CC		11	PS	11
Ishikawa, H.	2504	THE GENOME ORGANIZATION OF BUCHNERA, AN INTRACELLULAR BACTERIAL SYMBIONT OF APHIDS	II	632	24/08/00	16:30	CC		13	PS	13
Ishikawa, Y.	2476	BIPHASIC EFFECT OF LOW TEMPERATURE ON COMPLETION OF WINTER DIAPAUSE IN THE ONION MAGGOT	II	625	23/08/00	16:30	CC		13	PS	13
Isidoro, N.	3145	SPIRACULAR GLANDS OF DROSOPHILA MELANOGASTER PUPARIA ELICIT RECOGNITION RESPONSE IN TRICHOPRIA DROSOPHILAE	II	793	23/08/00	16:30	CC		16	PS	16
Isman, M. B.	1253	OPPORTUNITIES AND PROBLEMS FOR DEVELOPMENT AND USE OF BOTANICAL INSECTICIDES IN INDUSTRIALIZED COUNTRIES	I	316	24/08/00	9:50	HM	N	7	7	7
Isobe, Y.	2530	TASTE ENHANCING EFFECT OF GLYCINE ON THE SWEETNESS OF GLUCOSE: A GUSTATORY TRICK FOR THE SYMBIOSIS BETWEEN THE ANT, CAMPONOTUS JAPONICUS AND THE LARVAE OF THE LYCAENID BUTTERFLY, NIPHANDA FUSCA	II	639	25/08/00	16:30	CC		13	PS	13
Isodoro, N.	1807	HOST LOCATION AND OVIPOSITION IN THE ORUSSIDAE (HYMENOPTERA), A BASAL PARASITIC WASP FAMILY	I	455	25/08/00	16:30	CC		9	PS	9
Isola, N.	368	FRUIT FLY (DIPTERA:TEPHRITIDAE) QUARANTINE PROCEDURES FOR EXPORT OF AVOCADOS FROM ARGENTINA TO CHILE	I	93	25/08/00	16:30	CC		2	PS	2
Issa, M. R. C.	3440	VARROA JACOBSONI INFESTATIONS IN THE TRANSITION ZONE BETWEEN AFRICANIZED AND EUROPEAN BEES	II	868	24/08/00	10:50	HM	Q	19	5	19
Itami, J. K.	829	SPECIATION IN GALL-INDUCING INSECTS	I	210	23/08/00	10:35	HB	D	6	5	6

Sub-titles: (HB=Hotel Bourbon) - (HM=Hotel Mabu) - (CC=Convention Center) - (Bol=Foz Boulevard) - (PS=Poster Session) - (PL=Plenary Lecturer)

AUTHOR	N°	TITLE	Book	Page	Date	Time	Local	Room	Session	Symp	New Session
Ito, H.	3503	CHEMICAL STRUCTURE AND PROPERTIES OF SILK PROTEINS PRODUCED BY THE SILKWORMS REARED UNDER ARTIFICIAL DIET/ASEPTIC CONDITIONS	II	884	23/08/00	16:30	CC		19	PS	19
Ito, H.	564	RELATION BETWEEN THE DIVERSITY OF CARABID BEETLES AND DEER, MICE, AND DWARF BAMBOO IN A DECLINING ALPINE FOREST	I	143	25/08/00	16:30	CC		3	PS	3
Ito, K.	3304	GENE REGULATION DURING OVARIAN DEVELOPMENT IN THE SILKMOTH	II	834	25/08/00	15:35	HB	K	18	7	18
Ito, K.	371	MIGRATION-RELATED CHARACTERS OF THE BROWN PLANT-HOPPER, NILAPARVATA LUGENS, COLLECTED IN EAST AND SOUTHEAST ASIA	I	94	25/08/00	16:30	CC		2	PS	2
Itoh, T.	2474	MODALITY-SPECIFIC PROJECTIONS OF ANTENNAL SENSORY AFFERENTS IN THE COCKROACH BRAIN	II	625	23/08/00	16:30	CC		13	PS	13
Ivezi*, M.	324	BT CORN IN CONTROLING ECB IN CROATIA.	I	82	24/08/00	16:30	CC		2	PS	2
Ivezi*, M.	2711	ECB (OSTRINIA NUBILALIS) AND WCR (DIABROTICA VIRGIFERA VIRGIFERA) IN EAST SLAVONIA (CROATIA)	II	685	22/08/00	16:30	CC		14	PS	14
Ivie, M.	797	PROBLEMS AND STATUS OF TAXOMONIC RELATIONSHIPS AMONG CEPHIDAE	I	202	21/08/00	9:35	HB	D	6	1	6
Iwabuchi, K.	1603	REQUIREMENT OF LIPOPHORIN AND ECDYSTEROID FOR IN VITRO DEVELOPMENT OF A LARVAL ENDOPARASITOID, VENTURIA CANESCENS (HYMENOPTERA: ICHNEUMONIDAE)	I	404	23/08/00	16:30	CC		8	PS	8
Iwahashi, O.	3878	AEDEAGAL LENGTH PLASTICITY WITHIN SPECIES OF BACTROCERA DORSALIS COMPLEX	II	979	22/08/00	9:35	HB	H	22	2	22
Izawa, H.	2712	INTEGRATED PEST MANAGEMENT PROGRAM USING MATING DISRUPTOR IN JAPANESE PEAR ORCHARDS	II	685	22/08/00	16:30	CC		14	PS	14
Izquierdo, I.	1897	PEST INSECT IN EUCALYPTUS FOREST PLANTATION ON TABASCO STATE, MEXICO.	I	478	26/08/00	16:20	HB	M	10	10	10
Izquierdo, I.	514	THE INSECTS COLLECTED BY THE COMISIÓN CIENTÍFICA DEL PACÍFICO: STUDYING BIODIVERSITY THROUGH HISTORICAL COLLECTIONS	I	130					3		3
Izquierdo, I.	513	THE INSECTS COLLECTED BY THE COMISIÓN CIENTÍFICA DEL PACÍFICO: STUDYING BIODIVERSITY THROUGH HISTORICAL COLLECTIONS	I	130	23/08/00	16:30	CC		3	PS	3
Izquierdo, I.	549	AN UNEXPLORED STORE OF THE EQUATOGUINEAN BIODIVERSITY IN THE MUSEO NACIONAL DE CIENCIAS NATURALES	I	139	24/08/00	16:30	CC		3	PS	3
J. C. Dickens	606	CHEMICAL VOCABULARY OF THE COLORADO POTATO BEETLE	I	153	23/08/00	14:35	Bol	S	4	5	4
J. D. Mumford	3894	INTEGRATING BIOPESTICIDES INTO THE IPM PARADIGM WITHOUT RISKS	II	983	24/08/00	14:00	HB	J	22	4	22
J. F. Day	2886	CULEX NIGRIPALPUS--AVIAN INTERACTION AND THE TRANSMISSION OF ST. LOUIS ENCEPHALITIS	II	728	22/08/00	13:35	Bol	R	15	4	15
J. Heinze, K.	1768	COOPERATION AND DIVISION OF LABOR BETWEEN UNRELATED INDIVIDUALS IN THE ANT PACHYCONDYLA 'INVERSA'	I	445	22/08/00	16:30	CC		9	PS	9
J. K Staples	678	CHEMICAL DEFENSE IN THE PLANT BUG LOPIDEA ROBINIAE	I	171	23/08/00	16:30	CC		4	PS	4
J. Soberon	772	ISSUES OF QUALITY CONTROL IN LARGE DISTRIBUTED ENTOMOLOGICAL DATABASES	I	195	24/08/00	10:50	Bol	T	5	5	5
J. W. Jenkins	679	USE OF MATING DISRUPTION IN COTTON IN NORTH AMERICA	I	172	23/08/00	16:30	CC		4	PS	4
J.B. Torres	2713	CAN THIAMETHOXAM BE ASSOCIATED TO STINKBUG PREDATOR PODISUS NIGRISPINUS NYMPHS IN A COTTON PEST MANAGEMENT PROGRAM ?	II	685	22/08/00	16:30	CC		14	PS	14
J.R.Haslett	422	INSECTS AS INDICATORS OF CHANGING LAND USE IN ALPINE ENVIRONMENTS	I	107	24/08/00	10:20	HB	C	3	5	3
J.V. Oliveira	2714	CONTROL OF POTATO LEAFHOPPER EMPOASCA KRAEMERI (HEMIPTERA: CICADELLIDAE) WITH THIAMETHOXAM ON COWPEA	II	685	23/08/00	16:30	CC		14	PS	14
Jacas, J. A.	2587	IPM FOR CITRUS IN SPAIN	II	654	24/08/00	14:20	HB	B	14	7	14
Jacintho, E. L.	3504	ADAPTATION OF THE SUBTERRANEAN TERMITE COPTOTERMES HAVILANDI (ISOPTERA: RHINOTERMITIDAE) TO THE INTERIOR OF BRAZIL	II	884	22/08/00	16:30	CC		19	PS	19
Jacintho, E. L.	3455	PRELIMINARY SURVEY AND SPECIES COMPOSITION OF TERMITES IN SOME SITES OF THE CAMPUS OF THE "UNIVERSIDADE FEDERAL RURAL DO RIO DE JANEIRO", IN SEROPEDICA (RJ), BRAZIL	II	872	21/08/00	16:30	CC		19	PS	19
Jacintho, E. L.	3465	ERADICATION OF THE COPTOTERMES HAVILANDI COLONIES BY CURATIVE AND PREVENTIVE TREATMENT OF INFESTED RESIDENTIAL BUILDINGS IN URBAN AREAS IN THE CITIES OF NITEROI AND RIO DE JANEIRO (RJ), BRAZIL	II	875	22/08/00	16:30	CC		19	PS	19
Jackle, H.	2469	OXYGEN RADICAL METABOLISM IN DROSOPHILA MELANOGASTER	II	624	23/08/00	16:30	CC		13	PS	13
Jackson, M. A.	2160	SCREENING FUNGAL PATHOGENS OF INSECTS FOR AMENABILITY TO LIQUID CULTURE SPORE PRODUCTION	I	545	25/08/00	16:30	CC		11	PS	11
Jackson, T.	84	MANAGEMENT OF RHINOCEROS BEETLES IN MALAYSIA	I	22	21/08/00	11:05	HB	A	2	1	2
Jackson, T. A.	82	NATURAL ENEMIES OF THE SCARABAEIDAE	I	22	21/08/00	10:35	HB	A	2	1	2
Jackson, T. A.	2008	CHALLENGES FACING MICROBIAL CONTROL OF SOIL-DWELLING PESTS	I	507	23/08/00	9:35	HM	P	11	5	11
Jackson, T. A.	2014	PATHOGENS OF TARO BEETLES AND THEIR POTENTIAL USE IN PEST MANAGEMENT IN THE SW PACIFIC	I	508	23/08/00	14:00	HM	P	11	5	11
Jackson, T. A.	2010	DISEASE/HOST MODELS FOR SOIL-DWELLING PESTS	I	507	23/08/00	10:35	HM	P	11	5	11
Jacobi, C. M.	3593	USE OF STACHYTARPHETA GLABRA (VERBENACEAE) BY HERBIVOROUS AND NECTARIVOROUS INSECTS IN A METALIFEROUS ALTITUDINAL REGION, MINAS GERAIS, BRAZIL	II	907	21/08/00	16:30	CC		20	PS	20
Jacobs, W.	1903	FOREST SOIL CLASSIFICATION BASED ON COLLEMBOLA FAUNA	I	480	22/08/00	16:30	CC		10	PS	10
Jacobsen, N. L.	3696	PHYLOGENY OF ARCTIIDAE (LEPIDOPTERA: NOCTUOIDEA) BASED ON IMMATURE STAGES AND ADULT MORPHOLOGY	II	933	26/08/00	10:50	HB	E	21	9	21
Jacobs-Lorena, M.	2919	SELECTION OF PEPTIDES FROM A PHAGE-DISPLAY LIBRARY WHICH BIND TO THE MOSQUITO MIDGUT AND TO SALIVARY GLANDS	II	737	24/08/00	16:05	Bol	R	15	8	15
Jacobs-Lorena, M.	2390	THE MOSQUITO PERITROPHIC MATRIX	II	604	26/08/00	11:05	HB	I	13	10	13
Jacobs-Lorena, M.	3001	TOWARD INTERRUPTING MALARIA TRANSMISSION BY GENETIC MANIPULATION OF THE MOSQUITO VECTOR	II	757	23/08/00	16:30	CC		15	PS	15
Jacobson, R. L.	3014	THE PLANT DIET OF SAND FLIES IS A MIXED BLESSING FOR THEIR LEISHMANIA PARASITES	II	760	24/08/00	16:30	CC		15	PS	15
Jadhav, D.	1280	DEVELOPMENT AND APPLICATION OF AN INSECTICIDE RESISTANCE IMPACT MINIMISATION STRATEGY FOR COTTON PEST CONTROL IN INDIA	I	323	25/08/00	15:05	HM	N	7	10	7
Jaenson, T. G. T.	3003	MOSQUITO REPELLENT PLANTS	II	758	24/08/00	16:30	CC		15	PS	15
Jaffe, H.	3250	TESTIS ECDYSIOTROPIN, AN INSECT GONADOTROPIN THAT INDUCES SYNTHESIS OF ECDYSTEROID	II	821	21/08/00	9:50	HB	K	18	1	18
Jaffe, K.	2174	ASSORTATIVE MATING, SEXUAL SELECTION, HAPLODIPLOIDY AND THE EVOLUTION OF SOCIAL BEHAVIOR IN INSECTS	I	549	21/08/00	14:35	HB	L	12	2	12
Jaffe, K.	1721	ASSORTATIVE MATING, SEXUAL SELECTION, HAPLODIPLOIDY AND THE EVOLUTION OF SOCIAL BEHAVIOR IN INSECTS	I	434	22/08/00	9:50	HB	F	9	2	9
Jagge, C.	2486	CLONING AND LOCALIZATION OF AQUAPORIN AND G PROTEIN-COUPLED RECEPTORS FROM THE MOSQUITO Aedes aegypti (DIPTERA) MALPIGHIAN TUBULE	II	628	24/08/00	16:30	CC		13	PS	13
Jaglarz, M. K.	3146	DIFFERENT MECHANISMS ENSURE THE FLOW OF CYTOPLASMIC CONSTITUENTS IN NURSE CELL-OOCYTE SYNCYTIA	II	794	23/08/00	16:30	CC		16	PS	16
Jahnke, S. M.	1024	POPULATION DYNAMICS OF COSMOCLOPIUS NIGROANNULATUS (HEMIPTERA, REDUVIIDAE) IN NICOTIANA TABACUM	I	258	23/08/00	16:30	CC		6	PS	6
Jahnke, S. M.	3176	DESCRIPTION OF INTERNAL REPRODUCTIVE ORGANS OF COSMOCLOPIUS NIGROANNULATUS (HEMIPTERA, REDUVIIDAE)	II	801	24/08/00	16:30	CC		16	PS	16
Jaisson, P.	3362	POSSIBLE REPRODUCTIVE DIVISION OF LABOR IN THE THELYTOKOUS ANT CERAPACHYS BIROI	II	849	24/08/00	16:30	CC		18	PS	18
Jaisson, P.	3469	WORKERS OF THE POLYGYNOUS PONERINE ANT GNAMPTOGENYS STRIATULA DO NOT CARE PREFERENTIALLY FOR SISTER LARVAE	II	876	22/08/00	16:30	CC		19	PS	19

Sub-titles: (HB=Hotel Bourbon) - (HM=Hotel Mabu) - (CC=Convention Center) - (Bol=Foz Boulevard) - (PS=Poster Session) - (PL=Plenary Lecturer)

AUTHOR	Nº	TITLE	Book	Page	Date	Time	Local	Room	Session	Symp	New Session
Jalali, J.	887	DETERMINATION OF SPATIAL DISTRIBUTION PATTERN OF EGG AND LARVAL INSTARS OF ELM-LEAF BEETLE XANTHOGALEAROCELLA LUTEOLA (COL.; CHRYSOMELLIDAE)	I	224	21/08/00	16:30	CC		6	PS	6
Jalali, J.	2715	THE EFFICACY OF CERTAIN AQUEOUS PLANT EXTRACTS FROM GUILAN PROVINCE AGAINST ELM LEAF BEETLE XANTHOGALEAROCELLA LUTEOLA (COL; CHRYSOMELLIDAE)	II	686	23/08/00	16:30	CC		14	PS	14
Jalali, J.	234	FIRST REPORT ON THE PRESENCE OF MULBERRY THRIPS PSEUDODENDROTHRIPS MORI (THYS., THRIPIDAE) AS A NEW SPECIES FOR INSECT FAUNA OF MULBERRY FIELD OF NORTH OF IRAN	I	60	22/08/00	16:30	CC		2	PS	2
Jalali, J.	962	INVESTIGATION ON HOST PREFERENCE OF PSUEDODENDROTHRIPS MORI (THYS; THRIPIDAE) ON FOUR VARIETIES OF MULBERRY IN THE FIELD AND LABORATORY	I	243	23/08/00	16:30	CC		6	PS	6
Jald, H. E.	1025	LIFE TABLE AND DEMOGRAPHIC PARAMETERS OF THE SOUTH AMERICAN FRUIT FLY (DIPTERA: TEPHRITIDAE)	I	259	23/08/00	16:30	CC		6	PS	6
James, A. A.	2220	MARINER MOBILITY IN AEDES AEGYPTI	I	560	25/08/00	15:05	HB	L	12	10	12
James, A. A.	3001	TOWARD INTERRUPTING MALARIA TRANSMISSION BY GENETIC MANIPULATION OF THE MOSQUITO VECTOR	II	757	23/08/00	16:30	CC		15	PS	15
James, A. A.	2927	STRUCTURE AND EXPRESSION OF THE LARVAL AND ADULT HEXAMERIN GENES, MDH1.1 AND MDH2.1, IN MUSCA DOMESTICA	II	739	25/08/00	11:20	Bol	R	15	9	15
James, A. A.	2916	GENETICALLY-ENGINEERED MOSQUITOES RESISTANT TO THE TRANSMISSION OF MALARIA	II	736	24/08/00	14:35	Bol	R	15	8	15
James, D. G.	586	PHEROMONE BIOLOGY OF A PENTATOMID PEST OF AUSTRALIAN CITRUS AND A REDUVIID PREDATOR	I	148	22/08/00	10:50	Bol	S	4	2	4
James, D. G.	2610	MANAGING HETEROPTERAN PESTS OF PERENNIAL CROPS IN THE TROPICS	II	659	26/08/00	14:30	HB	B	14	9	14
James, D. G.	2512	PALATABILITY OF BAIT MATRICES AND MATRIX/TOXICANT COMBINATIONS TO IRIDOMYRMEX PURPUREUS AND I.RUFONIGER GP SP. (HYMENOPTERA: FORMICIDAE)	II	634	25/08/00	16:30	CC		13	PS	13
Jameson, M. L.	3674	PHYLOGENETIC ANALYSES OF THE SUBTRIBE PELIDNOTINA (COLEOPTERA: SCARABAEIDAE)	II	928	24/08/00	15:20	HB	E	21	7	21
Janarthanan, R.	2108	COMPARATIVE EFFICACY OF BACILLUS THURINGIENSIS FORMULATIONS FOR CONTROL OF RICE LEAF FOLDER AND THEIR EFFECTS ON BIODIVERSITY IN RICE ECOSYSTEM	I	532	25/08/00	16:30	CC		11	PS	11
Janarthanan, R.	1598	DEVELOPING A COMMERCIALLY VIABLE SYSTEM USING TRICHOGRAMMA CHILONIS FOR CONTROL OF COTTON BOLLWORM HELIOTHIS ARMIGERA IN INDIA	I	403	23/08/00	16:30	CC		8	PS	8
Janarthanan, R.	1599	DEVELOPING A COMMERCIALLY VIABLE SYSTEM USING CHRYSOPERLA CARNEA FOR CONTROL OF COTTON PESTS IN INDIA	I	403	23/08/00	16:30	CC		8	PS	8
Janczur, M. K.	1343	HOW TO BE OPTIMAL UNDER TOXICANT STRESS: OPTIMAL ENERGY ALLOCATION AND ECOTOXICOLOGY OF INSECTS AND OTHER ARTHROPODS	I	339	23/08/00	16:30	CC		7	PS	7
Jang, C	2862	TOXICAL RESPONSES OF THE ASIAN LADYBIRDS, HARMONIA AXYRIDIS (COLEOPTERA: COCCINELLIDAE), AGAINST SEVERAL INSECTICIDES, ACARICIDES AND FUNGICIDES FOR INTEGRATED PEST MANAGEMENT OF APHIDS IN THE GREENHOUSES	II	722	23/08/00	16:30	CC		14	PS	14
Jani, , A.	226	BIO-CONTROL FOR NEW PESTS INVASIONS IN CALIFORNIA VINEYARDS: OBSCURE MEALYBUG AS A CASE EXAMPLE	I	58	22/08/00	16:30	CC		2	PS	2
Jani, , A.	2661	BIO-CONTROL FOR NEW PESTS INVASIONS IN CALIFORNIA VINEYARDS: OBSCURE MEALYBUG AS A CASE EXAMPLE	II	672	22/08/00	16:30	CC		14	PS	14
Janisiewicz, W.	2910	TRANSMISSION OF E. COLI 0157:H7 BY FLIES TO PRODUCE	II	734	24/08/00	10:35	Bol	R	15	7	15
Janjic, J.	3780	BEHAVIOURAL AND BIOGEOGRAPHICAL IMPLICATIONS OF AGAPOSTEMON PHYLOGENY (HYMENOPTERA: HALICTIDAE)	II	954	23/08/00	16:30	CC		21	PS	21
Jankevica, L.	2078	NEW ISOLATE OF ERIOGASTER LANESTRIS NUCLEOPOLYHEDROVIRUS IN LATVIA	I	524	22/08/00	16:30	CC		11	PS	11
Jankevics, E.	2078	NEW ISOLATE OF ERIOGASTER LANESTRIS NUCLEOPOLYHEDROVIRUS IN LATVIA	I	524	22/08/00	16:30	CC		11	PS	11
Janssen, A.	862	BEHAVIOUR AND INDIRECT INTERACTIONS IN FOOD WEBS OF PLANT-INHABITING ARTHROPODS	I	218	25/08/00	14:05	HB	D	6	8	6
Janssen, A.	300	PROSPECTS FOR BIOLOGICAL CONTROL OF THE WHITEFLY BEMISIA TABACI WITH PHYTOSEIID PREDATORS	I	76	24/08/00	16:30	CC		2	PS	2
Janssen, A.	662	PHYSIOLOGICAL STATE AND ASSOCIATIVE LEARNING DETERMINE RESPONSE OF PREDATORY MITE TO FOOD-RELATED AND OVIPOSITION-RELATED VOLATILES	I	167	22/08/00	16:30	CC		4	PS	4
Janssen, A.	707	ODOUR-MEDIATED INDIRECT INTERACTIONS IN FOOD WEBS	I	179	24/08/00	16:30	CC		4	PS	4
Janssen, A.	707	ODOUR-MEDIATED INDIRECT INTERACTIONS IN FOOD WEBS	I	179	24/08/00	16:30	CC		4	PS	4
Janssen, A.	961	CAN PLANTS USE ENTOMOPATHOGENS AS BODYGUARDS?	I	243	22/08/00	16:30	CC		6	PS	6
Janssen, A.	1199	INTRAGUILD INTERACTIONS IN AN ARTHROPOD FOOD WEB ON PLANTS	I	302	25/08/00	16:30	CC		6	PS	6
Janssen, I.	3261	ANGIOTENSIN CONVERTING ENZYME-LIKE ACTIVITY IN THE FLESHFLY NEOBELLIERIA BULLATA	II	824	21/08/00	16:15	HB	K	18	1	18
Janssen, T.	2259	MOLECULAR CLONING OF NEUROPARSIN PRECURSOR cDNAs IN THE DESERT LOCUST SCHISTOCERCA GREGARIA	I	570	22/08/00	16:30	CC		12	PS	12
Janssen, T.	2447	MOLECULAR CLONING OF NEUROPARSIN PRECURSOR CDNAS IN THE DESERT LOCUST SCHISTOCERCA GREGARIA	II	618	25/08/00	16:30	CC		13	PS	13
Janssen, T.	2321	THE 4-kDa PROTEASE INHIBITOR FAMILY IN THE DESERT LOCUST SCHISTOCERCA GREGARIA: MOLECULAR CLONING AND ANALYSIS OF TISSUE- AND STAGE-DEPENDENT EXPRESSION	I	586	23/08/00	16:30	CC		12	PS	12
Janssen, T.	2509	THE 4-KDA PROTEASE INHIBITOR FAMILY IN THE DESERT LOCUST SCHISTOCERCA GREGARIA: MOLECULAR CLONING AND ANALYSIS OF TISSUE- AND STAGE-DEPENDENT EXPRESSION	II	634	24/08/00	16:30	CC		13	PS	13
Janssen, T.	3249	MALE-FEMALE DIFFERENCES IN NEUROPEPTIDE PROFILES IN LOCUSTS	II	821	21/08/00	9:35	HB	K	18	1	18
Janssen, T.	2528	INSECT G PROTEIN-COUPLED RECEPTORS AND SIGNAL TRANSDUCTION	II	638	25/08/00	16:30	CC		13	PS	13
Janssen, T.	2529	INSECT G PROTEIN-COUPLED RECEPTORS AND SIGNAL TRANSDUCTION	II	639	25/08/00	16:30	CC		13	PS	13
Janssens, F.	470	RESPONSES OF COLLEMBOLA COMMUNITIES TO LEAD SHOT DEPOSITIONS IN A HEATHLAND ENVIRONMENT	I	119	21/08/00	16:30	CC		3	PS	3
Janssens, F.	1903	FOREST SOIL CLASSIFICATION BASED ON COLLEMBOLA FAUNA	I	480	22/08/00	16:30	CC		10	PS	10
Jansson, R. K.	1273	BIOLOGICAL ACTIVITY AND FIELD PERFORMANCE OF METHOXYFENOZIDE: A CORNERSTONE FOR CONTROL OF LEPIDOPTEROUS PESTS	I	321	25/08/00	11:20	HM	N	7	9	7
Jany, D.	3999	ECOLOGICAL STUDIES ACCOMPANYING THE CULTIVATION OF TRANSGENIC RAPE AND MAIZE IN THURINGIA (GERMANY)	II	1009	25/08/00	16:30	CC		22	PS	22
Jaramillo, C. A.	2244	EXPRESSION OF PAIRED GROUP III GENES AND THE EVOLUTION OF SEGMENTATION.	I	566	21/08/00	16:30	CC		12	PS	12
Jarošík, V.	2716	DEVELOPMENTAL RATE ISOMORPHY IN INSECTS AND MITES	II	686	23/08/00	16:30	CC		14	PS	14
Jasinskiene, N.	2220	MARINER MOBILITY IN AEDES AEGYPTI	I	560	25/08/00	15:05	HB	L	12	10	12
Jasinskiene, N.	3001	TOWARD INTERRUPTING MALARIA TRANSMISSION BY GENETIC MANIPULATION OF THE MOSQUITO VECTOR	II	757	23/08/00	16:30	CC		15	PS	15
Javahery, M.	3333	DEVELOPMENT AND EVOLUTION OF EGGS IN TRUE BUGS (HEMIPTERA: HETEROPTERA).	II	842	22/08/00	16:30	CC		18	PS	18

Sub-titles: (HB=Hotel Bourbon) - (HM=Hotel Mabu) - (CC=Convention Center) - (Bol=Foz Boulevard) - (PS=Poster Session) - (PL=Plenary Lecturer)

AUTHOR	Nº	TITLE	Book	Page	Date	Time	Local	Room	Session	Symp	New Session
Javahery, M.	3781	PHYLOGENETIC ANALYSIS OF CHARACTERS OF THE MALE AND FEMALE REPRODUCTIVE SYSTEMS OF SOME LAND BUGS (HEMIPTERA: HETEROPTERA.	II	954	23/08/00	16:30	CC		21	PS	21
Javahery, M.	3962	OUTBREAKS OF CEREAL SUNN PESTS (HETEROPTERA: PENTATOMOIDEA) AND SOLUTIONS FOR SUSTAINABLE CONTROL	II	1000	22/08/00	16:30	CC		22	PS	22
Jawara, M.	2964	THE IMPORTANCE OF MOSQUITO LARVAL SURVEYS IN THE MAPPING OF MALARIA TRANSMISSION RISK	II	748	21/08/00	16:30	CC		15	PS	15
Jayaraman, S.	612	PHEROMONE-BASED MASS TRAPPING OF THE BANANA WEEVIL, COSMOPOLITES SORDIDUS & THE WEST INDIAN SUGARCANE WEEVIL, METAMASIUS HEMIPTERUS IN BANANA & PLANTAIN	I	155	24/08/00	11:05	Bol	S	4	6	4
Jayas, D. S.	4041	CANADIAN GRAIN STORAGE CD-ROM	II	1020	23/08/00	15:30	HB	J	23	7	23
Jay-Robert, P.	3675	DUNG BEETLE COMMUNITIES IN MOUNTAIN SYSTEMS (COLEOPTERA: SCARABAEIDAE)	II	928	24/08/00	15:35	HB	E	21	7	21
Jędrzejowska, I.	3334	THE STRUCTURE AND GENESIS OF TELOTROPHIC OVARIES IN RAPHIDIOPTERANS	II	842	22/08/00	16:30	CC		18	PS	18
Jen, W.-Y.	828	CIRCADIAN TEMPERATURE PATTERNS IN TWO CECIDOMYIID GALLS OF MACHILUS THUNBERGII (LAURACEAE)	I	209	23/08/00	10:20	HB	D	6	5	6
Jen, W.-Y.	1810	CIRCADIAN TEMPERATURE PATTERNS IN TWO CECIDOMYIID GALLS OF MACHILUS THUNBERGII (LAURACEAE)	I	456	25/08/00	16:30	CC		9	PS	9
Jenkins, T. M.	2079	DNA SEQUENCE DATA USED TO VALIDATE SPECIES TAXONOMY AND ORIGIN OF UK SUBTERRANEAN TERMITE (ISOPTERA: RHINOTERMITIDAE) INFESTATION	I	524	22/08/00	16:30	CC		11	PS	11
Jensen, B.	1387	GENETIC MAPPING OF LOCI AFFECTING RESISTANCE TO INSECTICIDES IN ANOPHELES GAMBIAE	I	350	24/08/00	16:30	CC		7	PS	7
Jepson, P. C.	1235	CAPTURING POPULATION, COMMUNITY AND LANDSCAPE PROCESSES IN PESTICIDE ECOTOXICOLOGY	I	312	22/08/00	10:05	HM	N	7	3	7
Jepson, P. C.	2573	PESTICIDES, ECOLOGY AND IPM: OPTIMIZING PESTICIDE USE WITHIN PEST MANAGEMENT SYSTEMS	II	650	23/08/00	11:15	HB	B	14	5	14
Jepson, P. C.	2727	INTRODUCTION TO THE SYMPOSIUM: PERSPECTIVES IN ECOTHEORY AND INTEGRATED PEST MANAGEMENT	II	689	23/08/00	16:30	CC		14	PS	14
Jerez, V.	407	CONSERVATION OF THE BIODIVERSITY OF INSECTS IN CHILE	I	103	23/08/00	10:50	HB	C	3	3	3
Jerez, V.	541	THE SOCIEDAD CHILENA DE ENTOMOLOGIA	I	137	24/08/00	16:30	CC		3	PS	3
Jerez, V.	4125	PHYLOGENY AND BIOGEOGRAPHY OF THE GENUS PROCALUS (COLEOPTERA: CHRYSOMELIDAE)	II	1042	25/08/00	11:20	HM	P	24	2	24
Jerez, V.	4141	INTERSPECIFIC DIFFERENTIATION IN EGGS AND FIRST INSTAR LARVAE OF GENUS PROCALUS (COLEOPTERA: CHRYSOMELIDAE)	II	1046	26/08/00	10:00	HM	P	24	0	24
Jerez, V.	3147	INTERSPECIFIC DIFFERENTIATION IN EGGS AND FIRST INSTAR LARVAE OF GENUS PROCALUS (COLEOPTERA: CHRYSOMELIDAE)	II	794					16		16
Jerie, P. H.	2710	TWO YEARS OF AREAWIDE MATING DISRUPTION APPLICATION FOR SUCCESSFUL CONTROL OF ORIENTAL FRUIT MOTH GRAPHOLITA MOLESTA (LEPIDOPTERA: TORTRICIDAE) IN VICTORIA, AUSTRALIA	II	684	22/08/00	16:30	CC		14	PS	14
Jeronimo, F.	1661	FRUIT FLY BIOLOGICAL CONTROL IN LATIN AMERICA: MINIMIZING THE RISKS POSED BY TEPHRITIDAE IN MEXICO AND CENTRAL AMERICA	I	419	25/08/00	16:30	CC		8	PS	8
Jeshtadi, A.	3099	TRYPSIN-INDUCED MOTILITY IN MANDUCA SEXTA SPERMATOZOA IN VITRO	II	782	26/08/00	14:15	HB	G	16	9	16
Jespersen, J. B.	1278	COMBATING INSECTICIDE RESISTANCE: ENMARIA AND THE EUROPEAN PERSPECTIVE	I	323	25/08/00	14:35	HM	N	7	10	7
Jespersen, J. B.	2993	MULTIPLE ACETYLCHOLINESTERASE PHENOTYPES IN DANISH FIELD POPULATIONS AND LABORATORY STRAINS OF THE HOUSE-FLY MUSCA DOMESTICA	II	755	23/08/00	16:30	CC		15	PS	15
Jesus, C. R.	1026	POPULATION DYNAMICS OF CORECORIS DENTIVENTRIS ADULTS (HEMIPTERA: COREIDAE) IN A TOBACCO EXPERIMENTAL PLOT	I	259	23/08/00	16:30	CC		6	PS	6
Jesus, F. A. de	2641	CONTROL OF ANTICARSIA GEMMATALIS IN SOYBEAN BY RIMON 10 EC (NOVALURON) IN PARANÁ, BRAZIL.1999	II	667	22/08/00	16:30	CC		14	PS	14
Jesus, F. A. de	2642	EFFECT OF THE CONTROL OF ARMY WORMS SPODOPTERA FRUGIPERDA IN CORN BY RIMON 10 EC (NOVALURON). 1999	II	667	21/08/00	16:30	CC		14	PS	14
Jesus, F. A. de	2643	EFFICACY OF CONTROL OF ANTICARSIA GEMMATALIS IN SOYBEAN BY RIMON 10 EC (NOVALURON) AND OTHER INSECTICIDES. 1999	II	668	22/08/00	16:30	CC		14	PS	14
Jesus, F. A. de	2644	EVALUATION OF AGRONOMIC EFFICIENCY AND PRACTIBILITY OF INSECTICIDES ON COTTON WORM (ALABAMA ARGILLACEA) CONTROL ON COTTON CROP. 1999	II	668	21/08/00	16:30	CC		14	PS	14
Jesus, B. M. V.	1769	SPECIES RICHNESS AND SEASONAL ABUNDANCE OF MALE EUGLOSSINE BEES (HYMENOPTERA: APIDAE) IN A SEMIDECIDUAL STATIONAL FOREST OF THE SÃO PAULO STATE	I	446	22/08/00	16:30	CC		9	PS	9
Jhan, G. N.	1045	EFFECTS OF TRICHOMES AND CRISTALIFEROUS IDIOBLASTS DENSITIES, CONCENTRATIONS OF MINERALS AND WEATHER ON THE BEMISIA ARGENTIFOLII IN TOMATO	I	264	23/08/00	16:30	CC		6	PS	6
Ji, J.	77	POTENTIAL OF AMBLYSEIUS CUCUMERIS (ACARI: PHYTOSEIIDAE) AS A BIOCONTROL AGENT AGAINST SCHIZOTETRANYCHUS NANJINGENSIS (ACARI: TETRANYCHIDAE) IN CHINA	I	20	25/08/00	16:30	CC		1	PS	1
Ji, J.	49	CHECKLIST OF MITES FROM MOSO BAMBOO IN FUJIAN, CHINA	I	13	23/08/00	16:30	CC		1	PS	1
Ji, J.	1986	KEY FACTORS AFFECTING POPULATIONS OF SCHIZOTETRANYCHUS NANJINGENSIS, APONYCHUS CORPUZAE AND ACULUS BAMBUSAE IN FUJIAN BAMBOO FORESTS DURING DIFFERENT SEASONS: AN ANALYSIS USING METHODS OF GREY SEQUENCE	I	500	21/08/00	16:30	CC		10	PS	10
Ji, J.	2866	AN OVERVIEW OF OCCURRENCE, DEVELOPMENT AND DAMAGE OF BAMBOO MITES AND THEIR INTEGRATED MANAGEMENT IN FUJIAN, CHINA	II	723	22/08/00	16:30	CC		14	PS	14
Jia, F.-y.	1714	PARADOX(ES) OF THE LEK: CAN GENETIC VARIANCE OF SEXUALLY SELECTED TRAITS BE MAINTAINED BY GENOTYPE • ENVIRONMENT INTERACTION?	I	432	21/08/00	14:10	HB	F	9	1	9
Jin, Z.	3283	WHEN YOU CAN'T FLY TO BRAZIL: SURVIVING WINTER WITH ANTIFREEZE PROTEIN GENES	II	829	23/08/00	11:05	HB	K	18	4	18
Jiang, H.	2360	ACTIVATION OF PROPHENOLOXIDASE IN MANDUCA SEXTA	II	596	23/08/00	15:20	HB	I	13	5	13
Jiang, H.	2385	OXIDATIVE CONJUGATION OF CATECHOLS FOR INSECT CUTICLE SCLEROTIZATION	II	603	25/08/00	15:20	HB	I	13	9	13
Jiang, H.	2454	OXIDATIVE CONJUGATION OF CATECHOLS FOR INSECT CUTICLE SCLEROTIZATION	II	620	23/08/00	16:30	CC		13	PS	13
Jianyi, D.	3423	LIAONING TUSSAH	II	864	22/08/00	15:45	HM	Q	19	3	19
Jianzhong, Z.	3289	PHOTOAFFINITY LABELED NON-STEROIDAL ECDYSONE AGONIST AS A TOOL TO STUDY LIGAND-ECDYSONE RECEPTOR COMPLEX INTERACTION	II	831	23/08/00	15:35	HB	K	18	5	18
Jiggins, C. D.	3782	SPECIATION BY REINFORCEMENT OF A SHIFT IN MIMICRY	II	955	23/08/00	16:30	CC		21	PS	21
Jiggins, C. D.	2293	MULTIPLE PARTIAL BARRIERS TO GENE FLOW BETWEEN HELICONIUS CYDNO AND H. MELPOMENE	I	579	23/08/00	16:30	CC		12	PS	12
Jiménez, Y.	1003	PHENOLOGICAL INTERACTIONS BETWEEN THE WEEVILS EXAPION SPP. AND LEPIDAPION SPP. AND THE GENISTEAE IN CENTRAL SPAIN (SW EUROPE)	I	253	22/08/00	16:30	CC		6	PS	6
Jiménez-Pérez, A.	3335	REPRODUCTIVE POTENTIAL AND RHYTHMS OF THE BLACK-LYRE LEAFROLLER CNEPHASIA JACTATANA (LEPIDOPTERA: TORTRICIDAE), AN IMPORTANT PEST OF KIWIFRUIT IN NEW ZEALAND	II	842	22/08/00	16:30	CC		18	PS	18
Joachim-Bravo, I. S.	256	PERFORMANCE OF CERATITIS CAPITATA (DIPTERA, TEPHRITIDAE) ON FRUITS: COMPARISON OF TWO LABORATORY POPULATIONS	I	65	23/08/00	16:30	CC		2	PS	2
Jocqué, R.	3056	MATE CHECK: THE LINK BETWEEN NICHE THEORY AND SEXUAL SELECTION	II	771	23/08/00	10:00	HB	G	16	4	16

Sub-titles: (HB=Hotel Bourbon) - (HM=Hotel Mabu) - (CC=Convention Center) - (Bol=Foz Boulevard) - (PS=Poster Session) - (PL=Plenary Lecturer)

AUTHOR	N°	TITLE	Book	Page	Date	Time	Local	Room	Session	Symp	New Session
Jocys, T.	680	OLFACTORY RESPONSES TO ISOAMYL ACETATE AND ADULTS OF THE LARGE MILKWEED BUGS (ONCOPELTUS FASCIATUS, HETEROPTERA:LYGAEIDAE) IN MALE AND FEMALE ANTENNAE OF THE SAME SPECIES	I	172	23/08/00	16:30	CC		4	PS	4
Jocys, T.	2717	EVALUATION OF INSECTICIDES, IN LABORATORY, AGAINST THE VELVETBEAN CATERPILLAR ANTICARSIA GEMMATALIS (LEPIDOPTERA:NOCTUIDAE) IN SOY BEAN	II	686	24/08/00	16:30	CC		14	PS	14
Jocys, T.	2835	EVALUATION OF INSECTICIDES AGAINST THE THRIPS PALMI (THYSANOPTERA, THRIPIDAE) IN BEAN CROP (PHASEOLUS VULGARIS)	II	716	24/08/00	16:30	CC		14	PS	14
Jokki, Y.	1770	RELATIONSHIP BETWEEN MICROHABITAT AND BODY SHAPE IN ADULT PASSALID BEETLES (COLEOPTERA, PASSALIDAE)	I	446	22/08/00	16:30	CC		9	PS	9
John H. Lawton	I	Entomologists and the conservation of biodiversity	I	1	20/08/00	8:00	CC			PL	
Johnson, D. R.	257	FACTORS AFFECTING COTTON BOLL WEEVIL SURVIVAL IN VARIOUS OVERWINTERING HABITAT IN THE MIDDLE SOUTH REGION OF THE UNITED STATES	I	65	23/08/00	16:30	CC		2	PS	2
Johnson, D. R.	271	DEVELOPMENT OF AN EXTENSION-BASED SAMPLING SERVICE FOR COTTON APHID FUNGUS, NEOZYGITES FRESENII	I	69	23/08/00	16:30	CC		2	PS	2
Johnson, G. D.	799	ASPECTS OF THE ECOLOGY OF THE WHEAT STEM SAWFLY (HYMENOPTERA: CEPHIDAE) IN NORTH AMERICA	I	202	21/08/00	10:05	HB	D	6	1	6
Johnson, K. R.	3793	INSECT EXTINCTION AT THE END OF THE CRETACEOUS	II	957	23/08/00	16:30	CC		21	PS	21
Johnson, R. N.	2181	APPLICATION OF MOLECULAR GENETIC TECHNIQUES FOR A BETTER UNDERSTANDING OF EVOLUTION IN THE SOCIAL INSECTS	I	551	22/08/00	11:35	HB	L	12	3	12
Johnson, R. N.	3505	EXAMINING THE GENETIC CONTROL OF DANCE IN HONEY BEES (APIS MELLIFERA)	II	885	23/08/00	16:30	CC		19	PS	19
Johnson, S.	99	HABITAT FRAGMENTATION AND ITS CONSEQUENCES FOR PLANT-POLLINATOR MUTUALISMS IN SOUTH AFRICA	I	26	22/08/00	12:00	HB	A	2	3	2
Johnston, S.	3645	GENOME SIZE IN STREPSIPTERA	II	920	23/08/00	13:35	HB	E	21	5	21
Johnston, S.	3651	SUPERPARASITISM IN STREPSIPTERA	II	922	23/08/00	15:05	HB	E	21	5	21
Johnston, S.	3647	MITOCHONDRIAL AND NUCLEAR DNA PHYLOGENETIC ANALYSIS OF STREPSIPTERA	II	921	23/08/00	14:05	HB	E	21	5	21
Johnston, S.	4177	SPATIAL AND TEMPORAL PATTERNS OF MITOCHONDRIAL DNA IN FERAL HONEY BEES: IMPACT OF AFRICANIZATION	II	1055	21/08/00	16:30	CC		Erratum	PS	12
Jokes, M.	3149	STRUCTURE OF THE CROP IN THE ADULT QUEEN BLOWFLY, PHORMIA REGINA	II	794	24/08/00	16:30	CC		16	PS	16
Jokes, M.	1033	STRUCTURE OF THE CROP IN THE ADULT QUEEN BLOWFLY, PHORMIA REGINA	I	261	23/08/00	16:30	CC		6	PS	6
Jokeš, M.	2729	DETERMINATION OF EGGS OF STORED PRODUCT BEETLES (COLEOPTERA: SILVANIDAE, CUCUJIDAE) ACCORDING TO THEIR EXTERNAL MORPHOLOGY	II	689	23/08/00	16:30	CC		14	PS	14
Jolivet, P.	4135	SUBAQUATIC CHRYSOMELIDAE	II	1044	25/08/00	16:40	HM	P	24	2	24
Jolly, R. L.	44	THE PREDATORY MITE NEOSEIULUS CALIFORNICUS: ITS POTENTIAL AS A BIOCONTROL AGENT FOR THE FRUIT TREE RED SPIDER MITE PANONYCHUS ULMI	I	11	23/08/00	16:30	CC		1	PS	1
Jolly, R. L.	1662	THE COMMON EARWIG FORFICULA AURICULARIA; BENEFICIAL OR PEST IN ORCHARDS?	I	419	25/08/00	16:30	CC		8	PS	8
Jones, C. J.	2904	DISPERSAL OF HAEMATOPHAGOUS DIPTERA IN NORTH AMERICA: METEOROLOGY AND FLY BIOLOGY	II	733	23/08/00	15:05	Bol	R	15	6	15
Jones, D. T.	416	EVALUATING PRACTICAL METHODS FOR SAMPLING INVERTEBRATE BIOINDICATORS	I	106	23/08/00	15:05	HB	C	3	4	3
Jones, G. D.	953	DEPOSITION OF CORN POLLEN ON MILKWEED AND EXPOSURE RISK TO MONARCH BUTTERFLY LARVAE	I	241	22/08/00	16:30	CC		6	PS	6
Jones, G.D.	149	THE USE OF POLLEN SPORES AS NATURAL MARKERS FOR DETERMINING MIGRATION	I	38	25/08/00	15:00	HB	A	2	9	2
Jones, M. G. K.	1383	TOWARDS APHID RESISTANCE IN TRANSGENIC LUPINS	I	349	24/08/00	16:30	CC		7	PS	7
Jones, W.	2733	BIOLOGY OF SWEET POTATO WHITEFLY, (HOMOPTERA: ALEYRODIDAE) ON TRANSGENIC TOBACCO AND INTERACTIONS WITH A PARASITE	II	690	23/08/00	16:30	CC		14	PS	14
Jones, W. A.	102	CONSERVATION AND EVALUATION OF NATURAL ENEMIES IN IPM SYSTEMS	I	27	22/08/00	14:30	HB	A	2	4	2
Jones, W. A.	1564	JALISCO FLY (DIPTERA: TACHINIDAE) AS A BIOLOGICAL CONTROL AGAINST MEXICAN RICE BORER (LEPIDOPTERA: PYRALIDAE) IN TEXAS SUGARCANE	I	394	22/08/00	16:30	CC		8	PS	8
Jones, Walker	4176	OVIPOSITION BEHAVIOR OF THE AUTOPARASITIC ENCARSIA PERGANDIELLA	II	1055	22/08/00	14:35	HB	D	Erratum	4	6
Jong, D. De	3443	VARROA RESEARCH IN BRAZIL	II	869	24/08/00	11:50	HM	Q	19	5	19
Jong, D. De	3437	QUEEN PRESENCE AFFECTS VARROA INFESTATIONS	II	868	24/08/00	10:05	HM	Q	19	5	19
Jong, D. De	3438	THE INFLUENCE OF COMB CELL SIZE ON THE WEIGHT OF EMERGING HONEY BEES (APIS MELLIFERA) AND ON INFESTATION WITH THE MITE VARROA JACOBSONI	II	868	24/08/00	10:20	HM	Q	19	5	19
Jong, D. De	3439	TECHNIQUES FOR COMPARING DATA ON REPRODUCTION OF VARROA JACOBSONI	II	868	24/08/00	10:35	HM	Q	19	5	19
Jong, D. De	3440	VARROA JACOBSONI INFESTATIONS IN THE TRANSITION ZONE BETWEEN AFRICANIZED AND EUROPEAN BEES	II	868	24/08/00	10:50	HM	Q	19	5	19
Jong, H. de	3783	THE POSITION OF THE TIPULOIDEA IN THE LOWER DIPTERA	II	955	23/08/00	16:30	CC		21	PS	21
Jong, R. de	776	DEVELOPING AND SHARING DATA GLOBALLY: THE 'GLOBAL BUTTERFLY INFORMATION SYSTEM' – GLOBIS	I	196	24/08/00	14:00	Bol	T	5	5	5
Jonsell, M.	1027	IS A LIMITED DISPERSAL PROPENSITY THE REASON FOR THE RARITY OF THE BEETLE OPLOCEPHALA HAEMORRHOIDALIS IN NORTHERN EUROPE?	I	259	23/08/00	16:30	CC		6	PS	6
Jonsson, M.	1027	IS A LIMITED DISPERSAL PROPENSITY THE REASON FOR THE RARITY OF THE BEETLE OPLOCEPHALA HAEMORRHOIDALIS IN NORTHERN EUROPE?	I	259	23/08/00	16:30	CC		6	PS	6
Jonsson, N. N.	1348	TICK CONTROL: EVIDENCE TO SUPPORT RESISTANCE MANAGEMENT RECOMMENDTIONS	I	340	23/08/00	16:30	CC		7	PS	7
Jordaan, J.	189	BIOTYPIC VARIATION OF THE RUSSIAN WHEAT APHID BETWEEN SOUTH AFRICA AND HUNGARY	I	48	21/08/00	16:30	CC		2	PS	2
Jordal, B. H.	1835	DIFFERENTIAL COLONIZATION POTENTIAL AMONG WOOD-BORING BEETLES LEADS TO HIGH PROPORTIONS OF INBREEDING SPECIES ON TROPICAL ISLANDS	I	463	22/08/00	15:05	HB	M	10	3	10
Jordal, B. H.	2260	EVOLUTION OF LARVIFORM MALES IN THE INBREEDING BARK BEETLE OZOPEMON: FIERCE FIGHTERS OR JUST WEIRD?	I	570	22/08/00	16:30	CC		12	PS	12
Jordão, A. L.	2718	DEVELOPMENT OF TOMATO FRUITS IN PAPER BAGS (LYCOPERSICON ESCULENTUM) FOR PEST CONTROL AND PESTICIDE REDUCTION	II	686	23/08/00	16:30	CC		14	PS	14
Jordão, B. P.	2391	CHARACTERIZATION OF THREE MEMBRANE-BOUND AMINOPEPTIDASES ISOLATED FROM STOMOXYS CALCITRANS (DIPTERA: MUSCIDAE) MIDGUTS	II	604	21/08/00	16:30	CC		13	PS	13
Jorge, J. T.	4107	EFFICACY OF PHOSPHINE AND CARBON DIOXIDE TO CONTROL ALL LIFE STAGES OF SITOPHILUS ORYZAE	II	1037	25/08/00	16:30	CC		23	PS	23
Jorge, J. T.	4035	EFFICACY OF PHOSPHINE AND CARBON DIOXIDE TO CONTROL DIFFERENT STAGES OF RHYZOPERTHA DOMINICA	II	1019	23/08/00	11:30	HB	J	23	6	23
Jorgensen, P.	4167	CLIMATE SCENARIOS AND MODELING OF VECTOR-BORNE DISEASES	II	1052	21/08/00	14:35	Bol	R	Erratum	2	15
Joron, M.	515	MULLERIAN MIMICRY: CAN POLYMORPHISM BE STABLE ?	I	130	23/08/00	16:30	CC		3	PS	3
Josens, R. B.	3482	SUGAR SOLUTION LOADING AND UNLOADING IN THE ANT CAMPONOTUS MUS IN RELATION TO WORKER SIZE	II	879	22/08/00	16:30	CC		19	PS	19
Joseph, G.	1931	CHEMOTAXIS OF SOME SCOLYTIDS AND THEIR PREDATORS TO 4-ALLYLANISOLE AND ETHANOL IN CENTRAL OREGON PINE FORESTS	I	487	22/08/00	16:30	CC		10	PS	10

Sub-titles: (HB=Hotel Bourbon) - (HM=Hotel Mabu) - (CC=Convention Center) - (Bol=Foz Boulevard) - (PS=Poster Session) - (PL=Plenary Lecturer)

AUTHOR	Nº	TITLE	Book	Page	Date	Time	Local	Room	Session	Symp	New Session
Joseph, G.	1933	ATTRACTION OF SCOLYTUS UNISPINOSUS BARK BEETLES TO WATER-STRESSED BRANCHES OF DOUGLAS-FIR CONTAINING ETHANOL	I	487	22/08/00	16:30	CC		10	PS	10
Josephson, R. K.	3063	ASYNCHRONOUS FLIGHT MUSCLE: MECHANISM AND PERFORMANCE	II	773	23/08/00	15:05	HB	G	16	5	16
Jouanin, L.	1843	GENETIC ENGINEERING OF GENES THAT CONFERS INSECT RESISTANCE TO TREES	I	465	23/08/00	13:35	HB	M	10	4	10
Jouanin, L.	3952	EXAMINATION OF PROTEINASE AND PROTEINASE INHIBITOR ACTIVITIES IN THE APHID APHIS GOSSYPII	II	997	22/08/00	16:30	CC		22	PS	22
Jouanin, L.	2490	APHIDS AND APHID PROTEASES AS NON-CONVENTIONAL TARGETS FOR PROTEASE INHIBITOR TRANSGENES USED FOR CONTROLLING PHLOEM-FDEEDING INSECTS	II	629	24/08/00	16:30	CC		13	PS	13
Jourdan, H.	3413	UNDESIRABLE EFFECTS OF EXOTIC ANTS ON THE LOCAL FAUNA	II	862	22/08/00	11:35	HM	Q	19	2	19
Joyce, D. A.	431	CONSERVATION GENETICS OF A THREATENED EUROPEAN BUTTERFLY EURODRYAS AURINIA IN THE FRAGMENTED AGRICULTURAL LANDSCAPE OF THE UK	I	109	24/08/00	15:05	HB	C	3	6	3
Jozwiak, B.	690	BIOCHEMICAL ADAPTATION OF BIRD CHERRY-OAT APHID TO PLANT PHENOLICS	I	174	23/08/00	16:30	CC		4	PS	4
Juan, C.	2301	MOLECULAR PHYLOGENY, CHROMOSOMES, AND HOST PLANT AFFILIATION IN CHRYSOLINA AND OREINA (COLEOPTERA, CHRYSOMELIDAE)	I	581	24/08/00	16:30	CC		12	PS	12
Juan, C.	3769	MOLECULAR PHILOGENY OF THE GENUS CYRTONUS (COLEOPTERA: CHRYSOMELIDAE)	II	951					21		21
Juan, C.	4133	MOLECULAR PHILOGENY OF THE GENUS CYRTONUS (COLEOPTERA: CHRYSOMELIDAE)	II	1044	25/08/00	16:00	HM	P	24	2	24
Juárez, M. P.	2991	CHARACTERIZATION AND CARBON METABOLISM IN FUNGI PATHOGENOUS TO CHAGAS DISEASE VECTORS	II	755	23/08/00	16:30	CC		15	PS	15
Juárez, M. P.	2992	HYDROCARBONS OF THE CHAGAS DISEASE VECTOR RHODNIUS PROLIXUS	II	755	23/08/00	16:30	CC		15	PS	15
Juárez, M.P.	601	MICROSOMAL REACTIONS INVOLVED IN THE FORMATION OF HYDROCARBONS AND THE CONTACT SEX PHEROMONE IN BLATELLA GERMANICA INTEGUMENT	I	152	23/08/00	11:10	Bol	S	4	4	4
Judd, D. D.	3637	PHYLOGENETIC RELATIONSHIPS AMONG BASAL DIPTERA: EVIDENCE FROM MORPHOLOGY AND DNA SEQUENCES	II	918	22/08/00	13:35	HB	E	21	4	21
Judd, G. J.	2553	STERILE INSECT RELEASE IN CANADA: FROM ERADICATION TO AREA-WIDE MANAGEMENT	II	645	21/08/00	16:05	HB	B	14	2	14
Judd, G. J.	2838	STERILE INSECT RELEASE IN CANADA: FROM ERADICATION TO AREA-WIDE MANAGEMENT	II	716	25/08/00	16:30	CC		14	PS	14
Judd, G. J. R.	681	PHEROMONE-BASED MANAGEMENT PROGRAM FOR SIMULTANEOUS CONTROL OF CODLING MOTH AND LEAFROLLERS IN BRITISH COLUMBIA'S COMMERCIAL ORGANIC APPLE PRODUCTION SYSTEM	I	172	23/08/00	16:30	CC		4	PS	4
Juetterschenke, P	3949	EXTREME TEMPERATURES FOR RAPID AND NON-TOXIC STORED PRODUCT PROTECTION	II	997	21/08/00	16:30	CC		22	PS	22
Juliano, L.	2459	EVOLUTION OF TRYPSIN SPECIFICITY IN INSECTS	II	621	23/08/00	16:30	CC		13	PS	13
Juliano, M.A.	2459	EVOLUTION OF TRYPSIN SPECIFICITY IN INSECTS	II	621	23/08/00	16:30	CC		13	PS	13
Julio, C. E. A.	3784	A NEW GENUS OF ANISOCERINI (CERAMBYCIDAE, LAMIINAE)	II	955	23/08/00	16:30	CC		21	PS	21
Jung, J. K.	641	TRIALS OF CONTROLLING LEPIDOPTERAN PESTS WITH SEX PHEROMONES IN KOREAN APPLE AND PEAR ORCHARDS	I	162	21/08/00	16:30	CC		4	PS	4
Jung, J. K.	3872	TRIALS OF CONTROLLING LEPIDOPTERAN PESTS WITH SEX PHEROMONES IN KOREAN APPLE AND PEAR ORCHARDS	II	977	21/08/00	11:05	HB	H	22	1	22
Jungnickel, H.	3430	MATING SYSTEM EVOLUTION IN ATTINE FUNGUS GROWING ANTS	II	866	23/08/00	10:50	HM	Q	19	4	19
Jungnickel, H.	429	HOST-SPECIFICITY IN MACULINEA ALCON: A LARGE BLUE BUTTERFLY CONSERVATION ISSUE IN EUROPE	I	109	24/08/00	14:05	HB	C	3	6	3
Junior, A. L. B.	1484	BIOLOGICAL ASPECTS OF CHRYSOPERLA EXTERNA AND CERAEOCHRYSA CINCTA IMMATURE STAGES FED EGGS AND NYMPHS OF BIOTYPE "B" BEMISIA TABACI	I	374	22/08/00	16:30	CC		8	PS	8
Júnior, A. L. B.	1802	AGING AND TOMATO LEAFLET POSITIONS INFLUENCE ON OVIPOSITION OF BEMISIA TABACI BIOTYPE "B" (HEMIPTERA: ALEYRODIDAE)	I	454	25/08/00	16:30	CC		9	PS	9
Júnior, A. L. B.	2810	RESISTANCE OF COTTON GENOTYPES (GOSSYPIUM HIRSUTUM) TO ALABAMA ARGILLACEA (LEPIDOPTERA: NOCTUIDAE)	II	709	24/08/00	16:30	CC		14	PS	14
Júnior, C. R. S.	223	OCCURRENCE AND DAMAGES OF ONCIDERES SAGA (COLEOPTERA, CERAMBYCIDAE) IN MIMOSA CAESALPINAEFOLIA (LEGUMINOSAE, CAESALPINOIDAE)	I	57	22/08/00	16:30	CC		2	PS	2
Junqueira, A. C. M.	2261	RECOVERY OF MITOCHONDRIAL DNA SEQUENCES FROM MUSEUM SPECIMENS: METHODS AND EVOLUTIONARY PERSPECTIVES	I	571	22/08/00	16:30	CC		12	PS	12
Junqueira, A. C. M.	2270	CHRYSOMYA (CALLIPHORIDAE) MITOCHONDRIAL DNA CONTROL REGION: CHARACTERIZATION OF C. MEGACEPHALA tRNA REPEAT	I	573	22/08/00	16:30	CC		12	PS	12
Junqueira, A. C. M.	2271	THE COMPLETE MITOCHONDRIAL GENOME OF THE PRIMARY SCREWWORM FLY COCHLIOMYIA HOMINIVORAX (DIPTERA: CALLIPHORIDAE)	I	573	22/08/00	16:30	CC		12	PS	12
Junqueira, A. C. M.	2242	CHARACTERIZATION OF MOLECULAR MARKERS ON CHRYSOMYA ALBICEPS BY PCR-RFLP OF MITOCHONDRIAL DNA	I	566	21/08/00	16:30	CC		12	PS	12
Junqueira, A. M. R.	2616	EVALUATING SWEET POTATO FOR RESISTANCE TO THE WEST INDIAN SWEET POTATO WEEVIL	II	661	21/08/00	16:30	CC		14	PS	14
Junqueira, L. K.	1932	TERMITES (INSECTA: ISOPTERA) IN EUCALYPTUS SPP. PLANTATIONS OF THE FOREST EXPERIMENTAL STATION, UNIVERSITY OF SÃO PAULO, IN ANHEMBI, STATE OF SÃO PAULO, BRAZIL	I	487	22/08/00	16:30	CC		10	PS	10
Junqueira, N. T. V.	1622	BIOLOGICAL DATA OF SOME NATURAL ENEMIES OF THE SOURSOP BORER CERCONOTA ANONELLA (LEPIDOPTERA: OECOPHORIDAE) IN PLANALTINA, FEDERAL DISCTRICT, BRAZIL	I	409	24/08/00	16:30	CC		8	PS	8
Jurenka, R. A.	598	REGULATION OF PHEROMONE BIOSYNTHETIC PATHWAYS IN MOTHS	I	151	23/08/00	10:15	Bol	S	4	4	4
Justi Junior, J.	3449	FIELD EVALUATION OF A 0,5% HEXAFLUMURON BAIT (RECRUIT® II) FOR COLONY ELIMINATION OF THE SUBTERRANEAN TERMITE COPTOTERMES HAVILANDI (ISOPTERA : RHINOTERMITIDAE)	II	871	21/08/00	16:30	CC		19	PS	19
Justi Junior, J.	4165	FIELD EVALUATION OF A 0,5% HEXAFLUMURON BAIT (RECRUIT® II) FOR COLONY ELIMINATION OF SUBTERRANEAN TERMITE HETEROTERMES TENUIS (ISOPTERA : RHINOTERMITIDAE).	II	1052	21/08/00	16:30	CC		Erratum	PS	19
Justi Junior, J.	3506	FORAGING POPULATION AND TERRITORY OF THE SUBTERRANEAN TERMITE COPTOTERMES HAVILANDI (ISOPTERA : RHINOTERMITIDAE) BY THE TRIPLE MARKED RECAPTURE METHOD IN AN URBAN AREA	II	885	23/08/00	16:30	CC		19	PS	19
Justi Junior, J.	3507	FORAGING POPULATION AND TERRITORY OF THE SUBTERRANEAN TERMITE HETEROTERMES TENUIS (ISOPTERA : RHINOTERMITIDAE) BY THE TRIPLE MARKED RECAPTURE METHOD IN AN URBAN AREA	II	885	23/08/00	16:30	CC		19	PS	19
Justi Junior, J.	3535	USE OF ABOVE GROUND 0.5% HEXAFLUMURON BAITS (RECRUIT® AG) IN THE CONTROL OF COPTOTERMES HAVILANDI (ISOPTERA: RHINOTERMITIDAE) IN CONSTRUCTIONS LOCATED IN SÃO PAULO, SP, BRAZIL	II	892	24/08/00	16:30	CC		19	PS	19
Justus, K.	608	SENSORY INPUTS GOVERNING UPWIND FLIGHT OF MALE MOTHS ALONG PHEROMONE PLUMES	I	154	23/08/00	15:35	Bol	S	4	5	4
Kaas, J.P.	4163	BIOLOGICAL CONTROL IN THE NETHERLANDS WITH SPECIAL REFERENCE TO BOTANIC GARDENS	II	1051	21/08/00	16:30	CC		Erratum	PS	8
Kabaluk, J. T.	2719	MINING THE DATA OF A PEST MANAGEMENT COMPANY: IMPROVEMENTS TO TUBER FLEA BEETLE AND GREEN PEACH APHID IPM OF CANADIAN POTATOES	II	687	23/08/00	16:30	CC		14	PS	14
Kabiri, F.	1426	ARTIFICIAL DIETS FOR REARING PREDATORS AND PARASITOIDS OF GREENHOUSE PEST INSECTS	I	360	21/08/00	13:35	HM	O	8	2	8

Sub-titles: (HB=Hotel Bourbon) - (HM=Hotel Mabu) - (CC=Convention Center) - (Bol=Foz Boulevard) - (PS=Poster Session) - (PL=Plenary Lecturer)

AUTHOR	Nº	TITLE	Book	Page	Date	Time	Local	Room	Session	Symp	New Session
Kacic, S.	258	GIANT BLACK BARK PEACH APHID PTEROCHLOROIDES PERSICAE (HOMOPTERA: LACNIDAE)	I	66	23/08/00	16:30	CC		2	PS	2
Kacic, S.	2864	CITRUS WHITEFLY, DIALEURODES CITRI (HOMOPTERA: ALEYRODIDAE) IN ADRIATIC REGION OF CROATIA	II	723	25/08/00	16:30	CC		14	PS	14
Kadash, K.	2371	THE ROLE OF POLYDNAVIRUSES IN DEFINING PARASITOID HOST RANGES	II	599	24/08/00	13:35	HB	I	13	7	13
Kafatos, F.	2918	STABLE TRANSFORMATION OF ANOPHELINE MOSQUITOES WITH THE MINOS TRANSPOSABLE ELEMENT FROM DROSOPHILA HYDEI	II	736	24/08/00	15:35	Bol	R	15	8	15
Kafatos, F. C.	2358	GENOMIC STRUCTURE AND ECDYSONE REGULATION OF THE PROPHENOLOXIDASE 1 GENE IN THE MALARIA VECTOR ANOPHELES GAMBIAE	II	596	23/08/00	14:20	HB	I	13	5	13
Kafatos, F. C.	2914	MOSQUITO – PARASITE INTERACTIONS: MOLECULAR DISSECTION OF INNATE IMMUNE RESPONSES TO MALARIA INFECTION	II	735	24/08/00	13:35	Bol	R	15	8	15
Kafatos, F. C.	2915	MALARIA PARASITE ENCAPSULATION GENES IN ANOPHELES GAMBIAE	II	736	24/08/00	14:05	Bol	R	15	8	15
Kafatos, F.C.	2353	THIOESTER-CONTAINING PROTEINS IN INNATE IMMUNITY OF MOSQUITO ANOPHELES GAMBIAE	II	594	23/08/00	10:45	HB	I	13	4	13
Kafer, H.	1772	PREDICTABILITY OF AGGRESSIVENESS IN THE GIANT HONEYBEE APIS DORSATA	I	446	22/08/00	16:30	CC		9	PS	9
Kageyama, D.	2142	TRANSINFECTION OF WOLBACHIA ENDOSYMBIONTS AMONG THREE SPECIES OF LEPIDOPTERAN INSECTS	I	540	25/08/00	16:30	CC		11	PS	11
Kainoh, Y.	1677	HOST LOCATION BEHAVIOR OF THE PARASITOID FLY, EXORISTA JAPONICA (DIPTERA: TACHINIDAE)	I	423	25/08/00	16:30	CC		8	PS	8
Kainoh, Y.	3875	DEVELOPMENT OF A STRAIN OF THE SMALLER TEA TORTRIX, ADOXOPHYES HONMAI (LEPIDOPTERA: TORTRICIDAE) RESISTANT TO A MATING DISRUPTANT IN JAPAN	II	978	21/08/00	14:30	HB	H	22	I	22
Kaiser, L.	1557	SUBLETHAL EFFECTS OF INSECTICIDES ON THE BEHAVIOUR OF TWO PARASITOIDS : INFLUENCE OF INDIVIDUAL EXPERIENCE AND GENETIC VARIABILITY	I	393	22/08/00	16:30	CC		8	PS	8
Kaiser, M. A.	174	EFFICIENCY OF INSECTICIDES IN THE CONTROL OF THRIPS, FRANKLINIELLA SCHULZEI, IN COTTON CROP	I	45	22/08/00	16:30	CC		2	PS	2
Kaitala, A.	1715	EVOLUTION OF CONSPECIFIC EGG-CARRYING BEHAVIOR: ANCIENT AND INFANT EXPRESSIONS IN THE HETEROPTERA	I	432	21/08/00	14:30	HB	F	9	I	9
Kaitala, A.	898	A FIVE YEAR STUDY OF MATING FREQUENCIES AND SIZE VARIATIONS IN WILD POPULATIONS OF THE GREEN-VEINED WHITE BUTTERFLY PIERIS NAPI	I	227	21/08/00	16:30	CC		6	PS	6
Kajiham, L. H.	190	DIFFERENT INSECTICIDES AND DOSES FOR EUSCHISTUS HEROS CONTROL ON SOYBEAN CROP	I	49	21/08/00	16:30	CC		2	PS	2
Kajiham, L. H.	191	DIFFERENT INSECTICIDES AND DOSES TO CONTROL GREEN STINKBUG NEZARA VIRIDULA ON SOYBEAN CROP	I	49	21/08/00	16:30	CC		2	PS	2
Kakiuchi, A. M.	4179	TASTE OF NOXIOUS LIPOPHILIC SUBSTANCES: AVERSIVE BEHAVIOR AND TASTE RESPONSE TO LIMONENE IN THE BLOWFLY, PHORMIA REGINA	II	1055	22/08/00	16:30	CC		Erratum	PS	13
Kakizaki, M.	259	STICKY NET CYLINDER TRAP FOR THE RICE LEAF BUG, TRIGONOTYLUS CAELESTIALIUM (HETEROPTERA: MIRIDAE)	I	66	23/08/00	16:30	CC		2	PS	2
Kakul, T. K.	682	CONTROL OF SCAPANES AUSTRALIS A MAJOR PEST OF COCONUT USING SEMIOCHEMICALS	I	172	23/08/00	16:30	CC		4	PS	4
Kalaszich, J.	3964	EVALUATION OF RESISTANT CLONES OF POTATO WITH AND WITHOUT CHEMICAL PROTECTION, AGAINST THE POTATO TUBER MOTH	II	1000	22/08/00	16:30	CC		22	PS	22
Kalberer, N. M.	1085	COST OF FLIGHT DISPERSAL IN OREINA CACALIAE (COLEOPTERA: CHRYSOMELIDAE)	I	274	24/08/00	16:30	CC		6	PS	6
Kalinova, B.	733	IDENTIFICATION OF CAMERARIA OHRIDELLA SEX PHEROMONE AND ITS POSSIBLE USE IN HORSE CHESTNUT PROTECTION	I	185	25/08/00	16:30	CC		4	PS	4
Kalinovi, I.	4083	CONTROL OF PSOCIDS IN STORED WHEAT AND ITS PRODUCTS	II	1031	23/08/00	16:30	CC		23	PS	23
Kalinovi•, I.	1392	THE EFFICACY OF SOME AROMATIC PLANTS AGAINST STORED PRODUCT INSECTS	I	351	25/08/00	16:30	CC		7	PS	7
Kalosaka, K.	2262	HEAT SHOCK RESPONSE IN THE MEDITERRANEAN FRUIT FLY: GENES, PROMOTERS AND THERMOTOLERANCE	I	571	22/08/00	16:30	CC		12	PS	12
Kamal, S.	2354	THE ROLE OF INNATE IMMUNE PEPTIDES TO REDUCE PARASITE DEVELOPMENT IN AEDES AEGYPTI	II	595	23/08/00	11:05	HB	I	13	4	13
Kamarudin, N.	84	MANAGEMENT OF RHINOCEROS BEETLES IN MALAYSIA	I	22	21/08/00	11:05	HB	A	2	1	2
Kamata, N.	1863	DEPLOYMENT OF TREE RESISTANCE TO PESTS IN ASIA.	I	470	24/08/00	15:20	HB	M	10	6	10
Kamata, N.	1868	OUTBREAKS OF FOREST DEFOLIATING INSECTS AND FOREST DAMAGE IN JAPAN.	I	471	25/08/00	10:05	HB	M	10	7	10
Kamata, N.	2080	THE POTENTIAL IMPACT OF GROBAL WARMING ON DECIDUOUS OAK DIEBACK CAUSED BY AMBROSIA FUNGUS CARRIED BY AMBROSIA BEETLE IN JAPAN	I	525	22/08/00	16:30	CC		11	PS	11
Kamau, L.	2905	MICROEPIDEMIOLOGY OF MALARIA IN WESTERN KENYA	II	733	23/08/00	15:35	Bol	R	15	6	15
Kamba, M.	3265	RECENT PROGRESS IN THE TRANSGENESIS OF SILKWORM, BOMBYX MORI AND APPLICATION TO THE GENOME PROJECT	II	825	22/08/00	10:35	HB	K	18	2	18
Kamble, S. T.	4026	BAITING TECHNOLOGY FOR CONTROLLING SUBTERRANEAN TERMITES IN URBAN ENVIRONMENT	II	1017	22/08/00	10:00	HB	J	23	10	23
Kamble, S. T.	4026	BAITING TECHNOLOGY FOR CONTROLLING SUBTERRANEAN TERMITES IN URBAN ENVIRONMENT	II	1017	22/08/00	10:00	HB	J	23	10	23
Kamikouchi, A.	2263	CONCENTRATED EXPRESSION OF THE GENES FOR PROTEINS INVOLVED IN CALCIUM SIGNALING IN THE MUSHROOM BODIES OF THE BRAIN OF THE WORKER HONEYBEE APIS MELLIFERA	I	571	22/08/00	16:30	CC		12	PS	12
Kamikouchi, A.	3558	IDENTIFICATION AND CHARACTERIZATION OF A NOVEL GENE (KL-1), WHICH IS EXPRESSED PREFERENTIALLY IN LARGE TYPE KENYON CELLS OF THE HONEYBEE BRAIN	II	898	25/08/00	16:30	CC		19	PS	19
Kamikouchi, A.	2448	CONCENTRATED EXPRESSION OF THE GENES FOR PROTEINS INVOLVED IN CALCIUM SIGNALING IN THE MUSHROOM BODIES OF THE BRAIN OF THE WORKER HONEYBEE APIS MELLIFERA	II	618	23/08/00	16:30	CC		13	PS	13
Kamikouchi, A.	2336	IDENTIFICATION AND CHARACTERIZATION OF THE KS-1 GENE, WHICH IS EXPRESSED PREFERENTIALLY IN THE SMALL TYPE-KENYON CELLS OF THE HONEYBEE BRAIN	I	589	25/08/00	16:30	CC		12	PS	12
Kamimura, M.	3381	MOLECULAR CLONING OF JUVENILE HORMONE BINDING PROTEINS OF SILKWORM, BOMBYX MORI	II	854	25/08/00	16:30	CC		18	PS	18
Kamitani, S.	516	GEOGRAPHICAL VARIATIONS IN DELTOCEPHALINE LEAFHOPPERS (HOMOPTERA, CICADELLIDAE) IN EAST ASIA	I	131	23/08/00	16:30	CC		3	PS	3
Kamito, T.	3336	JH APPLICATION MODIFIES THE ADULT DEVELOPMENT PROGRAM AND ECDYSONE RECEPTOR EXPRESSION IN THE TOBACCO HORNWORM, MANDUCA SEXTA	II	842	22/08/00	16:30	CC		18	PS	18
Kamiya, T.	2324	SEX-SPECIFIC ALTERNATIVE SPLICING OF THE LEPIDOPTERAN HOMOLOGS OF THE DROSOPHILA MELANOGASTER SEX DETERMINING GENE DOUBLESEX	I	586	25/08/00	16:30	CC		12	PS	12
Kammlah, D. M.	1336	DIAZINON AND PYRETHROID RESISTANCE TO THE HORN FLY IN TEXAS	I	337	22/08/00	16:30	CC		7	PS	7
Kanda, T.	3265	RECENT PROGRESS IN THE TRANSGENESIS OF SILKWORM, BOMBYX MORI AND APPLICATION TO THE GENOME PROJECT	II	825	22/08/00	10:35	HB	K	18	2	18
Kanda, T.	2305	CHARACTERIZATION OF GENOMIC GENE ENCODING KYNURENINE 3-MONOOXYGENASE IN THE SILKWORM BOMBYX MORI	I	582	24/08/00	16:30	CC		12	PS	12
Kanda, T.	3530	CHANGE OF GENE EXPRESSION PATTERN CAUSEDBY COMPOUND EYE METAMORPHOSIS OF BOMBYX MORI	II	891	24/08/00	16:30	CC		19	PS	19
Kandori, I.	1028	DIVERSITY AND TEMPORAL CHANGE IN THE EFFECTIVE POLLINATORS OF GERANIUM THUNBERGII	I	259	23/08/00	16:30	CC		6	PS	6

Sub-titles: (HB=Hotel Bourbon) - (HM=Hotel Mabu) - (CC=Convention Center) - (Bol=Foz Boulevard) - (PS=Poster Session) - (PL=Plenary Lecturer)

AUTHOR	Nº	TITLE	Book	Page	Date	Time	Local	Room	Session	Symp	New Session
Kanematsu, S.	3226	COMPARISON OF RIBOSOMAL DNA BY PCR-RFLP ANALYSIS AMONG LOCAL CLONES OF FOXGLOBE APHID, AULACORTHUM SOLANI, WHICH SHOW DIFFERENT TRANSMISSION EFFICIENCY OF SOYBEAN DWARF LUTEOVIRUS	II	814	22/08/00	16:30	CC		17	PS	17
Kaneshi, K.	1344	CONTROL OF DIAMONDBACK MOTH (PLUTELLA XYLOSTELLA) BY SPINOSAD AND ITS INFLUENCE ON PARASITIC WASPS	I	339	23/08/00	16:30	CC		7	PS	7
Kaneshi, K.	1272	A GLOBAL PERSPECTIVE ON THE BIOLOGY AND FIELD PERFORMANCE OF SPINOSAD	I	321	25/08/00	11:05	HM	N	7	9	7
Kaneshiro, K. Y.	1029	THE DYNAMICS OF SEXUAL SELECTION AND THE EVOLUTION OF NOVEL ACOUSTICAL SIGNALING IN HAWAIIAN DROSOPHILA	I	260	23/08/00	16:30	CC		6	PS	6
Kaneshiro, K. Y.	1743	THE DYNAMICS OF SEXUAL SELECTION AND THE EVOLUTION OF NOVEL ACOUSTICAL SIGNALING IN HAWAIIAN DROSOPHILA	I	439	23/08/00	11:30	HB	F	9	3	9
Kaneshiro, K. Y.	3354	UTILIZATION OF SPECIFIC PLANT VOLATILES IN MATING STRATEGIES IN THE ORIENTAL FRUIT FLY AND MEDFLY	II	847	23/08/00	16:30	CC		18	PS	18
Kanesiger, C.	2483	THE DESIGN AND APPLICATION OF AN ACTIGRAPH TO STUDY THE CIRCADIAN RHYTHM OF THE DUMP FLY, HYDROTAEA AENESCENS	II	627	24/08/00	16:30	CC		13	PS	13
Kanno , H.	683	EFFECT OF WHEAT INFESTED BY LARVAE OF THE HESSIAN FLY, MAYETIOLA DESTRUCTOR, ON OVIPOSITION BEHAVIOR OF THE HESSIAN FLY FEMALES	I	173	23/08/00	16:30	CC		4	PS	4
Kanost, M. R.	2385	OXIDATIVE CONJUGATION OF CATECHOLS FOR INSECT CUTICLE SCLEROTIZATION	II	603	25/08/00	15:20	HB	I	13	9	13
Kanost, M. R.	2454	OXIDATIVE CONJUGATION OF CATECHOLS FOR INSECT CUTICLE SCLEROTIZATION	II	620	23/08/00	16:30	CC		13	PS	13
Kanost, M. R.	2360	ACTIVATION OF PROPHENOLOXIDASE IN MANDUCA SEXTA	II	596	23/08/00	15:20	HB	I	13	5	13
Kapongo, J. P. T.	1534	THE BIOLOGICAL CONTROL OF HOUSEFLIES ASSOCIATED WITH POULTRY PRODUCTION	I	387	22/08/00	16:30	CC		8	PS	8
Karama, S.	2210	TRANSPOSABLE ELEMENTS IN CULICINES MOSQUITO GENOMES : CLASSICAL AND ODD STRUCTURES, HIGH COPY NUMBER AND ROLE IN POPULATION POLYMORPHISM	I	558	24/08/00	15:15	HB	L	12	8	12
Karama, S.	2247	RAPID GENOME SHUFFLING BY TRANSPOSABLE ELEMENTS: WHAT CAN WE LEARN FROM CULEX PIPIENS MOSQUITOES?	I	567	21/08/00	16:30	CC		12	PS	12
Karel Slama	VIII	A new look at insect breathing	I	XXX III	23/08/00	8:00	HB			PL	
Karras, M.	3017	VACCINE DELIVERY BY TRANSGENIC HAEMATOPHAGOUS INSECTS - A MODEL SYSTEM	II	761	25/08/00	16:30	CC		15	PS	15
Karsai, I.	3508	DOES EATING MORE MAKE YOU TOUGH? THE EFFECT OF NUTRITION ON THE DEVELOPMENT OF SOCIAL WASPS	II	885	23/08/00	16:30	CC		19	PS	19
Karunaratne, S. H. H. P.	2999	COMPARISON OF VECTORIAL CAPACITY IN INSECTICIDE RESISTANT AND SUSCEPTIBLE CULEX QUINQUEFASCIATUS FROM FILARIASIS ENDEMIC SRI LANKAN FIELD POPULATIONS	II	757	23/08/00	16:30	CC		15	PS	15
Karunaratne, S. H. H. P.	351	MOLECULAR CHARACTERISATION AND QUANTITATION OF THE AMPLIFIED CARBOXYLESTERASE GENE ASSOCIATED WITH ORGANOPHOSPHORUS INSECTICIDE RESISTANCE IN THE BROWN PLANTHOPPER, NILAPARVATA LUGENS	I	89	25/08/00	16:30	CC		2	PS	2
Kasahara, S.	3767	MORPHOLOGY, BIOACUSTIC AND CYTOGENETIC IN 4 SPECIES OF ANUROGRYLLUS (ORTHOPTERA, GRYLLIDAE).	II	951	22/08/00	16:30	CC		21	PS	21
Kashio, T.	2720	INTEGRATED PEST MANAGEMENT OF MAJOR INSECT PESTS UTILIZING APHID RESISITANT VARIETY AND NATURAL ENEMIES ON GREENHOUSE MELON	II	687	23/08/00	16:30	CC		14	PS	14
Kashio, T.	2724	THE VARIETY DIFFERENCES IN DAMAGE OF STRAWBERRY FRUITS BY WESTERN FLOWER THRIPS	II	688	23/08/00	16:30	CC		14	PS	14
Kastberger, G.	785	HOW MIGRATION AFFECTS ECOLOGICAL DIVERSIFICATION OF APIS DORSATA POPULATION. AN APPROACH BY SELF-ORGANIZING MAPS PROCESSING	I	198	21/08/00	16:30	CC		5	PS	5
Kastberger, G.	1771	INTERACTION BETWEEN PREDATORY BEE EATER AND DEFENCE-ATTACKING GIANT HONEYBEE APIS DORSATA	I	446	22/08/00	16:30	CC		9	PS	9
Kastberger, G.	1772	PREDICTABILITY OF AGGRESSIVENESS IN THE GIANT HONEYBEE APIS DORSATA	I	446	22/08/00	16:30	CC		9	PS	9
Katalinic, M.	258	GIANT BLACK BARK PEACH APHID PTEROCHLOROIDES PERSICAE (HOMOPTERA: LACNIDAE)	I	66	23/08/00	16:30	CC		2	PS	2
Katsuka, H.	3501	MOLECULAR CLONING OF A PROTHORACICOSTATIC PEPTIDE (PTSP) IN THE LARVAL BRAIN OF THE SILKWORM, BOMBYX MORI	II	884	23/08/00	16:30	CC		19	PS	18
Kathirithamby, J.	1555	A DISCUSSION ON THE PRELIMINARY OBSERVATIONS OF THE RELATIONSHIP BETWEEN XENOS VESPARUM ROSSI AND IT'S HOST POLISTES DOMINULUS CHRIST (HYMENOPTERA)	I	392	22/08/00	16:30	CC		8	PS	8
Kathirithamby, J.	3647	MITOCHONDRIAL AND NUCLEAR DNA PHYLOGENETIC ANALYSIS OF STREPSIPTERA	II	921	23/08/00	14:05	HB	E	21	5	21
Kathirithamby, J.	3651	SUPERPARASITISM IN STREPSIPTERA	II	922	23/08/00	15:05	HB	E	21	5	21
Kathirithamby, J.	3656	HISTOCHEMICAL AND MOLECULAR EVIDENCE OF PEROXIDASE ACTIVITY IN SEGESTIDEA NOVAGUINEAE (ORTHOPTERA) AND STICHOTREMA DALLATORREANUM (STREPSIPTERA)	II	923	23/08/00	16:20	HB	E	21	5	21
Kathirithamby, J.	3648	MORPHOLOGY AND BIOGEOGRAPHY OF FEMALE MYRMECOLACIDAE PARASITIC IN ORTHOPTERA IN PAPUA NEW GUINEA	II	921	23/08/00	14:20	HB	E	21	5	21
Kathirithamby, J.	3655	A SURVEY OF THE STRUCTURE OF THE APRON IN THE EXTANT FAMILIES OF STREPSIPTERA	II	923	23/08/00	16:05	HB	E	21	5	21
Kathirithamby, J.	3649	HOST-PARASITE RELATIONSHIP OF HALICTOPHAGUS NAULTI PARASITIC IN LEAFHOPPER PESTS OF MAIZE IN MEXICO	II	921	23/08/00	14:35	HB	E	21	5	21
Kathirithamby, J.	3652	INITIAL OBSERVATIONS OF THE STREPSIPTERAN XENOS VESPARUM IN THE PAPER WASP POLISTES DOMINULUS	II	922	23/08/00	15:20	HB	E	21	5	21
Kathuria, V.	1345	STATUS OF INSECTICIDE RESISTANCE IN HELICOVERPA ARMIGERA POPULATIONS FROM AREAS WITH DIFFERENT INSECTICIDE-USE REGIMES	I	339	23/08/00	16:30	CC		7	PS	7
Kathuria, V.	1346	SUSCEPTIBILITY OF HELICOVERPA ARMIGERA EGGS TO SOME COMMONLY USED INSECTICIDES	I	340	23/08/00	16:30	CC		7	PS	7
Katis, N. I.	3221	THE MEDIAN ACQUISITION AND INOCULATION ACCESS PERIOD OF THRIPS TABACI LINDEMAN MALES AND FEMALES IN THE TRANSMISSION OF TOMATO SPOTTED WILT TOSPOVIRUS	II	813	21/08/00	16:30	CC		17	PS	17
Katis, N. I.	3227	NEW APHID VECTORS OF ZUCCHINI YELLOW MOSAIC VIRUS AND THEIR ROLE IN THE EPIDEMIOLOGY OF THE VIRUS IN GREECE	II	815	22/08/00	16:30	CC		17	PS	17
Katis, N. I.	3242	APHID POPULATION FLUCTUATION AND SPREAD OF APHID-BORNE VIRUSES IN TOBACCO CROPS IN GREECE	II	818	23/08/00	16:30	CC		17	PS	17
Kato, M. J.	1365	INSECTICIDE PROPERTIES OF ETHANOLIC EXTRACT ISOLATED FROM SEEDS OF PIPER TUBERCULATUM SEEDS (PIPERACEAE) ON DIATRAEA SACCHARALIS (LEPIDOPTERA: PYRALI DAE)	I	344	25/08/00	16:30	CC		7	PS	7
Kato, C. M.	4150	EFFECT OF DIFFERENT TEMPERATURES ON THE BIOLOGY OF TAKECALLIS TAIWANUS (HOMOPTERA: APHIDIDAE) AND THERMAL REQUIREMENTS	II	1048	21/058/00	16:30	CC		Erratum	PS	18
Kato, C. M.	1537	EFFECT OF THE AGE OF APHIDIUS COLEMANI (HYMENOPTERA: APHIDIIDAE) ON THE GREEN APHID SCHIZAPHIS GRAMINUM (HOMOPTERA: APHIDIDAE) PARASITISM	I	388	22/08/00	16:30	CC		8	PS	8
Kato, K.	2080	THE POTENTIAL IMPACT OF GROBAL WARMING ON DECIDUOUS OAK DIEBACK CAUSED BY AMBROSIA FUNGUS CARRIED BY AMBROSIA BEETLE IN JAPAN	I	525	22/08/00	16:30	CC		11	PS	11

Sub-titles: (HB=Hotel Bourbon) - (HM=Hotel Mabu) - (CC=Convention Center) - (Bol=Foz Boulevard) - (PS=Poster Session) - (PL=Plenary Lecturer)

AUTHOR	Nº	TITLE	Book	Page	Date	Time	Local	Room	Session	Symp	New Session
Kato, M.J.	703	SUSCEPTIBILITY TESTS OF 4,5-DIIDROPIPERLONGUMININA ISOLATED FROM PIPER TUBERCULATUM SEEDS ON VELVETBEAN CATERPILLAR	I	178	24/08/00	16:30	CC		4	PS	4
Kato, Y.	3961	INSECTICIDAL ACTIVITY OF A NOVEL INSECT PEST CONTROL AGENT, CHROMAFENOZIDE	II	1000	22/08/00	16:30	CC		22	PS	22
Katoh, T.	3820	MOLECULAR SYSTEMATICS AND EVOLUTION OF BUTTERFLIES OF THE GENUS PARNASSIUS, PAPILIONIDAE, BASED ON MITOCHONDRIAL DNA SEQUENCE DATA	II	964	24/08/00	16:30	CC		21	PS	21
Katsoyannos, B. I.	613	FIELD EVALUATION OF FEMALE TARGETED TRAPPING SYSTEMS FOR DETECTION AND USE IN POPULATION SUPPRESSION/ERADICATION OF CERATITIS CAPITATA (DIPTERA: TEPHRITIDAE)	I	155	24/08/00	13:30	Bol	S	4	6	4
Kauffman, M.	2483	THE DESIGN AND APPLICATION OF AN ACTIGRAPH TO STUDY THE CIRCADIAN RHYTHM OF THE DUMP FLY, HYDROTAEA AENESCENS	II	627	24/08/00	16:30	CC		13	PS	13
Kaufmann, L.	1226	PYMETROZINE, A SELECTIVE FEEDING INHIBITOR FOR SUCKING INSECTS, ACTS THROUGH A NOVEL MECHANISM	I	310	21/08/00	11:35	HM	N	7	1	7
Kaufmann, L.	1224	MODE OF ACTION OF THIAMETHOXAM, A NOVEL LIGAND OF NICOTINIC ACETYLCHOLINE RECEPTORS – A COMPARATIVE STUDY OF NEONICOTINOIDS AND INSECTS	I	309	21/08/00	10:35	HM	N	7	1	7
Kaur, J. J.	3369	ANTIREPRODUCTIVE EFFECTS OF THE ECDYSTEROID AGONISTS ON THE COMMON CUTWORM, SPODOPTERA LITURA	II	851	21/08/00	16:30	CC		18	PS	18
Kaushik, N.	1347	EFFECTS OF EUCALYPTUS AND CALLISTEMON LEAF EXTRACTS ON HELICOVERPA ARMIGERA LARVAE	I	340	23/08/00	16:30	CC		7	PS	7
Kavallieratos, N. G.	1558	THE INFLUENCE OF CITRUS SPECIES ON THE PARASITIZATION OF APHIS GOSSYPII BY VARIOUS PARASITOIDS	I	393	22/08/00	16:30	CC		8	PS	8
Kawabe, S.	1184	THE INFLUENCE OF INCREASED ATMOSPHERIC CO2 AND TEMPERATURE ON NEPHOTETTIX CINCTICEPS LIFE CYCLES ANDECOSYSTEMS	I	298	25/08/00	16:30	CC		6	PS	6
Kawahara, Y.	4179	TASTE OF NOXIOUS LIPOPHILIC SUBSTANCES: AVERSIVE BEHAVIOR AND TASTE RESPONSE TO LIMONENE IN THE BLOWFLY, PHORMIA REGINA	II	1055	22/08/00	16:30	CC		Erratum	PS	13
Kawai, A.	2721	EFFECTIVENESS OF VINYL FILM THAT COMPLETELY ABSORBS ULTRAVIOLET REGION SPECTRUM FOR IPM IN GREENHOUSE CULTIVATION	II	687	23/08/00	16:30	CC		14	PS	14
Kawai, A.	1393	MECHANISMS OF RESISTANCE TO THE INSECTICIDE METHIDATHION IN AMBLYSEIUS WOMERSLEYI (ACARI: PHYTOSEIIDAE)	I	351	22/08/00	16:30	CC		7	PS	7
Kawai, A.	1282	MANAGEMENT OF ACARICIDE RESISTANCE IN JAPAN	I	324	25/08/00	15:35	HM	N	7	10	7
Kawakita, H.	2145	WOLBACHIA ARE DISTRIBUTED THROUGHOUT SOMATIC AND GENITAL ORGANS OF A MULBERRY LEAFHOPPER, HISHIMONOIDES SELLATIFORMIS	I	541	25/08/00	16:30	CC		11	PS	11
Kawamura, H.	3267	GENOMICS OF REPRODUCTION AND DIAPAUSE IN BOMBYX MORI	II	825	22/08/00	11:35	HB	K	18	2	18
Kawasaki, H.	3530	CHANGE OF GENE EXPRESSION PATTERN CAUSEDBY COMPOUND EYE METAMORPHOSIS OF BOMBYX MORI	II	891	24/08/00	16:30	CC		19	PS	19
Kay, F. Mc	2064	SAFETY OF GRATIANA BOLIVIANA AS A BIOCONTROL AGENT OF TROPICAL SODA APPLE (SOLANUM VIARUM): IS EGGPLANT A SUITABLE HOST?	I	521	22/08/00	16:30	CC		11	PS	11
Kayser, H.	1224	MODE OF ACTION OF THIAMETHOXAM, A NOVEL LIGAND OF NICOTINIC ACETYLCHOLINE RECEPTORS – A COMPARATIVE STUDY OF NEONICOTINOIDS AND INSECTS	I	309	21/08/00	10:35	HM	N	7	1	7
Kayser, H.	1226	PYMETROZINE, A SELECTIVE FEEDING INHIBITOR FOR SUCKING INSECTS, ACTS THROUGH A NOVEL MECHANISM	I	310	21/08/00	11:35	HM	N	7	1	7
Kazanci, N.	2449	CHEMO AND MECHANO RECEPTORS OF GENUS OLIGONEURIELLA (OLIGONEURIIDAE, EPHEMEROPTERA)	II	619	22/08/00	16:30	CC		13	PS	13
Kazimírová, M.	2893	TICK-HOST INTERACTIONS IN THE CO-FEEDING TRANSMISSION OF TICK-BORNE ENCEPHALITIS VIRUS: CELL INVOLVEMENT	II	730	22/08/00	15:50	Bol	R	15	4	15
Keane, G. J.	2026	PROGRESS IN THE GENETIC IMPROVEMENT OF GRANULOVIRUSES FOR THE CONTROL OF TWO IMPORTANT APPLE PESTS	I	511	24/08/00	15:30	HM	P	11	7	11
Keeping, M. G.	2722	CALCIUM SILICATE APPLICATION ENHANCES RESISTANCE OF SUGARCANE TO THE STALK BORER ELDANA SACCHARINA	II	687	23/08/00	16:30	CC		14	PS	14
Keffer, S. L.	3628	A REVIEW OF THE FAMILY LEVEL PHYLOGENY OF THE NEPOMORPHA (HETEROPTERA)	II	916	22/08/00	9:50	HB	E	21	3	21
Keil, T. A.	3049	DEVELOPMENT OF THE ANTENNA	II	769	22/08/00	13:35	HB	G	16	3	16
Keillor, K. E.	2695	INFLUENCE OF COTTON NITROGEN FERTILITY ON COTTON APHID, APHIS GOSSYPII, POPULATION DYNAMICS IN CALIFORNIA	II	681	22/08/00	16:30	CC		14	PS	14
Kéita, S. M.	3963	INSECTICIDAL EFFECTS OF THUJA OCCIDENTALIS (CUPRESSACEAE) ESSENTIAL OIL ON CALLOSOBRUCHUS MACULATUS [COLEOPTERA: BRUCHIDAE]	II	1000	22/08/00	16:30	CC		22	PS	22
Keller, M. A.	1643	THE INFLUENCE OF TEMPERATURE ON DEVELOPMENT AND LONGEVITY OF APANTELES SUBANDINUS AND ORGILUS LEPIDUS (HYMENOPTERA: BRACONIDAE)	I	414	25/08/00	16:30	CC		8	PS	8
Keller, M. A.	1644	REPRODUCTIVE CAPACITIES OF TWO PARASITOIDS OF POTATO TUBER MOTH	I	414	25/08/00	16:30	CC		8	PS	8
Kellner, R.	2453	HORMONAL REGULATION OF FLIGHT METABOLISM IN A MIGRATORY BUTTERFLY, VANESSA CARDUI (LEPIDOPTERA: NYMPHALIDAE)	II	620	23/08/00	16:30	CC		13	PS	13
Kells, A.	3496	IMPACT OF ALIEN SOCIAL BEES ON TASMANIAN FLORA AND FAUNA	II	882	23/08/00	16:30	CC		19	PS	19
Kells, A. R.	3601	FIELD MARGINS ARE POTENTIALLY VALUABLE HABITATS FOR FORAGING BUMBLEBEES	II	909	23/08/00	16:30	CC		20	PS	20
Kells, A. R.	3602	EVIDENCE FOR HANDEDNESS IN BUMBLEBEES	II	909	23/08/00	16:30	CC		20	PS	20
Kelsey, R. G.	1931	CHEMOTAXIS OF SOME SCOLYTIDS AND THEIR PREDATORS TO 4-ALLYLANISOLE AND ETHANOL IN CENTRAL OREGON PINE FORESTS	I	487	22/08/00	16:30	CC		10	PS	10
Kelsey, R. G.	1933	ATTRACTION OF SCOLYTUS UNISPINOSUS BARK BEETLES TO WATER-STRESSED BRANCHES OF DOUGLAS-FIR CONTAINING ETHANOL	I	487	22/08/00	16:30	CC		10	PS	10
Kelsey, R. G.	2432	PUPAL DIAPAUSE OF COLORADIA PANDORA: THERMAL CONSTRAINTS ON SUCCESSFUL PUPATION	II	614	22/08/00	16:30	CC		13	PS	13
Kemp, D. H.	1348	TICK CONTROL: EVIDENCE TO SUPPORT RESISTANCE MANAGEMENT RECOMMENDTIONS	I	340	23/08/00	16:30	CC		7	PS	7
Kemper, E. L.	2271	THE COMPLETE MITOCHONDRIAL GENOME OF THE PRIMARY SCREWWORM FLY COCHLIOMYIA HOMINIVORAX (DIPTERA: CALLIPHORIDAE)	I	573	22/08/00	16:30	CC		12	PS	12
Kendirgi, F.	3304	GENE REGULATION DURING OVARIAN DEVELOPMENT IN THE SILKMOTH	II	834	25/08/00	15:35	HB	K	18	7	18
Kenis, M.	1839	PREDATORS AND PARASITOIDS FOR CONTROLLING INSECT PESTS OF FORESTS	I	464	23/08/00	10:05	HB	M	10	4	10
Kenis, M.	3916	ASSESSING HOST RANGE OF A GYPSY MOTH PARASITOID: APHANTORHAPHOPSIS SAMARENSIS (DIPTERA: TACHINIDAE)	II	988	25/08/00	14:00	HB	H	22	7	22
Kenmore, P.	2595	IMPLEMENTING RICE IPM IN DEVELOPING COUNTRIES: ECOSYSTEM BASES, COMMUNITY SCIENCE AND POLICY REFORM	II	656	25/08/00	10:05	HB	B	14	8	14
Kenmore, P.	93	TOWARDS AN INTERNATIONAL PROGRAMME ON POLLINATORS AND THEIR ROLE IN ECOSYSTEM RESILIENCE	I	24	22/08/00	10:00	HB	A	2	3	2
Kennedy, G.	2577	ECOLOGY OF GENETICALLY TRANSFORMED POST PLANTS AND NATURAL ENEMIES	II	651	23/08/00	15:00	HB	B	14	5	14
Kenneth Grace, J.	3567	INSTALLATION GUIDELINES FOR THE BASALTIC TERMITE BARRIER: A PARTICLE BARRIER FOR FORMOSAN SUBTERRANEAN TERMITES (ISOPTERA: RHINOTERMITIDAE)	II	900	25/08/00	16:30	CC		19	PS	19
Kent Jr., J. W.	1030	MIGRATORY SPECIES, INDIVIDUAL VARIATION IN MIGRATORY TENDENCY: CORRELATIONS WITH RESOURCE STORAGE AND MOBILIZATION	I	260	23/08/00	16:30	CC		6	PS	6
Kephalogianni, T. E.	2327	LIFE CYCLE, MORPHOLOGICAL AND GENETIC VARIATION IN CLONES OF MYZUS PERSICAE (HOMOPTERA: APHIDIDAE)	I	587	25/08/00	16:30	CC		12	PS	12
Kerns, D. L.	122	USE OF KAOLINIC PARTICLE FILM IN A CITRUS IPM PROGRAM	I	32	23/08/00	16:20	HB	A	2	6	2
Kerpel, S. M.	1031	BEHAVIORAL AND ECOLOGICAL FEATURES OF HOST PLANT SELECTION AND INFLUENCE ON LOCAL SPECIALIZATIONS BY HELICONIUS ERATO	I	260	23/08/00	16:30	CC		6	PS	6

Sub-titles: (HB=Hotel Bourbon) - (HM=Hotel Mabu) - (CC=Convention Center) - (Bol=Foz Boulevard) - (PS=Poster Session) - (PL=Plenary Lecturer)

AUTHOR	N°	TITLE	Book	Page	Date	Time	Local	Room	Session	Symp	New Session
Kerr, W. E.	2177	EVOLUTION ABOUT BEES EVOLUTION	I	550	22/08/00	9:35	HB	L	12	3	12
Kersting, U.	1559	BIOLOGICAL CONTROL OF VECTOR INSECTS IN CITRUS: A CASE STUDY IN TURKEY	I	393	22/08/00	16:30	CC		8	PS	8
Kersting, U.	3228	OVERWINTERING BIOLOGY OF CIRCULIFER HAEMATOCEPS (HOMOPTERA, CICADELLIDAE), A VECTOR OF PROCARYONTS IN CITRUS AND SESAME	II	815	23/08/00	16:30	CC		17	PS	17
Kerzhner, I. M.	3629	THE STRUCTURE OF THE PHALLUS IN CIMICOMORPHA (HETEROPTERA)	II	916	22/08/00	10:05	HB	E	21	3	21
Kestenholz, C.	684	REPELLENT PROPERTIES OF CASSIA SOPHERA (CAESALPINIACEAE) AGAINST THE RICE WEEVIL SITOPHILUS ORYZAE (COLEOPTERA; CURCULIONIDAE); POTENTIAL AS A STORAGE PROTECTANT	I	173	23/08/00	16:30	CC		4	PS	4
Kester, K. M.	1455	LOCAL ADAPTATION OF PARASITOID POPULATIONS: WHAT DOES LEARNING HAVE TO DO WITH IT?	I	367	23/08/00	14:55	HM	O	8	6	8
Kestler, P.	3086	ACTOGRAPHIC RESPIROMETRY REVEALS THE STRATEGIES OF SPIRACULAR CONTROL OF GAS EXCHANGE IN INSECTS	II	779	25/08/00	14:05	HB	G	16	8	16
Ketelhut, S. M.	397	COMPARATIVE ANT SPECIES DIVERSITIES IN INTACT AND LOGGED AMAZONIAN RAINFORESTS	I	101	22/08/00	14:50	HB	C	3	2	3
Ketelhut, S. M.	1032	COMPARATIVE ANT SPECIES DIVERSITIES IN INTACT AND LOGGED AMAZONIAN RAINFORESTS	I	260	23/08/00	16:30	CC		6	PS	6
Ketmaier, V.	3785	A PHYLOGENETIC STUDY IN THE CAVE CRICKET GENUS TROGLOPHILUS (ORTHOPTERA, RAPHIDOPHORIDAE): COMBINING ALLOZYMIC AND MITOCHONDRIAL DNA SEQUENCE VARIATION DATA	II	955	23/08/00	16:30	CC		21	PS	21
Ketterl, J.	1821	LITTER ANT COMMUNITY IN SUBTROPICAL ARAUCARIA AND COASTAL ESCARPMENT FORESTS IN SOUTHERN BRAZIL	I	459	21/08/00	16:05	HB	M	10	1	10
Kevan, P. G.	92	POLLINATION AS A PROBLEM: AN INTEGRATED APPROACH IN ECOSYSTEM HEALTH FROM AGRICULTURE TO CONSERVATION OF NATURE	I	24	22/08/00	9:45	HB	A	2	3	2
Khambay, B. P. S.	595	CHALLENGES IN IDENTIFYING AND EXPLOITING PLANT-DERIVED INSECTICIDES	I	151	22/08/00	15:05	Bol	S	4	3	4
Khambay, B. P. S.	1252	BOTANICAL INSECTICIDES: ACCEPTABILITY OF ESTABLISHED PRACTICES AND CHALLENGES IN DEVELOPING NEW ONES	I	316	24/08/00	9:35	HM	N	7	7	7
Khan, Z. R.	194	STEM BORER HABITAT MANAGEMENT IN EAST AND SOUTHERN AFRICA	I	50	21/08/00	16:30	CC		2	PS	2
Khan, Z. R.	1535	EFFECTS OF MOLASSES GRASS (MELINIS MINUTIFLORA) VOLATILES ON THE FORAGING BEHAVIOUR OF THE STEMBORER PARASITOID COTESIA SESAMIAE	I	387	22/08/00	16:30	CC		8	PS	8
Khokhar, K. S.	3792	BIOSYSTEMATICS OF SOME SPECIES OF AGROTIS OCHSENHEIMER (NOCTUINAE: NOCTUIDAE: LEPIDOPTERA) FROM NORTH INDIA	II	957	23/08/00	16:30	CC		21	PS	21
Khoo, C. C. H.	2450	LOCALIZATION AND CHARACTERIZATION OF A NOVEL RHABDOVIRUS FROM A PARASITIC WASP DIACHASMIMORPHA LONGICAUDATA, A PARASITE OF THE CARIBBEAN FRUIT FLY ANASTREPHA SUSPENSA	II	619	22/08/00	16:30	CC		13	PS	13
Khuman, A. V.	1349	INSECT ANTIESTERASE ACTIVITY OF NOVEL ORGANO-PHOSPHORUS COMPOUNDS AND CHANGES OF ENZYME LEVEL IN FIELD RESISTANT POPULATIONS MUSCA DOMESTICA	I	340	23/08/00	16:30	CC		7	PS	7
Kibaki, J.	2825	SURVEY OF PRACTICES AND PERCEPTIONS OF SMALL HOLDER FARMERS RELATING TO PEST MANAGEMENT ON VEGETABLE CROPS IN EASTERN AFRICA	II	713	23/08/00	16:30	CC		14	PS	14
Kibler, E.	1351	BAS 620 H - A NEW GRAMINICIDE FOR POST-EMERGENCE GRASS CONTROL IN BROADLEAF CROPS	I	341	23/08/00	16:30	CC		7	PS	7
Kibler, E.	1350	BAS 620 H - A NEW GRAMINICIDE FOR POST-EMERGENCE GRASS CONTROL IN BROADLEAF CROPS	I	341	23/08/00	16:30	CC		7	PS	7
Kĺe•ek, J.	3455	PRELIMINARY SURVEY AND SPECIES COMPOSITION OF TERMITES IN SOME SITES OF THE CAMPUS OF THE "UNIVERSIDADE FEDERAL RURAL DO RIO DE JANEIRO", IN SEROPEDICA (RJ), BRAZIL	II	872	21/08/00	16:30	CC		19	PS	19
Kilic, N.	45	LIFE TABLES OF ACARUS SIRO (ACARI, ACARIDAE) ON SEVEN DIFFERENT DIETS	I	12	23/08/00	16:30	CC		1	PS	1
Kilic, N.	46	A FAUNISTIC INVESTIGATION ON THE MITE SPECIES OF STORED PRODUCTS IN TEKIRDAG PROVINCE	I	12	23/08/00	16:30	CC		1	PS	1
Kilic, N.	1561	EFFECTS OF SOME PLANTS ON PARASITIZATION OF EURYGASTER INTEGRICEPS EGGS BY TRISSOLCUS SEMISTRIATUS	I	394	22/08/00	16:30	CC		8	PS	8
Kim, D. S.	3965	MONITORING OF TWO MAJOR FRUIT MOTHS WITH SEX PHEROMONE TRAPS IN KOREAN APPLE ORCHARDS	II	1001	23/08/00	16:30	CC		22	PS	22
Kim, D.-S.	2723	TEMPERATURE-DEPENDENT DEVELOPMENTS OF CARPOSINA SASAKII (LEPIDOPTERA: CARPOSINIDAE) AND ITS STAGE EMERGENCE MODELS	II	688	24/08/00	16:30	CC		14	PS	14
Kim, H. J.	2445	COMPARATIVE ANALYSIS OF STORAGE PROTEIN GENE OF FALL WEBWORM, HYPHANTRIA CUNEA	II	618	22/08/00	16:30	CC		13	PS	13
Kim, I.	2305	CHARACTERIZATION OF GENOMIC GENE ENCODING KYNURENINE 3-MONOOXYGENASE IN THE SILKWORM BOMBYX MORI	I	582	24/08/00	16:30	CC		12	PS	12
Kim, J. P.	3786	THE SPIDER FAUNA OF NAMHAIDO ISLAND, KOREA	II	956	23/08/00	16:30	CC		21	PS	21
Kim, J. P.	3787	THE SPIDER FAUNA OF ISLAND ANMYUN-DO, KOREA	II	956	23/08/00	16:30	CC		21	PS	21
Kim, J. P.	3821	TWO NEW SPECIES OF THE GENUS THOMISUS FROM CHINA (ARANEAE : THOMISIDAE)	II	964	24/08/00	16:30	CC		21	PS	21
Kim, J. P.	3822	ONE NEW SPECIES OF THE GENUS XYSTICUS FROM CHINA (ARANEAE: THOMISIDAE)	II	965	24/08/00	16:30	CC		21	PS	21
Kim, K. C.	2946	FIELD INVESTIGATION IN FORENSIC ENTOMOLOGY: TRAINING FORENSIC INVESTIGATORS	II	743	26/08/00	11:20	Bol	R	15	11	15
Kim, K. C.	3216	CYTOPATHOLOGY AND DOUBLE MEMBRANE-BOUND VIRUS-LIKE PARTICLES ASSOCIATED WITH HIGH PLAINS DISEASE AND OTHER DISEASES CAUSED BY ERIPHYID MITE-BORNE AGENTS OF UNKNOWN ETIOLOGY	II	812	22/08/00	16:00	Bol	U	17	2	17
Kim, K. C.	3229	FIELD INVESTIGATION IN FORENSIC ENTOMOLOGY: TRAINING FORENSIC INVESTIGATORS	II	815	22/08/00	16:30	CC		17	PS	17
Kim, M. G.	2116	ULTRASTRUCTURAL AND MOLECULAR IDENTIFICATION OF A WOLBACHIA ENDOSYMBIONT IN A SPIDER, NEPHILA CLAVATA.	I	534	24/08/00	16:30	CC		11	PS	11
Kim, T. H.	2035	THE BENEFICIAL NEMATODE, HETERORHABDITIS MARELATUS : ITS PROMISE IN BIOCONTROL OF PESTS IN NURSERY AND FIELD CROPS	I	513	21/08/00	16:30	CC		11	PS	11
Kim, Y.	1545	AN EDIBLE ALGINATE FORMULATION OF STEINERNEMA CARPOCAPSAE – ITS INSECTICIDAL EFFECT AND MOISTURE-HOLDING PROPERTIES	I	390	22/08/00	16:30	CC		8	PS	8
Kim, Y.-S.	2269	GRAM-NEGATIVE BACTERIA BINDING PROTEIN, A PATTERN RECOGNITION RECEPTOR FOR LIPOPOLYSACCHARIDE AND b-1,3-GLUCAN, WHICH MEDIATES THE SIGNALING FOR THE INDUCTION OF INNATE IMMUNE GENES IN DROSOPHILA MELANOGASTER CELLS	I	573	22/08/00	16:30	CC		12	PS	12
Kimura, M. T.	3308	EVOLUTIONARY ASPECTS OF PHOTOPERIODISM IN DROSOPHILA	II	835	25/08/00	10:35	HB	K	18	8	18
Kimura, T.	2252	A NOVEL GENE UP-REGULATED DURING RECOVERY FROM COLD-SHOCK IN DROSOPHILA	I	568	22/08/00	16:30	CC		12	PS	12
Kimura, Y.	1773	SEASONAL CHANGE IN DAYLENGTH REGULATES INCIDENCE AND INTENSITY OF DIAPAUSE IN A MOTH	I	447	22/08/00	16:30	CC		9	PS	9
Kimura, Y.	3309	PHOTOPERIOD IN EARLY DEVELOPMENT MODIFIES THE CRITICAL PHOTOPERIOD IN LATE DEVELOPMENT FOR PUPAL DIAPAUSE INDUCTION IN A MOTH	II	836	25/08/00	11:05	HB	K	18	8	18
Kindl, J.	733	IDENTIFICATION OF CAMERARIA OHRIDELLA SEX PHEROMONE AND ITS POSSIBLE USE IN HORSE CHESTNUT PROTECTION	I	185	25/08/00	16:30	CC		4	PS	4
Kindlman, P.	983	SOURCE-SINK RE-COLONISATION: A POSSIBLE STRATEGY OF INSECTS LIVING IN TEMPORARILY SUITABLE HABITATS	I	248	22/08/00	16:30	CC		6	PS	6
Kindlmann, P.	858	WHEN AND WHY TOP-DOWN REGULATION FAILS	I	217	25/08/00	11:05	HB	D	6	7	6

Sub-titles: (HB=Hotel Bourbon) - (HM=Hotel Mabu) - (CC=Convention Center) - (Bol=Foz Boulevard) - (PS=Poster Session) - (PL=Plenary Lecturer)

AUTHOR	N°	TITLE	Book	Page	Date	Time	Local	Room	Session	Symp	New Session
King, N.	3788	OVERCOMING THE TAXONOMIC IMPEDIMENT TO SUSTAINABLE DEVELOPMENT - BioNET-INTERNATIONAL, THE GLOBAL NETWORK FOR TAXONOMY	II	956	23/08/00	16:30	CC		21	PS	21
King, N.	3788	OVERCOMING THE TAXONOMIC IMPEDIMENT TO SUSTAINABLE DEVELOPMENT - BioNET-INTERNATIONAL, THE GLOBAL NETWORK FOR TAXONOMY	II	956	23/08/00	16:30	CC		21	PS	21
King, E. G.	1431	PRODUCTION AND EFFICACY OF CATOLACCUS GRANDIS, A HYMENOPTEROUS LARVAL PARASITOID OF THE BOLL WEEVIL	I	361	21/08/00	14:50	HM	O	8	2	8
King, J.	1853	MECHANISMS OF RESISTANCE IN TREES TO SHOOT INSECTS	I	467	24/08/00	10:20	HB	M	10	5	10
Kingsley, P. C.	3916	ASSESSING HOST RANGE OF A GYPSY MOTH PARASITOID: APHANTORHAPHOPSIS SAMARENSIS (DIPTERA: TACHINIDAE)	II	988	25/08/00	14:00	HB	H	22	7	22
Kinjo, K.	3552	TERMITICIDAL SUBSTANCES FROM THE HEARTWOOD OF CRYPTOMERIA JAPONICA D. DON	II	896	25/08/00	16:30	CC		19	PS	19
Kinkorova, J.	1033	STRUCTURE OF THE CROP IN THE ADULT QUEEN BLOWFLY, PHORMIA REGINA	I	261	23/08/00	16:30	CC		6	PS	6
Kinkorová, J.	3148	STRUCTURE OF THE BASAL SHEATH AS A POSSIBLE DIAGNOSTIC CHARACTER IN THE TRIBE TERELLINAE (DIPTERA, TEPHRITIDAE)	II	794	24/08/00	16:30	CC		16	PS	16
Kinkorová, J.	3149	STRUCTURE OF THE CROP IN THE ADULT QUEEN BLOWFLY, PHORMIA REGINA	II	794	24/08/00	16:30	CC		16	PS	16
Kinomura, K.	3499	SYMPATRIC AND INTRASPECIFIC QUEEN-SIZE DIMORPHISM ASSOCIATED WITH QUEEN DISPERSAL STRATEGY OF JAPANESE ANT, LEPTOTHORAX SPINOSIOR	II	883	23/08/00	16:30	CC		19	PS	19
Kirk, A.	3960	REVIEWING A MULTI-AGENCY BIOLOGICAL CONTROL PROGRAM FOR BEMISIA ARGENTIFOLII IN THE SOUTHWEST UNITED STATES: FOREIGN EXPLORATION, MASS CULTURE & EVALUATIONS	II	999	22/08/00	16:30	CC		22	PS	22
Kirk, J. M.	2243	THE IDENTIFICATION OF TRANSPOSABLE ELEMENTS IN THE GENOME OF THE MALARIA VECTOR, ANOPHELES GAMBIAE	I	566	21/08/00	16:30	CC		12	PS	12
Kirkendall, L. R.	1034	INVASION SUCCESS AND BREEDING SYSTEMS: A COMPARISON OF INBREEDING AND OUTBREEDING BARK BEETLES BREEDING IN PALM SEEDS (CURCULIONIDAE, SCOLYTINAE)	I	261	23/08/00	16:30	CC		6	PS	6
Kirkendall, L. R.	3618	THE ROLE OF INBREEDING IN THE PHYLOBIOLOGY OF TROPICAL BARK BEETLES	II	914	21/08/00	13:50	HB	E	21	2	21
Kirkendall, L. R.	1835	DIFFERENTIAL COLONIZATION POTENTIAL AMONG WOOD-BORING BEETLES LEADS TO HIGH PROPORTIONS OF INBREEDING SPECIES ON TROPICAL ISLANDS	I	463	22/08/00	15:05	HB	M	10	3	10
Kirkton, S. D.	2451	EFFECTS OF ONTOGENY ON THE OXYGEN SENSITIVITY OF JUMPING PERFORMANCE IN THE AMERICAN LOCUST (SCHISTOCERCA AMERICANA)	II	619	23/08/00	16:30	CC		13	PS	13
Kirkton, S. D.	3085	BODY SIZE AND TRACHEAL FUNCTION IN GRASSHOPPERS	II	778	25/08/00	13:35	HB	G	16	8	16
Kirtibutr, N.	559	SPECIES DIVERSITY AND FUNCTIONAL DIVERSITY OF TERMITES IN EASTERN ASIA	I	141	25/08/00	16:30	CC		3	PS	3
Kishimoto, H.	1560	DEVELOPMENT AND REPRODUCTION OF PREDATORY INSECTS STETHORUS JAPONICUS (COLEOPTERA: COCCINELLIDAE), OLIGOTA KASHMIRICA BENEFICA (COLEOPTERA: STAPHYLINIDAE) AND SCOLOTHRIPS TAKAHASHII (THYSANOPTERA: THRIPIDAE) REARED ON DIFFERENT SPECIES OF SPIDER MITES (ACARI: TETRANYCHIDAE)	I	393	22/08/00	16:30	CC		8	PS	8
Kiss, J.	163	MANAGEMENT OF WESTERN CORN ROOTWORM IN EUROPE	I	42	26/08/00	15:20	HB	A	2	11	2
Kitade, O.	2326	MOLECULAR PHYLOGENETIC INSIGHTS INTO THE ORIGIN OF TERMITE WORKERS	I	587	25/08/00	16:30	CC		12	PS	12
Kitajima, E. W.	2110	SUSCEPTIBILITY OF IMMATURE STAGES OF THYRINTEINA ARNOBIA (LEPIDOPTERA: GEOMETRIDAE) TO A POSSIBLE PICORNAVIRUS	I	532	23/08/00	16:30	CC		11	PS	11
Kitajima, H.	1934	ARTIFICIAL REARING OF AN AMBROSIA BEETLE, PLATYPUS QUERCIVORUS (COLEOPTERA: PLATYPODIDAE) ON BOLTS OF A DECIDUOUS OAK, QUERCUS SERRATA	I	487	23/08/00	16:30	CC		10	PS	10
Kitamura, T.	2720	INTEGRATED PEST MANAGEMENT OF MAJOR INSECT PESTS UTILIZING APHID RESISTANT VARIETY AND NATURAL ENEMIES ON GREENHOUSE MELON	II	687	23/08/00	16:30	CC		14	PS	14
Kitamura, T.	2724	THE VARIETY DIFFERENCES IN DAMAGE OF STRAWBERRY FRUITS BY WESTERN FLOWER THRIPS	II	688	23/08/00	16:30	CC		14	PS	14
Kitching, I. J.	3694	RECENT DEVELOPMENTS IN THE HIGHER SYSTEMATICS OF NOCTUOID MOTHS	II	933	26/08/00	10:20	HB	E	21	9	21
Kitching, I. J.	459	RICHNESS HOTSPOTS AND RARITY HOTSPOTS OF MEXICAN SATURNIIDAE (INSECTA: LEPIDOPTERA)	I	116	26/08/00	15:20	HB	C	3	10	3
Kitron, U.	2901	RANGE EXTENSION OF IXODES SCAPULARIS AND LYME DISEASE IN NORTH AMERICA	II	732	23/08/00	13:35	Bol	R	15	6	15
Kivan, M.	1561	EFFECTS OF SOME PLANTS ON PARASITIZATION OF EURYGASTER INTEGRICEPS EGGS BY TRISSOLCUS SEMISTRIATUS	I	394	22/08/00	16:30	CC		8	PS	8
Kivan, M.	1696	FECUNDITY OF EURYGASTER INTEGRICEPS AND EURYGASTER AUSTRIACA IN LABORATORY CONDITION AND NATURE	I	427	25/08/00	16:30	CC		8	PS	8
Kjer, K. M.	3688	THE HIGHER LEVEL PHYLOGENY OF TRICHOPTERA WITH AN EMPHASIS ON THE RELATIONSHIPS AMONG SUBORDERS	II	931	25/08/00	15:50	HB	E	21	8	21
Klaczko, L. B.	2198	MORPHOLOGICAL CORRELATES OF CHROMOSOME INVERSION GENOTYPES	I	555	23/08/00	14:35	HB	L	12	6	12
Klasmer, P.	1935	MAIN INSECT FOREST PESTS AFFECTING PINES IN THE PATAGONIA ARGENTINA	I	488	23/08/00	16:30	CC		10	PS	10
Klasmer, P.	1881	SIREX NOCTILIO IN SOUTH AMERICA: DISTRIBUTION, MONITORING AND CONTROL	I	474	26/08/00	9:35	HB	M	10	9	10
Klasmer, P.	1882	RISK TO SOUTH AMERICAN RADIATA PINE RESOURCES BY THE PINE SHOOT MOTH, RHYACIONIA BUOLIANA	I	474	26/08/00	10:05	HB	M	10	9	10
Klaudiny, J.	2322	FROM GENE OF HONEYBEE (APIS MELLIFERA) TO MOLECULAR PROPERTIES AND FUNCTION OF MAJOR PROTEINS OF ROYAL JELLY	I	586	25/08/00	16:30	CC		12	PS	12
Klein, M.	3230	HYTOPLASMA-BEARING LEAFHOPPERS/PLANTHOPPERS, SUSPECTED TO BE VECTORS, IN VINEYARDS IN THE GOLAN HEIGHTS, ISRAEL	II	815	23/08/00	16:30	CC		17	PS	17
Klein, M. G.	83	ERADICATION OF A SCARAB PEST FROM A NATIONAL WILDLIFE REFUGE	I	22	21/08/00	10:50	HB	A	2	1	2
Klein, M. G.	2013	PATHOGENS FOR CONTROL OF NORTH AMERICAN SCARABS	I	508	23/08/00	13:30	HM	P	11	5	11
Klein, M. G.	2701	INTEGRATED PEST MANAGEMENT OF SCARABS IN NORTH AMERICA	II	682	22/08/00	16:30	CC		14	PS	14
Klein, M. G.	2701	INTEGRATED PEST MANAGEMENT OF SCARABS IN NORTH AMERICA	II	682	22/08/00	16:30	CC		14	PS	14
Kleinert, A. M. P.	1201	COMMUNITY STRUCTURE OF BEES IN A COASTAL SAND DUNE IN BAHIA, NORTHEAST BRAZIL	I	303	25/08/00	16:30	CC		6	PS	6
Kleinert, A. M. P.	3972	THE ADAPTATION AND CONTRIBUTION OF DIFFERENT SPECIES OF STINGLESS BEES IN STRAWBERRY PRODUCTION WITHIN GREENHOUSE AT ATIBAIA COUNTY – SP	II	1002	23/08/00	16:30	CC		22	PS	22
Kleinert, A. M. P.	972	NECTAR AND POLLEN COLLECTION PATTERNS OF MELIPONA BICOLOR BICOLOR (HYMENOPTERA, APIDAE, MELIPONINAE)	I	245	22/08/00	16:30	CC		6	PS	6
Kleinert, A. M. P.	1012	CIRCADIAN RHYTHMS ON NECTAR AND POLLEN COLLECTION BY FORAGERS OF MELIPONA BICOLOR BICOLOR (HYMENOPTERA, APIDAE, MELIPONINAE)	I	255	22/08/00	16:30	CC		6	PS	6
Klimek, A.	2411	INTERACTION OF SOME PROTEINS ON BIOLOGY OF GRAIN APHID (SITOBION AVENAE /F./)	II	609	21/08/00	16:30	CC		13	PS	13
Kline, D. L.	2867	UTILIZATION OF HOST-SEEKING ATTRACTANTS CONTAINER BREEDING AND FLOODWATER AEDES CONTROL	II	724	21/08/00	9:35	Bol	R	15	1	15
Klingenberg, C.	3337	COLONY DEVELOPMENT OF ATTA LEAFCUTTING ANTS UNDER LABORATORY AND FIELD CONDITIONS	II	843	22/08/00	16:30	CC		18	PS	18
Klingenberg, C.	3509	LEAFCUTTING ANTS AS PESTS IN ARAUCARIA CULTURES: DIET PREFERENCE BIO-ASSAY UNDER LABORATORY CONDITIONS	II	886	23/08/00	16:30	CC		19	PS	19
Klingler, M.	4000	UNIVERSAL TRANSFORMATION SYSTEM FOR TRANSGENIC ARTHROPODS	II	1009	25/08/00	16:30	CC		22	PS	22
Klingler, M.	3076	PROXIMAL-DISTAL PATTERNING IN TRIBOLIUM CASTANEUM, AN INSECT WITH EMBRYONIC LIMB FORMATION	II	776	24/08/00	15:30	HB	G	16	6	16

Sub-titles: (HB=Hotel Bourbon) - (HM=Hotel Mabu) - (CC=Convention Center) - (Bol=Foz Boulevard) - (PS=Poster Session) - (PL=Plenary Lecturer)

AUTHOR	Nº	TITLE	Book	Page	Date	Time	Local	Room	Session	Symp	New Session
Klok, C. J.	50	INTERSPECIFIC PHYSIOLOGICAL DIFFERENTIATION IN MARINE AND TERRESTRIAL HALOZETES SPECIES (ACARI, ORIBATIDA)	I	13	23/08/00	16:30	CC		1	PS	1
Kluh, I.	2452	THE EFFECT OF PLANT INHIBITORS OF INSECT DIGESTIVE ENYZYMES ON GROWTH AND MORTALITY OF MODEL PESTS	II	619	23/08/00	16:30	CC		13	PS	13
Knapp, A.	1828	INTEGRATION OF REMOTE SENSING TECHNOLOGIES INTO INTEGRATED PEST MANAGEMENT PROGRAM FOR SIREX NOCTILIO IN BRAZIL	I	461	22/08/00	11:05	HB	M	10	2	10
Knapp, J.	2585	INTEGRATED PEST MANAGEMENT OF CITRUS IN FLORIDA	II	653	24/08/00	13:50	HB	B	14	7	14
Knapp, J. J.	3491	THE EFFECTS OF ELECTRICAL FIELDS ON THE BEHAVIOUR OF ANTS	II	881	22/08/00	16:30	CC		19	PS	19
Knapp, J. J.	1035	THE ROLE OF LEARNING AND MEMORY IN LEAF-CUTTING ANT FORAGING ECOLOGY.	I	261	23/08/00	16:30	CC		6	PS	6
Knapp, M.	47	TETRANYCHUS EVANSI – A NEW CHALLENGE TO SMALL-HOLDER TOMATO GROWERS IN SOUTHERN AFRICA	I	12	23/08/00	16:30	CC		1	PS	1
Knell, R. J.	1706	SEXUALLY TRANSMITTED DISEASES AND THE EVOLUTION OF INSECT MATING SYSTEMS	I	430	21/08/00	9:55	HB	F	9	1	9
Knight, A.	2539	AREAWIDE MANAGEMENT OF LEPIDOPTEROUS PESTS IN PERENNIAL CROPPING SYSTEMS: OPPORTUNITIES AND CONSTRAINTS	II	642	21/08/00	9:35	HB	B	14	1	14
Knight, A. L.	2548	CODLING MOTH MANAGEMENT: MONITORING METHODS, CONTROL GUIDELINES AND PREDICTIVE MODELS	II	644	21/08/00	14:35	HB	B	14	2	14
Knight, A. L.	121	EVALUATION OF SEASONAL PARTICLE FILM SPRAY PROGRAMS IN A WESTERN APPLE ORCHARD	I	31	23/08/00	16:05	HB	A	2	6	2
Knutelski, S.	2481	SIGNIFICANCE OF TERATOCYTES AS A SOURCE OF NUTRIENTS FOR DEVELOPING LARVAE OF 3 SPECIES OF EUPHORINE PARASITOIDS OF THE ADULT HOSTS	II	627	24/08/00	16:30	CC		13	PS	13
Knutson, A. E.	1562	SAMPLING PREDATORY INSECTS AND SPIDERS IN COTTON	I	394	22/08/00	16:30	CC		8	PS	8
Knutson, L.	3855	NOT ALL SCIOMYZIDAE KILL MOLLUSKS : SEPEDONELLA NANA EATS WORMS	II	973	25/08/00	16:30	CC		21	PS	21
Knutson, O.	616	MATING DISRUPTION TO MANAGE ORCHARD PESTS IN THE PACIFIC NORTHWEST OF NORTH AMERICA: PAST, PRESENT AND FUTURE	I	156	24/08/00	15:00	Bol	S	4	6	4
Kobayashi, J.	2505	CHARACTERIZATION OF A RECOMBINANT INSECT CHITINASE AND A BACULOVIRUS CHITINASE	II	633	24/08/00	16:30	CC		13	PS	13
Kobayashi, K.	1184	THE INFLUENCE OF INCREASED ATMOSPHERIC CO2 AND TEMPERATURE ON NEPHOTETTIX CINCTICEPS LIFE CYCLES ANDECOSYSTEMS	I	298	25/08/00	16:30	CC		6	PS	6
Kobayashi, M.	3358	VARIETAL DIFFERENCE IN NYMPHAL SURVIVAL RATE, ADULT FECUNDITY AND LONGEVITY OF FRANKLINIELLA OCCIDENTALIS (TYSANOPTERA: THRIPIDAE) ON JAPANESE CHRYSANTHEMUM LEAVES	II	848	24/08/00	16:30	CC		18	PS	18
Kobayashi, M.	2305	CHARACTERIZATION OF GENOMIC GENE ENCODING KYNURENINE 3-MONOOXYGENASE IN THE SILKWORM BOMBYX MORI	I	582	24/08/00	16:30	CC		12	PS	12
Kobayashi, M.	3264	RELATIONSHIPS BETWEEN THE LOCATION AND THE RADIATION SENSITIVITY OF RETROTRANSPOSONS IN THE GENOME AND THE INSERTION MECHANISM	II	824	22/08/00	10:20	HB	K	18	2	18
Kobayashi, M. R.	322	DIFFERENT PESTICIDE APPLICATION METHODS IN CONTROL OF WHITEFLY AND LEAFMINER ON TOMATO PLANTS UNDER VINYL HOUSE	I	82	24/08/00	16:30	CC		2	PS	2
Kobayashi, M. R.	323	INFLUENCE OF DIFFERENT APPLICATION METHODS AND DOSAGES OF THIAMETHOXAM IN THRIPS CONTROL	I	82	24/08/00	16:30	CC		2	PS	2
Kobayashi, T.	3267	GENOMICS OF REPRODUCTION AND DIAPAUSE IN BOMBYX MORI	II	825	22/08/00	11:35	HB	K	18	2	18
Kobayashi, Y.	3789	MOLECULAR PHYLOGENY OF THE JAPANESE AND NEW ZEALAND MICROPTERIGIDAE (LEPIDOPTERA) BASED ON MITOCHONDRIAL GENE SEQUENCES	II	956	23/08/00	16:30	CC		21	PS	21
Kobus, K.	236	POPULATIONAL COMPOSITION AND SOIL MOBILITY OF SCAPTOCORIS CASTANEA (HETEROPTERA:CYDNIDAE) IN GOIÁS, BRAZIL	I	60	22/08/00	16:30	CC		2	PS	2
Kobus, K. R.	225	EFFECT OF THE INSECT GROWTH REGULATOR DIFLUBENZURON ON REPRODUCTION OF EUSCHISTUS HEROS (FABR.) (HETEROPTERA: PENTATOMIDAE)	I	57	22/08/00	16:30	CC		2	PS	2
Kocáková, P.	34	INTERACTION OF TICK SALIVA WITH THE HOST IMMUNE MECHANISMS AND ITS SIGNIFICANCE FOR PATHOGEN TRANSMISSION	I	9	22/08/00	16:30	CC		1	PS	1
Koch, M.	3079	MYRIAPOD AND HEXAPOD MOUTHPARTS: FUNCTIONAL MORPHOLOGY AND PHYLOGENETIC IMPLICATIONS	II	777	25/08/00	10:15	HB	G	16	7	16
Kochansky, J. P.	3250	TESTIS ECDYSIOTROPIN, AN INSECT GONADOTROPIN THAT INDUCES SYNTHESIS OF ECDYSTEROID	II	821	21/08/00	9:50	HB	K	18	1	18
Kocourek, F.	2452	THE EFFECT OF PLANT INHIBITORS OF INSECT DIGESTIVE ENYZYMES ON GROWTH AND MORTALITY OF MODEL PESTS	II	619	23/08/00	16:30	CC		13	PS	13
Kocourek, F.	2024	CONTROL OF THE CODLING MOTH WITH CpGV DISSEMINATED BY MEANS OF PHEROMONE STATIONS: 5 YEARS OF FIELD TRIALS	I	511	24/08/00	14:30	HM	P	11	7	11
Kocourek, F.	2725	THE MANAGEMENT OF SAN JOSE SCALE (QUADRASPIDIOTUS PERNICIOSUS COMST.): USE OF PHEROMONE TRAPS AND TEMPERATURE MODEL FOR TIMING OF CONTROL	II	688	24/08/00	16:30	CC		14	PS	14
Kodama, S.	2726	MODE OF ACTION AND CHARACTARISTICS OF A NOVEL INSECT PEST CONTROL AGENT, CHROMAFENOZIDE	II	688	23/08/00	16:30	CC		14	PS	14
Kodama, S.	3961	INSECTICIDAL ACTIVITY OF A NOVEL INSECT PEST CONTROL AGENT, CHROMAFENOZIDE	II	1000	22/08/00	16:30	CC		22	PS	22
Koehl, M. A. R.	576	AIR FLOW THROUGH PECTINATE INSECT ANTENNAE AND ODORANT INTERCEPTION RATES	I	146	21/08/00	10:00	Bol	S	4	1	4
Koekemoer, L. L.	2264	MOLECULAR IDENTIFICATION OF THE ANOPHELES FUNESTUS GROUP IN SOUTHERN AFRICA	I	571	22/08/00	16:30	CC		12	PS	12
Koella, J. C.	2255	HOST GENETICS AND THE CONTROL OF LIFE HISTORY TRAITS IN THE YELLOW FEVER MOSQUITO AEDES AEGYPTI INFECTED WITH NOSEMA ALGERAE MICROSPORIDIA	I	569	22/08/00	16:30	CC		12	PS	12
Koga, A. G.	1533	SURVEY OF PARASITOIDS OF THE FALL ARMYWORM, SPODOPTERA FRUGIPERDA (LEPIDOPTERA: NOCTUIDAE), IN FERNANDÓPOLIS REGION, SÃO PAULO STATE, BRAZIL	I	387	22/08/00	16:30	CC		8	PS	8
Kogan, M.	761	AN INTERACTIVE INFORMATION RETRIEVAL AND REFERRAL SYSTEM FOR WORLDWIDE ELECTRONIC IPM INFORMATION	I	192	23/08/00	10:05	Bol	T	5	4	5
Kogan, M.	2623	ONLINE DECISION SUPPORT SYSTEM FOR INTEGRATED CODLING MOTH MANAGEMENT	II	663	22/08/00	16:30	CC		14	PS	14
Kogan, M.	2657	ONLINE APPLICATION SERVER FOR PHENOLOGY MODELS AND MAPS	II	671	21/08/00	16:30	CC		14	PS	14
Kogan, M.	2561	INTRODUCTION: HISTORICAL AND ECOLOGICAL FOUNDATIONS OF IPM	II	647	22/08/00	13:35	HB	B	14	4	14
Kogan, M.	2727	INTRODUCTION TO THE SYMPOSIUM: PERSPECTIVES IN ECOTHEORY AND INTEGRATED PEST MANAGEMENT	II	689	23/08/00	16:30	CC		14	PS	14
Kogel, W.J. de	738	NEW TOOLS TO CONTROL APHID PESTS: REPELLENT ODOURS	I	186	25/08/00	16:30	CC		4	PS	4
Kohara, S.	3568	CONTROL OF THE MATING FLIGHT TIME OF HONEYBEES BY PHOTOPERIODIC TREATMENT WITHIN THE HIVE	II	900	25/08/00	16:30	CC		19	PS	19
Köhler, A.	1036	BEE-PLANT-RELATIONS OF MASS-FLOWERING TREES IN A SOUTH BRAZILIAN ARAUCARIA FOREST OF THE MATA ATLÂNTICA	I	261	23/08/00	16:30	CC		6	PS	6
Köhler, A.	3607	EXTRAORDINARY NEST SITE OF AUGOCHLOROPSIS CAERULANS (HYMENOPTERA; HALICTINAE) IN A WET PASTURE HOLLOW	II	910	25/08/00	16:30	CC		20	PS	20
Köhler, A.	398	HOW FAR NORTH AND SOUTH DOES THE APIFAUNA OF AMAZONIA REACH, ESPECIALLY THE BEE SPECIES VISITING MASS-FLOWERING TREES	I	101	22/08/00	15:05	HB	C	3	2	3
Köhlerová, P.	2362	EVIDENCE FOR PHENOLOXIDASE ACTIVITY IN EARTHWORMS	II	597	23/08/00	13:50	HB	I	13	5	13
Kohlmann, B.	3668	STUDIES ON COSTA RICAN SCARABAEINAE (COLEOPTERA: SCARABAEIDAE)	II	926	24/08/00	13:50	HB	E	21	7	21
Koike, Y.	3510	STRUCTURAL ANALYSIS OF THE Z CHROMOSOME IN BOMBYX MORI BY USING THE BAC LIBRARY	II	886	23/08/00	16:30	CC		19	PS	19

Sub-titles: (HB=Hotel Bourbon) - (HM=Hotel Mabu) - (CC=Convention Center) - (Bol=Foz Boulevard) - (PS=Poster Session) - (PL=Plenary Lecturer)

AUTHOR	N°	TITLE	Book	Page	Date	Time	Local	Room	Session	Symp	New Session
Koike, Y.	3266	BOMBYX EST DATABASE, SILKBASE, FOR GENOME ANALYSIS OF BOMBYX MORI	II	825	22/08/00	11:05	HB	K	18	2	18
Koike, Y.	3530	CHANGE OF GENE EXPRESSION PATTERN CAUSEDBY COMPOUND EYE METAMORPHOSIS OF BOMBYX MORI	II	891	24/08/00	16:30	CC		19	PS	19
Koike, Y.	2324	SEX-SPECIFIC ALTERNATIVE SPLICING OF THE LEPIDOPTERAN HOMOLOGS OF THE DROSOPHILA MELANOGASTER SEX DETERMINING GENE DOUBLESEX	I	586	25/08/00	16:30	CC		12	PS	12
Kojima, H.	3626	PHYLOGENY AND EVOLUTION OF DRYOPHTHORIDAE (COLEOPTERA: CURCULIONOIDEA)	II	916	21/08/00	16:05	HB	E	21	2	21
Kojima, H.	3790	ON THE GENERA OF THE ORIENTAL AND AUSTRALIAN CONODERINAE (ZYGOPINAE AUCTT) (COLEOPTERA: CURCULIONIDAE)	II	957	23/08/00	16:30	CC		21	PS	21
Kokanova, E.	2081	ENTOMOPHAGS OF THE POPLAR LEAF BEETLE IN TURKMENISTAN	I	525	22/08/00	16:30	CC		11	PS	11
Kokinis, G. M.	3227	NEW APHID VECTORS OF ZUCCHINI YELLOW MOSAIC VIRUS AND THEIR ROLE IN THE EPIDEMIOLOGY OF THE VIRUS IN GREECE	II	815	22/08/00	16:30	CC		17	PS	17
Kokolakis, G.	2262	HEAT SHOCK RESPONSE IN THE MEDITERRANEAN FRUIT FLY: GENES, PROMOTERS AND THERMOTOLERANCE	I	571	22/08/00	16:30	CC		12	PS	12
Kokoza, V. A.	2917	ENGINEERING BLOOD MEAL-ACTIVATED SYSTEMIC IMMUNITY USING FAT BODY-SPECIFIC GENES IN THE MOSQUITO VECTOR	II	736	24/08/00	15:05	Bol	R	15	8	15
Kokuho, T.	3523	MASS-PRODUCTION OF PORCINE INTERLEUKIN-2 IN BOMBYX MORI	II	889	24/08/00	16:30	CC		19	PS	19
Kolaczinski, J.	1266	ATTEMPTS TO MEET THE THREAT OF PYRETHROID RESISTANCE TO THE CONTINUED SUCCESS OF INSECTICIDE TREATED BEDNETS AGAINST MALARIA VECTORS	I	320	24/08/00	15:35	HM	N	7	8	7
Kollars Jr., T. M.	2924	PREVENTION OF SPOROGONY OF PLASMODIUM VIVAX IN ANOPHELES DIRUS MOSQUITOES BY TRANSMISSION-BLOCKING ANTIMALARIALS	II	738	25/08/00	10:35	Bol	R	15	9	15
Kollisch, G. V.	2453	HORMONAL REGULATION OF FLIGHT METABOLISM IN A MIGRATORY BUTTERFLY, VANESSA CARDUI (LEPIDOPTERA: NYMPHALIDAE)	II	620	23/08/00	16:30	CC		13	PS	13
Kolluru, G.R	1740	SINGING UNDER PRESSURE: CALLING BEHAVIOR AND MATE ATTRACTION IN CRICKETS SUBJECT TO PHONOTACTIC PARASITOIDS	I	438	23/08/00	10:45	HB	F	9	3	9
Kolmer, K.	1768	COOPERATION AND DIVISION OF LABOR BETWEEN UNRELATED INDIVIDUALS IN THE ANT PACHYCONDYLA 'INVERSA'	I	445	22/08/00	16:30	CC		9	PS	9
Komazaki, S.	2298	ANALYSIS OF GENETIC STRUCTURE CHANGES WITH POPULATION DENSITY IN PANONYCHUS CITRI IN A SMALL HABITAT USING AN ESTERASE LOCUS	I	580	25/08/00	16:30	CC		12	PS	12
Komazaki, S.	3851	DISCRIMINATION OF NINE THRIPS SPECIES (THYSANOPTERA: THRIPIDAE) BY PCR-RFLP ANALYSIS	II	972	25/08/00	16:30	CC		21	PS	21
Komitopoulou, K. I.	2237	MOLECULAR STUDIES OF SEX-SPECIFIC GENES IN THE INSECTS C. CAPITATA AND BACTROCERA OLEAE	I	565	21/08/00	16:30	CC		12	PS	12
Kômoto, N.	3265	RECENT PROGRESS IN THE TRANSGENESIS OF SILKWORM, BOMBYX MORI AND APPLICATION TO THE GENOME PROJECT	II	825	22/08/00	10:35	HB	K	18	2	18
Kômoto, T.	2305	CHARACTERIZATION OF GENOMIC GENE ENCODING KYNURENINE 3-MONOOXYGENASE IN THE SILKWORM BOMBYX MORI	I	582	24/08/00	16:30	CC		12	PS	12
Kon, M.	1770	RELATIONSHIP BETWEEN MICROHABITAT AND BODY SHAPE IN ADULT PASSALID BEETLES (COLEOPTERA, PASSALIDAE)	I	446	22/08/00	16:30	CC		9	PS	9
Kon, M.	3719	PHYLOGENY AND SEXUAL DIMORPHISM OF STAG BEETLES (COLEOPTERA, LUCANIDAE)	II	939	21/08/00	16:30	CC		21	PS	21
Kon, M.	3355	BIMODAL LIFE CYCLE AND SUMMER DIAPAUSE IN THE BURYING BEETLE, NICROPHORUS QUADRIPUNCTATUS	II	847	23/08/00	16:30	CC		18	PS	18
Kondo, T.	3791	A PHYLOGENETIC ANALYSIS OF BRAZILIAN SOFT SCALE INSECTS	II	957	23/08/00	16:30	CC		21	PS	21
Kongkanjana, A.	2650	INSECTICIDE SPRAYING TECHNIQUES FOR CONTROLLING THE DIAMOND BACK MOTH, PLUTELLA XYLOSTELLA ON CHINESE KALE	II	669	21/08/00	16:30	CC		14	PS	14
Konno, K.	685	AMINO ACID SECRETION IN DIGESTIVE JUICE: COUNTERADAPTATION OF HERBIVOROUS INSECTS AGAINST PROTEIN-DENATURING ACTIVITY OF PLANT IRIDOID GLYCOSIDES ACTIVATED BY PLANT BETA-GLUCOSIDASE	I	173	23/08/00	16:30	CC		4	PS	4
Konno, R. H.	2082	BASELINE SUSCEPTIBILITY OF BREVIPALPUS (ACARI: TENUIPALPIDAE) TO ORGANOTIN ACARICIDES IN BRAZILIAN CITRUS GROVES	I	525	22/08/00	16:30	CC		11	PS	7
Konstandi, "	3150	MOLECULAR CHARACTERIZATION AND IN SITU LOCALIZATION OF A PEROXIDASE GENE WITH RESPECT TO CHORIOGENESIS IN DROSO-PHILA MELANOGASTER	II	795	23/08/00	16:30	CC		16	PS	16
Konstandi, "	3656	HISTOCHEMICAL AND MOLECULAR EVIDENCE OF PEROXIDASE ACTIVITY IN SEGESTIDEA NOVAGUINEAE (ORTHOPTERA) AND STICHOTREMA DALLATORREANUM (STREPSIPTERA)	II	923	23/08/00	16:20	HB	E	21	5	21
Konstandi, O.	3196	CHORIOGENESIS IN DACUS OLEAE WITH RESPECT TO PEROXIDASES	II	806	25/08/00	16:30	CC		16	PS	16
Kontodimas, D.	2613	THE EFFECTS OF CITRUS LEAF MINER INFESTATIONS IN CITRUS GROVES	II	660	21/08/00	16:30	CC		14	PS	14
Kontodimas, D. C.	1176	THE BLACK SCALE OF GRAPES TARGIONIA VITIS IN GREECE	I	296	25/08/00	16:30	CC		6	PS	6
Kontsedalov, S.	1342	NOVALURON (RIMON EC-10), A NOVEL IGR FOR CONTROLLING AGRICULTURAL INSECT PESTS	I	339	23/08/00	16:30	CC		7	PS	7
Koponen, S.	1040	LARVAL FOOD AND FEEDING HABIT CONTRIBUTE TO PERIODICITY AND MAGNITUDE OF DENSITY FLUCTUATIONS IN SUBARCTIC FOREST MOTHS	I	262	23/08/00	16:30	CC		6	PS	6
Koppenhoffer, A. M.	2701	INTEGRATED PEST MANAGEMENT OF SCARABS IN NORTH AMERICA	II	682	22/08/00	16:30	CC		14	PS	14
Koppenhoffer, A. M.	2701	INTEGRATED PEST MANAGEMENT OF SCARABS IN NORTH AMERICA	II	682	22/08/00	16:30	CC		14	PS	14
Koptur, S.	809	PATTERNS OF SPECIALIZATION AMONG LEPIDOPTERAN HERBIVORES OF INGA (FABACEAE: MIMOSOIDEAE) AND THEIR PARASITOIDS	I	205	24/08/00	15:35	HB	F	6	2	6
Koptur, S.	3933	INTERACTIONS AMONG PLANTS AND INSECTS MEDIATED BY EXTRAFLORAL NECTARIES	II	993	24/08/00	14:35	HM	Q	22	9	22
Korob, P.	4086	ANALYSIS OF VARIATION OF SPECIFIC CHARACTERS OF CULEX (CULEX) IN TWO ENVIROMENTS AND DETECTION OF NEW SPECIES IN THE CITY OF BUENOS AIRES	II	1032	23/08/00	16:30	CC		23	PS	23
Korsaneczky, M.	2051	DESIGNING PROTEINASE INHIBITORS FOR THE CONTROL OF HELICOVERPA SPECIES	I	517	21/08/00	16:30	CC		11	PS	11
Korunic, Z.	4010	DIATOMACEOUS EARTH TO CONTROL STORED-GRAIN INSECTS	II	1013	21/08/00	14:45	HB	J	23	2	23
Kotiaho, J. S.	1713	LEK PARADOX RESOLVED: EMPIRICAL EVIDENCE FOR GENETIC VARIANCE IN CONDITION AND IN CONDITION DEPENDENCE	I	432	21/08/00	13:50	HB	F	9	1	9
Kotze, D. J.	1037	ABUNDANCE-REGIONAL DISTRIBUTION RELATIONSHIPS IN NORTHERN EUROPEAN CARABIDS (COLEOPTERA: CARABIDAE)	I	262	23/08/00	16:30	CC		6	PS	6
Kotze, J.	417	ASSESSING ANTHROPOGENIC IMPACTS ON BIODIVERSITY USING CARABIDS: A GLOBAL NETWORK	I	106	23/08/00	15:20	HB	C	3	4	3
Kotze, J.	418	CARABID BEETLES (COLEOPTERA, CARABIDAE) ACROSS URBAN-RURAL GRADIENTS IN BULGARIA, CANADA AND FINLAND: AN INTERNATIONAL COLLABORATIVE EFFORT	I	106	23/08/00	15:35	HB	C	3	4	3
Kouki, J.	1040	LARVAL FOOD AND FEEDING HABIT CONTRIBUTE TO PERIODICITY AND MAGNITUDE OF DENSITY FLUCTUATIONS IN SUBARCTIC FOREST MOTHS	I	262	23/08/00	16:30	CC		6	PS	6
Kouretas, D.	4152	DIFFERENTIAL DISPLAY PCR WITH NON-RADIOACTIVE DETECTION OF DIFFERENTIALLY EXPRESSED mRNAs IN APHIDS.	II	1049	21/08/00	16:30	CC		Erratum	PS	21
Koutroubas, A. G.	2083	COMBINED APPLICATION OF MATING DISRUPTION AND BACILLUS THURINGIENSIS FOR CONTROL OF THE BERRY MOTH IN GREEK ISLANDS, LIMNOS AND SAMOS	I	525	22/08/00	16:30	CC		11	PS	11
Kouyanou-Koutsoukou, S.	2265	CLONING OF THE ACIDIC RIBOSOMAL P-PROTEINS IN THE SILKMOTH BOMBYX MORI	I	572	22/08/00	16:30	CC		12	PS	12
Kovaleski, A.	686	USE OF MICROENCAPSULATED PHEROMONE OF THE ORIENTAL FRUIT MOTH FOR MATING DISRUPTION IN BRAZIL	I	173	23/08/00	16:30	CC		4	PS	4

Sub-titles: (HB=Hotel Bourbon) - (HM=Hotel Mabu) - (CC=Convention Center) - (Bol=Foz Boulevard) - (PS=Poster Session) - (PL=Plenary Lecturer)

AUTHOR	Nº	TITLE	Book	Page	Date	Time	Local	Room	Session	Symp	New Session
Kovaleski, A.	1531	PARASITISM OF EGGS OF APPLE LEAF ROLLER BONAGOTA CRANAODES (LEPIDOPTERA: TORTRICIDAE) BY TRICHOGRAMMA SP. IN FIELD CONDITIONS	I	386	22/08/00	16:30	CC		8	PS	8
Kovaleski, A.	2728	TECHNICAL AND ECONOMICAL FEASIBILITY OF ERADICATING THE CODLING MOTH FROM THE BRAZILIAN APPLE GROWING AREA	II	689	24/08/00	16:30	CC		14	PS	14
Kovaleski, A.	693	MANAGING TEMPERATE FRUIT PESTS IN BRAZIL USING SEMIOCHEMICALS	I	175	23/08/00	16:30	CC		4	PS	4
Kovaleski, A.	3970	A HIGHLY INTEGRATED MONITORING SYSTEM TO SUPPORT ON-TIME, ON-LINE DECISION-MAKING IN AGRICULTURE	II	1002	24/08/00	16:30	CC		22	PS	22
Kovanci, B.	1038	ECOLOGICAL ADAPTATIONS AND CONSERVATION OF THREE PAPILIONID SPECIES LIVING ON THE ARISTOLOCHIA SPECIES IN ULUDAG, BURSA, TURKEY	I	262	23/08/00	16:30	CC		6	PS	6
Kovanci, O. B.	1038	ECOLOGICAL ADAPTATIONS AND CONSERVATION OF THREE PAPILIONID SPECIES LIVING ON THE ARISTOLOCHIA SPECIES IN ULUDAG, BURSA, TURKEY	I	262	23/08/00	16:30	CC		6	PS	6
Kovarik, P. W.	3624	IMMATURES AND CURCULIONOID PHYLOGENY: THE REST OF THE STORY!	II	915	21/08/00	15:35	HB	E	21	2	21
Kozlov, M. V.	1039	INCREASED INCIDENCE OF BOREAL FOREST PEST OUTBREAKS: HERALD OF GLOBAL CHANGE?	I	262	23/08/00	16:30	CC		6	PS	6
Kozlov, M. V.	1040	LARVAL FOOD AND FEEDING HABIT CONTRIBUTE TO PERIODICITY AND MAGNITUDE OF DENSITY FLUCTUATIONS IN SUBARCTIC FOREST MOTHS	I	262	23/08/00	16:30	CC		6	PS	6
Koznetsova, L.	3230	HYTOPLASMA-BEARING LEAFHOPPERS/PLANTHOPPERS, SUSPECTED TO BE VECTORS, IN VINEYARDS IN THE GOLAN HEIGHTS, ISRAEL	II	815	23/08/00	16:30	CC		17	PS	17
Kraaijeveld, A. R.	1584	A LABORATORY SELECTION EXPERIMENT: EVOLUTION OF DROSOPHILA MELANOGASTER UNDER THE ATTACK OF THE PUPAL PARASITOID PACHYCREPOIDEUS VINDEMIAE	I	399	23/08/00	16:30	CC		8	PS	8
Krall, S.	870	THE DESERT LOCUST FROM PAKISTAN TO MAURITANIA	I	220	26/08/00	10:20	HB	D	6	9	6
Kramer, K. J.	2385	OXIDATIVE CONJUGATION OF CATECHOLS FOR INSECT CUTICLE SCLEROTIZATION	II	603	25/08/00	15:20	HB	I	13	9	13
Kramer, K. J.	2454	OXIDATIVE CONJUGATION OF CATECHOLS FOR INSECT CUTICLE SCLEROTIZATION	II	620	23/08/00	16:30	CC		13	PS	13
Kranner, G.	785	HOW MIGRATION AFFECTS ECOLOGICAL DIVERSIFICATION OF APIS DORSATA POPULATION. AN APPROACH BY SELF-ORGANIZING MAPS PROCESSING	I	198	21/08/00	16:30	CC		5	PS	5
Kranthi, K.	1280	DEVELOPMENT AND APPLICATION OF AN INSECTICIDE RESISTANCE IMPACT MINIMISATION STRATEGY FOR COTTON PEST CONTROL IN INDIA	I	323	25/08/00	15:05	HM	N	7	10	7
Kranz, B. D.	1041	SOCIAL EVOLUTION IN THRIPS: LACK OF REPRODUCTIVE SKEW IN A GALL FORMING THRIPS WITH 'SOLDIERS'	I	263	23/08/00	16:30	CC		6	PS	6
Kraus, O.	3059	SPERM TRANSFER, LOCK AND KEY MECHANISMS, AND FUNCTIONAL DEMANDS IN TRACHEATES	II	772	23/08/00	11:20	HB	G	16	4	16
Kraus, O.	3079	MYRIAPOD AND HEXAPOD MOUTHPARTS: FUNCTIONAL MORPHOLOGY AND PHYLOGENETIC IMPLICATIONS	II	777	25/08/00	10:15	HB	G	16	7	16
Krause, S. C.	2933	BACILLUS SPHAERICUS: LONG-TERM EFFICACY AND ROLE IN RESISTANCE MANAGEMENT	II	740	25/08/00	14:30	Bol	R	15	10	15
K•e•ek, P.	2452	THE EFFECT OF PLANT INHIBITORS OF INSECT DIGESTIVE ENYZYMES ON GROWTH AND MORTALITY OF MODEL PESTS	II	619	23/08/00	16:30	CC		13	PS	13
Krecek, P.	3338	ASPARTIC PROTEASES FROM LEPTINOTARSA DECEMLINEATA AND THEIR INHIBITORS	II	843	22/08/00	16:30	CC		18	PS	18
Krekling, T.	2410	DEFENCE MECHANISMS OF NORWAY SPRUCE AGAINST BARK BEETLE-FUNGUS ATTACKS	II	609	21/08/00	16:30	CC		13	PS	13
Krell, R.	93	TOWARDS AN INTERNATIONAL PROGRAMME ON POLLINATORS AND THEIR ROLE IN ECOSYSTEM RESILIENCE	I	24	22/08/00	10:00	HB	A	2	3	2
Krenn, H.	3081	BEHAVIORAL ADAPTATIONS TO POLLEN-FEEDING IN HELICONIUS BUTTERFLIES	II	777	25/08/00	10:45	HB	G	16	7	16
Krenn, H. W.	3080	PROBOSCIS MORPHOLOGY AND SPECIALIZED FEEDING HABITS IN NYMPHALID BUTTERFLIES	II	777	25/08/00	10:30	HB	G	16	7	16
Krenn, H. W.	993	LIVING AT THE EDGE OF ICE: CARABID BEETLES IN AN ALPINE GLACIER FORELAND.	I	251	22/08/00	16:30	CC		6	PS	6
Krenn, H. W.	3082	FLIES THAT TAP CONCEALED NECTAR: MORPHOLOGICAL INNOVATIONS OF THE PROBOSCIS IN BOMBYLIIDAE (DIPTERA)	II	778	25/08/00	11:00	HB	G	16	7	16
Krenn, H. W.	3575	LIVING AT THE EDGE OF ICE: CARABID BEETLES IN AN ALPINE GLACIER FORELAND.	II	902	23/08/00	14:30	Bol	U	20	1	20
Krettek, R.	2953	PARASITOIDS IN FORENSIC ENTOMOLOGY	II	745	26/08/00	14:45	Bol	R	15	11	15
Kretli, A. U.	2916	GENETICALLY-ENGINEERED MOSQUITOES RESISTANT TO THE TRANSMISSION OF MALARIA	II	736	24/08/00	14:35	Bol	R	15	8	15
Kreuter, Th.	3999	ECOLOGICAL STUDIES ACCOMPANYING THE CULTIVATION OF TRANSGENIC RAPE AND MAIZE IN THURINGIA (GERMANY)	II	1009	25/08/00	16:30	CC		22	PS	22
Krieger, N.	2002	FUNDAMENTAL ISSUES THAT LIMIT SCALE UP OF FUNGAL BIOPESTICIDES USING SOLID STATE FERMENTATION PROCESSES	I	505	22/08/00	10:50	HM	P	11	3	11
Krips, °	1420	PLANTS CRY FOR HELP: DO PLANT BREEDERS AND BIOCONTROL COMPANIES LISTEN?	I	358	21/08/00	10:20	HM	O	8	1	8
Krishnaiah, K.	3876	PHEROMONES FOR CONTROL OF YELLOW RICE STEM BORER, SCIRPOPHAGA INCERTULAS (LEPIDOPTERA: PYRALIDAE) IN INDIA	II	978	21/08/00	15:00	HB	H	22	1	22
Krisman, C. R.	2519	METABOLISM OF GLYCOGEN DURING THE METAMORPHOSIS OF THE MEDFLY, CERATITIS CAPITATA	II	636	25/08/00	16:30	CC		13	PS	13
Kristensen, M.	2993	MULTIPLE ACETYLCHOLINESTERASE PHENOTYPES IN DANISH FIELD POPULATIONS AND LABORATORY STRAINS OF THE HOUSE-FLY MUSCA DOMESTICA	II	755	23/08/00	16:30	CC		15	PS	15
Kristensen, N. P.	434	LEPIDOPTERA	I	110	25/08/00	10:05	HB	C	3	7	3
Kristensen, N. P.	3679	PHYLOGENY OF THE HOLOMETABOLOUS INSECT ORDERS: STATE OF MORPHOLOGY	II	929	25/08/00	13:35	HB	E	21	8	21
Kristensen, N. P.	3692	INVENTORY AND CLADISTICS OF NON-DITRYSIAN MOTHS: SOME RECENT ADVANCES	II	932	26/08/00	9:35	HB	E	21	9	21
Krokene, P.	2084	INDUCED DISEASE RESISTANCE IN NORWAY SPRUCE AND ITS IMPLICATIONS FOR BARK BEETLE POPULATION DYNAMICS	I	526	22/08/00	16:30	CC		11	PS	11
Krokene, P.	2410	DEFENCE MECHANISMS OF NORWAY SPRUCE AGAINST BARK BEETLE-FUNGUS ATTACKS	II	609	21/08/00	16:30	CC		13	PS	13
Kropa, M.	2078	NEW ISOLATE OF ERIOGASTER LANESTRIS NUCLEOPOLYHEDROVIRUS IN LATVIA	I	524	22/08/00	16:30	CC		11	PS	11
Krticevic, F.	2988	PHLEBOTOMINAE SAND FLIES AND LEISHMANIASIS IN ARGENTINA	II	754	23/08/00	16:30	CC		15	PS	15
Krticevic, F. J.	3021	MONITORING OF HEMATOPHAGOUS VECTORS IN THE AREA OF INFLUENCE OF THE YACYRETA DAM	II	762	22/08/00	16:30	CC		15	PS	15
Krzyzanowski, R.	1213	GRAIN APHID PERFORMANCE ON TRITICALE	I	306	25/08/00	16:30	CC		6	PS	6
Kubátová, A.	42	THE FOOD INTERACTIONS BETWEEN THREE ACAROID MITES (ACARI: ACARIDIDA) AND SOME MICROMYCETES	I	11	23/08/00	16:30	CC		1	PS	1
Kubo, T.	3558	IDENTIFICATION AND CHARACTERIZATION OF A NOVEL GENE (KL-1), WHICH IS EXPRESSED PREFERENTIALLY IN LARGE TYPE KENYON CELLS OF THE HONEYBEE BRAIN	II	898	25/08/00	16:30	CC		19	PS	19
Kubo, T.	2336	IDENTIFICATION AND CHARACTERIZATION OF THE KS-1 GENE, WHICH IS EXPRESSED PREFERENTIALLY IN THE SMALL TYPE-KENYON CELLS OF THE HONEYBEE BRAIN	I	589	25/08/00	16:30	CC		12	PS	12

Sub-titles: (HB=Hotel Bourbon) - (HM=Hotel Mabu) - (CC=Convention Center) - (Bol=Foz Boulevard) - (PS=Poster Session) - (PL=Plenary Lecturer)

AUTHOR	N°	TITLE	Book	Page	Date	Time	Local	Room	Session	Symp	New Session
Kubo, T.	2263	CONCENTRATED EXPRESSION OF THE GENES FOR PROTEINS INVOLVED IN CALCIUM SIGNALING IN THE MUSHROOM BODIES OF THE BRAIN OF THE WORKER HONEYBEE APIS MELLIFERA	I	571	22/08/00	16:30	CC		12	PS	12
Kubo, T.	2448	CONCENTRATED EXPRESSION OF THE GENES FOR PROTEINS INVOLVED IN CALCIUM SIGNALING IN THE MUSHROOM BODIES OF THE BRAIN OF THE WORKER HONEYBEE APIS MELLIFERA	II	618	23/08/00	16:30	CC		13	PS	13
Kubo-Irie, M.	3094	ULTRASTRUCTURE OF DIMORPHIC SPERMATOZOA AND THEIR FERTILIZATION IN CICADIDAE (HEMIPTERA)	II	781	26/08/00	10:50	HB	G	16	9	16
Kubo-Irie, M.	3096	PHYLOGENETIC RELATIONSHIP ON SPERM ULTRASTRUCTURE OF THE STAG BEETLES (COLEOPTERA-LUCANIDAE)	II	781	26/08/00	11:40	HB	G	16	9	16
Kubo-Irie, M.	3095	ULTRASTRUCTURES AND MOVEMENTS IN THE SPERMATOZOON OF STAG BEETLES	II	781	26/08/00	11:15	HB	G	16	9	16
Kubota, T.	260	FACTORS INFLUENCING DEVELOPMENTAL VELOCITY IN CHRYSOPERLA CARNEA	I	66	23/08/00	16:30	CC		2	PS	2
Kubota, T.	1563	LARVAE OF CHRYSOPID AND FALL WEBWORM HAVE PREFERENCE FOR PARTIALLY DRIED FOOD TO FRESH ONE	I	394	22/08/00	16:30	CC		8	PS	8
Kubrakiewicz, J.	3034	THE OVARY STRUCTURE AND OOGENESIS IN NEUROPTEROID ORDERS	II	766	21/08/00	10:45	HB	G	16	1	16
Kubrakiewicz, J.	3151	THE OVARY STRUCTURE AND OOGENESIS IN POLYSTOECHOTES PUNCTATUS (NEUROPTERA: POLYSTOECHOTIDAE)	II	795	23/08/00	16:30	CC		16	PS	16
Kubrakiewicz, J.	3334	THE STRUCTURE AND GENESIS OF TELOTROPHIC OVARIES IN RAPHIDIOPTERANS	II	842	22/08/00	16:30	CC		18	PS	18
Kubrakiewicz, J.	3344	INTERCELLULAR CYTOPLASMIC TRANSPORT DURING OOGENESIS OF A MOTH MIDGE, TINEARIA ALTERNATA (DIPTERA: PSYCHODIDAE)	II	844	24/08/00	16:30	CC		18	PS	18
Kubrakiewicz, J.	3108	THE OVARIES OF CHAULIODIDS, AS THOSE OF CORYDALIDS, ARE PANOISTIC (SECONDARY PANOISTIC)	II	784	21/08/00	16:30	CC		16	PS	16
Kucerová, Z.	2729	DETERMINATION OF EGGS OF STORED PRODUCT BEETLES (COLEOPTERA: SILVANIDAE, CUCUJIDAE) ACCORDING TO THEIR EXTERNAL MORPHOLOGY	II	689	23/08/00	16:30	CC		14	PS	14
Kučerová, Z.	4109	THE EXTRACTION OF PYRALID EGGS FROM FLOUR: THE EFFECTIVENESS AND IMPACT ON EGG EXTERNAL MORPHOLOGY	II	1037	25/08/00	16:30	CC		23	PS	23
Kuehnhold, J.	2730	CALYPSO – OPTIONS FOR A NEW CHLORONICOTINYL	II	689	23/08/00	16:30	CC		14	PS	14
Kuenzli, M.	599	ENDOCRINE REGULATION AND MECHANISM OF HYDROCARBON PHEROMONE PRODUCTION IN THE HOUSEFLY, MUSCA DOMESTICA	I	152	23/08/00	10:35	Bol	S	4	4	4
Kuhlmann, U.	1469	THE RELATIONSHIP BETWEEN EGG LOAD AND FECUNDITY AMONG TRICHOGRAMMA PARASITOIDS	I	371	26/08/00	9:50	HM	O	8	8	8
Kuhlmann, U.	2551	THE ROLE OF NATURAL ENEMIES AND HABITAT MODIFICATION IN CODLING MOTH MANAGEMENT PROGRAMS	II	645	21/08/00	15:35	HB	B	14	2	14
Kuhlmann, U.	2758	THE ROLE OF NATURAL ENEMIES AND HABITAT MODIFICATION IN CODLING MOTH MANAGEMENT PROGRAMS	II	696	23/08/00	16:30	CC		14	PS	14
Kuhn, G. C. S.	2266	DROSOPHILA BUZZATII EVOLUTION IN BRAZIL REVISITED: HIGH SATELLITE DNA HOMOGENEITY AMONG POPULATIONS	I	572	22/08/00	16:30	CC		12	PS	12
Kühnhold, J.	1414	THIACLOPRID - FIRST EXPERIENCES WITH THE NOVEL INSECTICIDE IN BRAZIL	I	357	25/08/00	16:30	CC		7	PS	7
Kuiper, M. J.	3283	WHEN YOU CAN'T FLY TO BRAZIL: SURVIVING WINTER WITH ANTIFREEZE PROTEIN GENES	II	829	23/08/00	11:05	HB	K	18	4	18
Kulasekera, V. L.	3690	PHYLOGENETIC RELATIONSHIPS OF NEMATOCEROUS DIPTERA BASED ON MOLECULES AND MORPHOLOGY	II	932	25/08/00	16:20	HB	E	21	8	21
Kulcheski, F.	3946	ORIENTAL FRUIT MOTH CONTROL THROUGT MATING DISRUPTION WITH MICROENCAPSULATED PHEROMONE IN PEACH ORCHARDS	II	996	22/08/00	16:30	CC		22	PS	22
Kuldova, J.	4022	JUVENOGENS - INSECT HORMONOGENIC COMPOUNDS.	II	1016	22/08/00	13:45	HB	J	23	4	23
Kuldova, J.	2709	POTENTIAL OF JUVENOIDS IN BAIT TECHNOLOGY FOR THE MANAGEMENT OF SUBTERRANEAN TERMITES (ISOPTERA) – LABORATORY AND FIELD STUDIES WITH A CARBAMATE DERIVATIVE (W-328)	II	684	22/08/00	16:30	CC		14	PS	14
Kuldova, J.	2024	CONTROL OF THE CODLING MOTH WITH CpGV DISSEMINATED BY MEANS OF PHEROMONE STATIONS: 5 YEARS OF FIELD TRIALS	I	511	24/08/00	14:30	HM	P	11	7	11
Kulikov, A. M.	2267	INCOMPLETE DOMINANCE OF SOME MORPHOLOGICAL CHARACTERS IN HYBRIDS OF DROSOPHILA VIRILIS GROUP	I	572	22/08/00	16:30	CC		12	PS	12
Kulkarni, G. G.	2085	BIOEFFICACY AND PERSISTENCE OF NPV AGAINST SPODOPTERA LITURA ON COTTON SPRAYED AT DIFFERENT TIMINGS OF THE DAY	I	526	23/08/00	16:30	CC		11	PS	11
Kumar, K.	1406	NEEM DERIVATIVES AGAINST CRAWLERS AND ADULT COCCIDS	I	355	24/08/00	16:30	CC		7	PS	7
Kumar, R.	3792	BIOSYSTEMATICS OF SOME SPECIES OF AGROTIS OCHSENHEIMER (NOCTUINAE: NOCTUIDAE: LEPIDOPTERA) FROM NORTH INDIA	II	957	23/08/00	16:30	CC		21	PS	21
Kumashiro, M.	4162	THE ACTIVITY OF GENITAL MOTONEURONS DURING REPRODUCTIVE BEHAVIOR IN THE MALE CRICKET	II	1051	21/08/00	16:30	CC		Erratum	PS	6
Kurashima, R.	3950	NUTRITIONAL REQUIREMENTS OF MEDITERRANEAN FRUIT FLY	II	997	21/08/00	16:30	CC		22	PS	22
Kuroki, S.	3818	INTRASPECIFIC VARIATION IN GREEN LACEWING, CHRYSOPERLA NIPPONENSIS OF JAPAN USING COURTSHIP SONG AND MOLECULAR PHYLOGENETIC ANALYSES	II	964	24/08/00	16:30	CC		21	PS	21
Kuruc, J.	3024	POTENTIAL GEOGRAPHIC RANGE OF AEDES ALBOPICTUS (DIPTERA: CULICIDAE) IN ARGENTINA	II	763	23/08/00	16:30	CC		15	PS	15
Kutsch, W.	749	TRANSMISSION OF MUSCLE POTENTIALS DURING FREE FLIGHT OF LOCUSTS	I	189	21/08/00	13:30	Bol	T	5	1	5
Kuwahara, W. R.	323	INFLUENCE OF DIFFERENT APPLICATION METHODS AND DOSAGES OF THIAMETHOXAM IN THRIPS CONTROL	I	82	24/08/00	16:30	CC		2	PS	2
Kuwahara, W. R.	369	EFFICIENCY AND RESIDUAL OF DIFFERENT ACEPHATE FORMULATIONS IN CONTROL OF GREEN-PEACH APHIDS ON PEPPER'S CROP	I	93	25/08/00	16:30	CC		2	PS	2
Kuwahara, W. R.	370	EFFICIENCY OF FENPROPATHRIN AND CHLORFLUAZURON IN CONTROL OF NEOLEUCINODES ELEGANTALIS (LEPIDOPTERA: PYRALIDAE) ON TOMATO'S CROP	I	94	25/08/00	16:30	CC		2	PS	2
Kuwana, Y.	4119	INSECT-MODEL BASED ROBOTICS	II	1040	25/08/00	11:05	HM	Q	24	1	24
Kvedaras, O. L.	687	THE EFFECTS OF HOST PLANT ODOURS ON THE CALLING BEHAVIOUR, EGG MATURATION AND MATING SUCCESS OF THE COTTON BOLLWORM, HELICOVERPA ARMIGERA (HÜBNER) (LEPIDOPTERA: NOCTUIDAE)	I	174	23/08/00	16:30	CC		4	PS	4
Kwok, R.	3047	ALLATOSTATINS AND THE REGULATION OF THE CORPORA ALLATA IN A COCKROACH	II	769	22/08/00	11:05	HB	G	16	2	16
Kwon, O. S.	933	LIFE HISTORY OF ACRONICTA RUMICIS REARED ON THE NATURALIZED PLANT, RUMEX OBTUSIFOLIUS AS A HOST PLANT	I	236	25/08/00	16:30	CC		6	PS	6
Kwon, O. S.	1155	INSECT COMMUNITY ON RUMEX OBTUSIFOLIUS AS A HOST PLANT	I	291	25/08/00	16:30	CC		6	PS	6
Kyriacou, C. P.	2297	GENETIC VARIABILITY OF CACOPHONY GENE IN LUTZOMYIA LONGIPALPIS POPULATIONS	I	580	24/08/00	16:30	CC		12	PS	12
Kyto, M.	1936	PERFORMANCE OF NEEDLE-FEEDING INSECTS ON SCOTS PINES EXPOSED TO DROUGHT AND NUTRIENT STRESS	I	488	23/08/00	16:30	CC		10	PS	10
L. Arroyo	182	ATTEMPTS TO MANAGE ANTICARSIA GEMMATALIS (LEPIDOPTERA, NOCTUIDAE) ON SOYBEAN IN COLONIA OKINAWA, SANTA CRUZ DISTRICT, BOLIVIA WITH BACULOVIRUS ANTICARSIA COMMERCIALIZED IN BRASIL	I	47	21/08/00	16:30	CC		2	PS	2
L. Ruz	517	AN APPROACH TO THE KNOWLEDGE OF THE BIOGEOGRAPHICAL HISTORY OF THE BEE GENUS CALLONYCHIUM (HYMENOPTERA: ANDRENIDAE) IN SOUTH AMERICA	I	131	23/08/00	16:30	CC		3	PS	3
Labandeira, C. C.	1144	AN AQUATIC INSECT FAUNA FROM THE SUNDANCE FORMATION (LATE JURASSIC), NORTHERN WYOMING AND SOUTHERN MONTANA, U.S.A.	I	288	24/08/00	16:30	CC		6	PS	6
Labandeira, C. C.	3793	INSECT EXTINCTION AT THE END OF THE CRETACEOUS	II	957	23/08/00	16:30	CC		21	PS	21

Sub-titles: (HB=Hotel Bourbon) - (HM=Hotel Mabu) - (CC=Convention Center) - (Bol=Foz Boulevard) - (PS=Poster Session) - (PL=Plenary Lecturer)

AUTHOR	Nº	TITLE	Book	Page	Date	Time	Local	Room	Session	Symp	New Session
•abanowski, G. S.	2731	STEPHANITIS TAKEYAI DRAKE & MAA AND OTHER LACE BUGS (TINGIDAE) AS PESTS OF ORNAMENTAL PLANTS FROM ERICACEAE FAMILY IN POLAND	II	690	23/08/00	16:30	CC		14	PS	14
•abanowski, G. S.	68	NEW SPECIES OF ERIOPHOID MITES FOR WORLD FAUNA OCCURRING ON ORNAMENTAL PLANTS IN POLAND	I	17	25/08/00	16:30	CC		1	PS	1
Labinas, A.M.	261	USE OF THIAMETHOXAN IN BEAN PEST CONTROL	I	66	23/08/00	16:30	CC		2	PS	2
Labinas, A.M.	688	JAVA GRASS (CYMBOPOGON WINTWRIANUS JOWITT) ESSENTIAL OIL EFFECTS ON SPODOPTERA FRUGIPERDA BIOLOGY AND BEHAVIOR	I	174	24/08/00	16:30	CC		4	PS	4
Labruna, M. B.	3794	INVESTIGATION OF THE VALIDITY OF SPECIES STATUS OF IXODES DIDELPHIDIS (ACARI: IXODIDAE) USING THE SECOND INTERNAL TRANSCRIBED SPACER (ITS2) OF RIBOSOMAL DNA	II	958	23/08/00	16:30	CC		21	PS	21
Labuda, M.	2893	TICK-HOST INTERACTIONS IN THE CO-FEEDING TRANSMISSION OF TICK-BORNE ENCEPHALITIS VIRUS: CELL INVOLVEMENT	II	730	22/08/00	15:50	Bol	R	15	4	15
Labuda, M.	34	INTERACTION OF TICK SALIVA WITH THE HOST IMMUNE MECHANISMS AND ITS SIGNIFICANCE FOR PATHOGEN TRANSMISSION	I	9	22/08/00	16:30	CC		1	PS	1
Lacerda, C. A	262	CONTROL OF DIABROTICA SPECIOSA (COLEOPTERA, CHRYSOMELIDAE) NA CULTURA DA BATATA	I	67	23/08/00	16:30	CC		2	PS	2
Lacey, L. A.	2019	USE OF ENTOMOPATHOGENS FOR CONTROL OF LEPIDOPTERAN PESTS OF APPLE IN THE PACIFIC NORTHWEST OF THE UNITED STATES	I	509	24/08/00	10:35	HM	P	11	7	11
Lacey, L. A.	2086	DEVELOPMENT OF ENTOMOPATHOGENIC NEMATODES FOR CONTROL OF OVERWINTERING CODLING MOTH LARVAE	I	526	23/08/00	16:30	CC		11	PS	11
Lacey, L. A.	2098	INTERACTION OF THE ENTOMOPATHOGENIC FUNGUS, PAECILOMYCES FUMOSOROSEUS (DEUTEROMYCOTINA: HYPHOMYCETES) WITH THE PARASITOID, APHELINUS ASYCHIS (HYMENOPTERA: APHELINIDAE) AND THEIR COMPETITION FOR AN APHID HOST	I	529	23/08/00	16:30	CC		11	PS	11
Ladd, T.	2382	HORMONAL REGULATION OF CUTICLE FORMATION AND CHITIN SYNTHESIS	II	602	25/08/00	13:35	HB	I	13	9	13
Ladd, T. R.	1845	BIOLOGICAL CONTROL OF FOREST PESTS USING INSECT SPECIFIC VIRUSES	I	465	23/08/00	14:35	HB	M	10	4	10
Ladd, T. R.	3280	MOLECULAR ANALYSIS OF THE OVERWINTERING DIAPAUSE IN THE SPRUCE BUDWORM, CHORISTONEURA FUMIFERANA	II	828	23/08/00	10:20	HB	K	18	4	18
Ladd, T. R.	1320	AN RNA HELICASE OF THE "DEAD BOX" FAMILY CLONED FROM A LEPIDOPTERAN SPECIES, THE SPRUCE BUDWORM (CHORISTONEURA FUMIFERANA)	I	333	22/08/00	16:30	CC		7	PS	7
Ladd, T. R.	3325	GLUTATHIONE S-TRANSFERASE FROM THE SPRUCE BUDWORM, CHORISTONEURA FUMIFERANA: IDENTIFICATION, CHARACTER-IZATION, LOCALIZATION, CDNA CLONING, DEVELOPMENTAL EXPRESSION AND INDUCTION BY VARIOUS FACTORS	II	840	21/08/00	16:30	CC		18	PS	18
Laffont, E. R.	3511	NEW FINDINGS OF NYMPH- SOLDIER INTERCASTES OF NASUTITERMES AQUILINUS (ISOPTERA, TERMITIDAE, NASUTITERMITINAE)	II	886	23/08/00	16:30	CC		19	PS	19
Laffont, E. R.	3512	PRELIMINARY INVENTORY OF ISOPTERA FROM NATURAL PROTECTED AREAS OF NORTHEAST ARGENTINA	II	886	23/08/00	16:30	CC		19	PS	19
Lafreniere, J. J.	3085	BODY SIZE AND TRACHEAL FUNCTION IN GRASSHOPPERS	II	778	25/08/00	13:35	HB	G	16	8	16
Lagnaoui, A.	2012	AN INTEGRATED APPROACH TO MANAGE THE ANDEAN POTATO WEEVIL, PREMNOTRYPES SPP. (CURCULIONIDAE)	I	508	23/08/00	11:35	HM	P	11	5	11
Lago, A. A.	2769	DEVELOPMENT AND DAMAGE OF THE RICE WEEVIL ON TRITICALE AND WHEAT CULTIVARS	II	699	21/08/00	16:30	CC		14	PS	23
Lago, W. N. M.	2296	MORPHOLOGICAL AND MOLECULAR IDENTIFICATION OF WHITEFLIES SPECIES IN BRAZIL	I	579	24/08/00	16:30	CC		12	PS	12
Lagos, D.	2237	MOLECULAR STUDIES OF SEX-SPECIFIC GENES IN THE INSECTS C. CAPITATA AND BACTROCERA OLEAE	I	565	21/08/00	16:30	CC		12	PS	12
Lagos, S. J.	3603	VARIATIONS IN GROUND-DWELLING ARTHROPOD COMMUNITIES IN GRAZED AND PROTECTED AREAS IN THE DESERT OF MENDOZA (ARGENTINA)	II	909	23/08/00	16:30	CC		20	PS	20
Lagueux, M.	2353	THIOESTER-CONTAINING PROTEINS IN INNATE IMMUNITY OF MOSQUITO ANOPHELES GAMBIAE	II	594	23/08/00	10:45	HB	I	13	4	13
Laguna, I. G.	3236	DELPHACID PLANTHOPPERS AND THE "MAL DE RIO CUARTO" IN MAIZE IN THE NORTH OF ARGENTINA (INSECTA - FULGOROMORPHA)	II	817	23/08/00	16:30	CC		17	PS	17
Laguna, I. G.	3225	EPIDEMIOLOGY OF "MAL DE RÍO CUARTO" DISEASE AND THE RELATION WITH ITS VECTORS IN ARGENTINA	II	814	22/08/00	16:30	CC		17	PS	17
Lagunes-T., A.	1316	RESPONSE OF PLUTELLA XYLOSTELLA (LEPIDOPTERA: PLUTELLIDAE) TO THE SELECTION WITH BACILLUS THURINGIENSIS	I	332	22/08/00	16:30	CC		7	PS	7
Laigret, F.	3215	INSERTIONAL MUTAGENESIS OF SPIROPLASMA CITRI IN RELATION TO PATHOGENICITY	II	812	22/08/00	15:30	Bol	U	17	2	17
Lainé, L.V.	3404	TERMITES IN EUROPE: PERSPECTIVES OF RESEARCH AND MANAGEMENT FROM THE LAST CENTURY	II	859	22/08/00	9:35	HM	Q	19	2	19
Lalanne, P.	2229	OPTICAL PROPERTIES OF MORPHO TYPE SCALES. MULTILAYER AND GRATING MODEL	I	563	21/08/00	16:30	CC		12	PS	12
Lale, N. E. S.	4084	SIMULATION STUDIES ON THE EFFECTS OF SOLAR HEAT ON EGG-LAYING, DEVELOPMENT AND SURVIVAL OF CALLOSOBRUCHUS MACULATUS AND CALLOSOBRUCHUS SUBINNOTATUS IN STORED BAMBARA GROUNDNUT, VIGNA SUBTERRANEA	II	1031	23/08/00	16:30	CC		23	PS	23
Lall, S.	3291	EVOLUTION OF ANTEROPOSTERIOR AXIS FORMATION IN INSECTS: THE ROLE OF HUNCHBACK AND NANOS IN THE GRASSHOPPER	II	831	24/08/00	9:35	HB	K	18	6	18
Lall, S.	3066	EVOLUTION OF ANTEROPOSTERIOR AXIS FORMATION IN INSECTS: THE ROLE OF HUNCHBACK AND NANOS IN THE GRASSHOPPER	II	774	21/08/00	16:30	CC		16	PS	16
Lamas M., G.	409	BIODIVERSITY AND THE SOCIEDAD ENTOMOLOGICA DEL PERU	I	104	23/08/00	11:20	HB	C	3	3	3
Lamas, C.	1296	EFFECT OF THIAMETHOXAM (ACTARA® 250 WG) ON ENTOMOPATHOGENIC MICROORGANISMS	I	327	21/08/00	16:30	CC		7	PS	7
Lamas, C.	2629	EFFECT OF PHYSIOLOGICAL PRODUCTS ON ADULTS OF ANTICARSIA GEMMATALIS	II	664	22/08/00	16:30	CC		14	PS	14
Lamas, C.	3318	EFFECT OF THE TEMPERATURE AND LIGHT REGIME ON THE PRODUCTION AND STORAGE OF SPOROTHRIX INSECTORUM	II	838	23/08/00	16:30	CC		18	PS	18
Lamas, C. J. E.	3659	RECENT ADVANCES ON THE SYSTEMATICS OF THE CROCIDIINAE (DIPTERA, BOMBYLIIDAE)	II	924	24/08/00	10:05	HB	E	21	6	21
Lamas, G.	388	DIVERSITY AND BIOGEOGRAPHY OF UPPER AMAZON BUTTERFLIES (LEPIDOPTERA)	I	99	22/08/00	10:20	HB	C	3	2	3
Lamas, G.	776	DEVELOPING AND SHARING DATA GLOBALLY: THE 'GLOBAL BUTTERFLY INFORMATION SYSTEM' – GLOBIS	I	196	24/08/00	14:00	Bol	T	5	5	5
Lamb, M. A.	1694	MASSIVE PARASITISM OF GRASSHOPPERS BY TACHINID MAGGOTS	I	427	25/08/00	16:30	CC		8	PS	8
Lampe, K. H.	773	AN INFORMATION INFRASTRUCTURE FOR GERMAN INSECT COLLECTIONS INCLUDING MULTIMEDIA AND GIS-TOOLS	I	195	24/08/00	11:20	Bol	T	5	5	5
Lana, T. C.	1922	RESIN-COLLECTING BEES (HYMENOPTERA, APIDAE) ON CLUSIA PALMICIDA (CLUSIACEAE) IN A RIPARIAN FOREST IN BRAZIL	I	484	22/08/00	16:30	CC		10	PS	10
Lance, D. R.	86	DETECTING EXOTIC PESTS: THE SCIENCE AND PRACTICE OF SAMPLING WHEN THE ECONOMIC THRESHOLD IS ONE	I	23	21/08/00	13:35	HB	A	2	2	2
Landa, Z.	2559	BIOLOGICAL CONTROL WITH FUNGI	II	647	22/08/00	11:20	HB	B	14	3	14
Landeros, J.	18	LIFE HISTORY PARAMETERS AND FUNCTIONAL RESPONSE PHYTOSEIULUS PERSIMILIS ON TETRANYCHUS URTICAE	I	5	21/08/00	16:30	CC		1	PS	1
Landeros, J.	19	FUNCTIONAL RESPONSE OF PHYTOSEIULUS PERSIMILIS ON TETRANYCHUS URTICAE ON THREE DIFFERENT ROSE VARIETIES	I	5	21/08/00	16:30	CC		1	PS	1

Sub-titles: (HB=Hotel Bourbon) - (HM=Hotel Mabu) - (CC=Convention Center) - (Bol=Foz Boulevard) - (PS=Poster Session) - (PL=Plenary Lecturer)

AUTHOR	Nº	TITLE	Book	Page	Date	Time	Local	Room	Session	Symp	New Session
Landes, M.	1351	BAS 620 H - A NEW GRAMINICIDE FOR POST-EMERGENCE GRASS CONTROL IN BROADLEAF CROPS	I	341	23/08/00	16:30	CC		7	PS	7
Landes, M.	1350	BAS 620 H - A NEW GRAMINICIDE FOR POST-EMERGENCE GRASS CONTROL IN BROADLEAF CROPS	I	341	23/08/00	16:30	CC		7	PS	7
Landolt, P. J.	2546	CODLING MOTH ADAPTATIONS: HOST AND GEOGRAPHIC RACES	II	643	21/08/00	14:05	HB	B	14	2	14
Lane, R. S.	4168	THE CONCEPT OF TICK-SPIROCHETE SPECIFICITY REVISITED	II	1053	22/08/00	15:05	Bol	R	Erratum	4	15
Lanfranco, D.	1834	AN IPM APPROACH TO PREVENT THE ACCIDENTAL IMPORTATION OF SUBCORTICAL INSECTS FROM CHILE TO THE UNIDET STATES	I	462	22/08/00	14:35	HB	M	10	3	10
Lanfranco, D.	407	CONSERVATION OF THE BIODIVERSITY OF INSECTS IN CHILE	I	103	23/08/00	10:50	HB	C	3	3	3
Lanfranco, D.	541	THE SOCIEDAD CHILENA DE ENTOMOLOGIA	I	137	24/08/00	16:30	CC		3	PS	3
Lanfranco, D.	1832	CERTIFICATION OF EXPORTED CHILEAN FOREST PRODUCTS. ADVANCES IN THE MANAGEMENT OF ENTOMOLOGICAL RISKS	I	462	22/08/00	13:35	HB	M	10	3	10
Lanfranco, D.	1882	RISK TO SOUTH AMERICAN RADIATA PINE RESOURCES BY THE PINE SHOOT MOTH, RHYACIONIA BUOLIANA	I	474	26/08/00	10:05	HB	M	10	9	10
Lanfranco, D.	373	EFFECTIVENESS OF METHYL BROMIDE ALTERNATIVES AGAINST POTENTIAL PESTS TO BE IMPORTED TO THE UNITED STATES FROM CHILE	I	94	25/08/00	16:30	CC		2	PS	2
Lanfranco, D.	2856	AN IPM APPROACH TO PREVENTION OF POTENTIAL PESTS THAT MIGHT BE IMPORTED TO THE UNITED STATES ON CHILEAN LOGS: PART I, EFFECTIVENESS OF METHYL BROMIDE ALTERNATIVES	II	721	24/08/00	16:30	CC		14	PS	14
Lang, A.	1733	PREDATION BY GLEANING AND AERIAL HAWKING BATS: ITS EFFECT ON THE EVOLUTION OF HEARING AND SOUND COMMUNICATION IN TWO GROUPS OF KATYDIDS IN PANAMA	I	437	22/08/00	16:00	HB	F	9	3	9
Lang, F.	1774	DEGRADATION OF TEMPORAL PARAMETERS OF A GRASSHOPPER SONG IN THE FIELD	I	447	23/08/00	16:30	CC		9	PS	9
Lang, P.	3793	INSECT EXTINCTION AT THE END OF THE CRETACEOUS	II	957	23/08/00	16:30	CC		21	PS	21
Langa, S.	1495	CLIMATIC CONSTRAINTS ON BIOCONTROL AGENTS: TRICHILOGASTER ACAIALONGIFOLIAE IN SOUTH AFRICA	I	377	22/08/00	16:30	CC		8	PS	8
Lange, A. B.	3253	MULTIPLE PEPTIDE FAMILIES ARE INVOLVED IN THE NEURAL CONTROL OF REPRODUCTIVE TISSUES OF THE FEMALE LOCUST	II	822	21/08/00	11:05	HB	K	18	1	18
Lange, A. B.	2288	ISOLATION, CLONING, AND CHARACTERIZATION OF G PROTEIN-COUPLED RECEPTOR GENES, FROM THE AFRICAN MIGRATORY LOCUST, LOCUSTA MIGRATORIA	I	577	23/08/00	16:30	CC		12	PS	12
Lange, C. E.	476	GRASSHOPPER (ORTHOPTERA: ACRIDOIDEA) SPECIES DIVERSITY IN THE PAMPAS, ARGENTINA	I	121	21/08/00	16:30	CC		3	PS	3
Lange, M. A.	2455	EXPERIMENTAL STUDY OF HAEMOCYTES AND HEMOPOIETIC TISSUE OF ADULT OF NAUPHOETA CINEREA	II	620	23/08/00	16:30	CC		13	PS	13
Lange, W.	1909	MORPHOLOGICAL CHARACTERISTICS OF NESTS AND CONTROL OF ATTA SEXDENS RUBROPILOSA WITH GRANULATED BAITS IN A PLANTATION OF PINUS TAEDA, SAFAC, WANDA, MISIONES	I	481	21/08/00	16:30	CC		10	PS	10
Langer, A.	3600	OVERWINTERING STRATEGY OF APHIDIUS ERVI (HYMENOPTERA: APHIDIIDAE)	II	908	23/08/00	16:30	CC		20	PS	20
Langor, D. W.	1817	ARTHROPODS, THINNING AND INNOVATIVE HARVEST DESIGNS: ECOSYSTEM MANAGEMENT AND BOREAL BIODIVERSITY	I	458	21/08/00	13:35	HB	M	10	1	10
Lanteri, A. A.	2241	ORIGIN AND DISPERSAL OF THE COTTON BOLL WEEVIL (COLEOPTERA: CURCULIONIDAE) IN SOUTH AMERICA: A mtDNA PHYLOGEOGRAPHIC STUDY	I	566	21/08/00	16:30	CC		12	PS	12
Lanzaro, G. C.	2215	CHROMOSOMAL POLYMORPHISM AND SPECIATION IN ANOPHELES GAMBIAE	I	559	24/08/00	10:05	HB	L	12	9	12
Lapis, E.	1884	CHALLENGES TO PEST MANAGEMENT IN SOUTHEAST ASIS	I	475	26/08/00	11:05	HB	M	10	9	10
Lapointe, S. L.	263	A KAOLIN-BASED PARTICLE FILM DETERS FEEDING AND OVIPOSITION BY THE WEEVIL DIAPREPES ABBREVIATUS	I	67	23/08/00	16:30	CC		2	PS	2
Lapointe, S. L.	1653	EFFECT OF ANT TENDING ON BIOLOGICAL CONTROL OF THE PINK HIBISCUS MEALYBUG ON ST. CROIX, US VIRGIN ISLANDS	I	417	24/08/00	16:30	CC		8	PS	8
Lapveteläinen, T.	1982	SPECIES MIXTURE OF BIRCH AND CONIFERS DECREASES DAMAGE BY A DIPTERAN MINER OF BIRCH STEMS	I	499	25/08/00	16:30	CC		10	PS	10
Lara, A. F. M.	2672	BIOLOGY OF IMMATURE CHRYSOPERLA EXTERNA PREDATOR FED WITH SCHIZAPHIS GRAMINUM APHIDS REARED ON RESISTANT, MODERATELY RESISTANT AND SUSCEPTIBLE SORGHUM GENOTYPES	II	675	22/08/00	16:30	CC		14	PS	14
Lara, A. F. M.	2673	EFFECTS OF SORGHUM GENOTYPES RESISTANCE TO SCHIZAPHIS GRAMINUM ON CHRYSOPERLA EXTERNA FECUNDITY	II	675	22/08/00	16:30	CC		14	PS	14
Lara, F. M.	4149	RESISTANCE OF POTATO GENOTYPES (SOLANUM SPP.) TO DIABROTICA SPECIOSA AND THE MECHANISMS ENVOLVED	II	1048	21/08/00	16:30	CC		Erratum	PS	2
Lara, F. M.	2739	ENVIRONMENT PROTECTION THROUGH RESISTANT POTATO: RESEARCH, EDUCATION AND DELIVERING INFORMATION IN BRAZIL	II	692	23/08/00	16:30	CC		14	PS	14
Lara, F. M.	631	RESISTANCE OF BEAN GENOTYPES TO THE BEAN WEEVIL ACANTHOSCELIDES OBTECTUS	I	160	22/08/00	16:30	CC		4	PS	4
Lara, F. M.	632	FEEDING PREFERENCE OF DIABROTICA SPECIOSA FOR SQUASH GENOTYPES	I	160	22/08/00	16:30	CC		4	PS	4
Lara, F. M.	633	EVALUATION OF FEEDING PREFERENCE OF EPICAUTA ATOMARIA FOR PASSION FRUIT GENOTYPES	I	160	22/08/00	16:30	CC		4	PS	4
Lara, F. M.	1380	RESISTANCE OF COMMON BEAN GENOTYPES TO DIABROTICA SPECIOSA (COLEOPTERA: CHRYSOMELIDAE) ADULTS	I	348	24/08/00	16:30	CC		7	PS	7
Lara, F. M.	628	EFFECTS OF SQUASH GENOTYPES ON BIOLOGY AND FEEDING PREFERENCE OF LEPTOGLOSSUS GONAGRA	I	159	21/08/00	16:30	CC		4	PS	4
Lara, F. M.	630	ATTRACTIVITY OF PASSION FRUIT GENOTYPES TO Hothymenia histrio AND FEEDING PREFERENCE	I	159	21/08/00	16:30	CC		4	PS	4
Lara, F. M.	629	RESISTANCE OF FRUITS OF PASSION FRUIT GENOTYPES TO ANISOSCELES FOLIACEA MARGINELLA	I	159	21/08/00	16:30	CC		4	PS	4
Lara, F. M.	711	ROLE OF NEZARA VIRIDULA (HEMIPTERA:PENTATOMIDAE) ON INDUCING THE PRODUCTION OF FLAVONOID IN SOYBEAN GENOTYPES	I	180	21/08/00	16:30	CC		4	PS	4
Lara, F. M.	2840	OVIPOSITION PREFERENCE OF SILVERLEAF WHITEFLY (HEMIPTERA: ALEYRODIDAE) FOR SQUASH GENOTYPES	II	717	22/08/00	16:30	CC		14	PS	14
Lara, F. M.	1114	BIOLOGICAL AND NUTRITIONAL ASPECTS OF NEZARA VIRIDULA (HEMIPTERA:PENTATOMIDAE) ON SOYBEAN GENOTYPES	I	281	22/08/00	16:30	CC		6	PS	6
Lara, R. I. R.	2794	USE OF THIAMETHOXAM IN THE BEMISIA SPP (HOMOPTERA: ALEYRODIDAE) CONTROL IN CULTIVATION OF VEGETABLES AND COTTON, IN MONITORED AREAS	II	705	25/08/00	16:30	CC		14	PS	14
Laranja, A. T.	1352	CAN CAFFEINE BE USED AS AN AUXILIARY AGENT IN THE CONTROL OF AEDES AEGYPTI ?	I	341	23/08/00	16:30	CC		7	PS	7
Laranjeira, F.	3209	VECTOR AND EPIDEMIOLOGICAL ASPECTS OF CITRUS VARIEGATED CHLOROSIS	II	810	21/08/00	15:50	Bol	U	17	1	17
Laranjeiro, A. J.	1814	ENTOMOFAUNA AS A BIOINDICATOR OF THE IMPACTS OF SILVICULTURAL OPERATIONS	I	457	21/08/00	11:20	HB	M	10	1	10
Laroca, S.	882	BIOCOENOTICS OF WILD BEES (HYMENOPTERA, APOIDEA) OF RESTRICTED AREAS OF "CERRADO" IN JAGUARIAÍVA, PARANÁ (SOUTHERN BRAZIL)	I	223	21/08/00	16:30	CC		6	PS	6
Laroca, S.	1775	ADDITIONAL OBSERVATIONS ON NESTING BIOLOGY OF PTILOTHRIX PLUMATA (APOIDEA, ANTHOPHORIDAE)	I	447	23/08/00	16:30	CC		9	PS	9
Laroque, N.	1301	EFFECTS OF SEVERAL PESTICIDES ON THE PREDACIOUS MITE AGISTEMUS FLESCHNERI (ACARI: STIGMAEIDAE) IN QUEBEC APPLE ORCHARDS	I	328	21/08/00	16:30	CC		7	PS	7
Laroque, N.	1302	INDOXACARB (DPX-MP062) A NEW OXIDIAZINE INSECTICIDE - ITS POTENTIAL IN QUEBEC APPLE ORCHARDS	I	329	22/08/00	16:30	CC		7	PS	7

Sub-titles: (HB=Hotel Bourbon) - (HM=Hotel Mabu) - (CC=Convention Center) - (Bol=Foz Boulevard) - (PS=Poster Session) - (PL=Plenary Lecturer)

AUTHOR	Nº	TITLE	Book	Page	Date	Time	Local	Room	Session	Symp	New Session
Larraín, P. I.	3964	EVALUATION OF RESISTANT CLONES OF POTATO WITH AND WITHOUT CHEMICAL PROTECTION, AGAINST THE POTATO TUBER MOTH	II	1000	22/08/00	16:30	CC		22	PS	22
Larsen, E. C.	2268	A MOLECULAR PHYLOGENY OF NOTONECTIDAE (HETEROPTERA) USING 16S RNA	I	572	22/08/00	16:30	CC		12	PS	12
Larsson, S.	1851	OVERVIEW OF MECHANISMS OF RESISTANCE IN TREES TO INSECTS	I	467	24/08/00	9:35	HB	M	10	5	10
Larsson, S.	843	GENOTYPIC VARIATION IN PR-PROTEIN ACTIVITY IN WILLOW AND RESISTANCE TO A GALLING INSECT	I	213	23/08/00	15:30	HB	D	6	5	6
Lashomb, J. H.	2071	A COMPARISON OF CARABID SPECIES IN FOUR VEGETATION TYPES	I	522	22/08/00	16:30	CC		11	PS	11
Laskows, R.	1233	STOCHASTIC AND DENSITY – DEPENDENT MODELS IN DEMOGAFIC ECOTOXICOLOGY	I	311	21/08/00	16:30	CC		7	PS	7
Lassablière, F.	1540	STABILITY OF THE WOLBACHIA TRANSFER FROM TRICHOGRAMMA PRETIOSUM TO T. DENDROLIMI	I	388	22/08/00	16:30	CC		8	PS	8
Lassablière, F.	1626	COEXISTENCE IN ONE FIELD OF DIFFERENT TRICHOGRAMMA SPECIES SHOWING DIFFERENT MODES OF REPRODUCTION AND DIFFERENT LEVELS OF WOLBACHIA INFECTION	I	410	24/08/00	16:30	CC		8	PS	8
Latchininsky, A.	874	ITALIAN LOCUST AND OTHER SPECIES OF THE EAST EUROPEAN STEPPE	I	221	26/08/00	11:20	HB	D	6	9	6
Latchininsky, A. V.	2732	LOCUST MANAGEMENT IN RUSSIA, UZBEKISTAN, KAZAKHSTAN AND OTHER CIS COUNTRIES: LESSONS OF DECENTRALIZATION	II	690	23/08/00	16:30	CC		14	PS	14
Lauman, R.	299	BIONOMY OF THE BOLL WEVILL REARED ON ARTIFICIAL DIET	I	76	24/08/00	16:30	CC		2	PS	2
Laumann, R. A.	1612	BIOLOGICAL STUDIES OF NEPHASPIS GEMINII (COLEOPTERA: COCCINELIDAE) A PREDATOR OF BEMISIA TABACI BIOTYPE B (HEMIPTERA: ALEYRODIDADE), IN BRAZIL	I	406	23/08/00	16:30	CC		8	PS	8
Laup, S.	2087	FIELD TESTS OF THE INFECTIVITIES OF BEAVERIA BASSIANA(DEUT: HYPHOMYCETES) ISOLATE IMI 335249 AGAINST PANTORHYTES PLUTUS (COL: CURCULIONIDAE) IN A COCOA SYSTEM	I	526	23/08/00	16:30	CC		11	PS	11
Laup, S.	682	CONTROL OF SCAPANES AUSTRALIS A MAJOR PEST OF COCONUT USING SEMIOCHEMICALS	I	172	23/08/00	16:30	CC		4	PS	4
Laurente, N. M.	2180	HYMENOPTERA DNA TELLS ALL, WELL, ALMOST ALL	I	550	22/08/00	11:05	HB	L	12	3	12
Laurentin, H. E.	689	SCREENING GENOTYPES OF SESAME (SESAMUM INDICUM) FOR RESISTANCE TO WHITEFLY (BEMISIA TABACI)	I	174	23/08/00	16:30	CC		4	PS	4
Lauzière Jr., I.	1564	JALISCO FLY (DIPTERA: TACHINIDAE) AS A BIOLOGICAL CONTROL AGAINST MEXICAN RICE BORER (LEPIDOPTERA: PYRALIDAE) IN TEXAS SUGARCANE	I	394	22/08/00	16:30	CC		8	PS	8
Lavorenti, M. R.	294	EFFICIENCY OF SOME CHEMICALS TO CONTROL WHITE FLY, BEMISIA ARGENTIFOLII IN PUMPKIN CUCURBITA MOSCHATA, IN SAN FRANCISCO VALLEY – BRAZIL	I	75	24/08/00	16:30	CC		2	PS	2
Lavorenti, M. R.	699	LUFENURON EFFICIENCY EVALUATION TO CONTROL THE MITE ACERIA GUERRERONIS THAT CAUSES NECROSIS IN THE COCONUT PALM	I	177	25/08/00	16:30	CC		4	PS	4
Lavorenti, M. R.	700	DIAFENTIURON EFFICIENCY EVALUATION TO CONTROL THE MITE ACERIA GUERRERONIS THAT CAUSES NECROSIS IN THE COCONUT PALM	I	177	25/08/00	16:30	CC		4	PS	4
Lavorenti, M. R.	701	ABAMECTIN EFFICIENCY EVALUATION TO CONTROL THE MITE ACERIA GUERRERONIS THAT CAUSES NECROSIS IN THE COCONUT PALM	I	177	25/08/00	16:30	CC		4	PS	4
Lawrence, J. F.	778	BEETLES AND BEETLE LARVAE OF THE WORLD: INTERACTIVE IDENTIFICATION AND INFORMATION SYSTEMS FOR FAMILIES AND SUBFAMILIES	I	196	24/08/00	14:45	Bol	T	5	5	5
Lawrence, P. O.	2374	PARASITISM SPECIFIC PROTEINS AND A SYMBIOTIC ENTOMOPOXVIRUS FROM DIACHASMIMORPHA LONGICAUDATA, A PARASITE OF TEPHRITID FRUIT FLIES	II	600	24/08/00	15:05	HB	I	13	7	13
Lawrence, P. O.	2450	LOCALIZATION AND CHARACTERIZATION OF A NOVEL RHABDOVIRUS FROM A PARASITIC WASP DIACHASMIMORPHA LONGICAUDATA, A PARASITE OF THE CARIBBEAN FRUIT FLY ANASTREPHA SUSPENSA	II	619	22/08/00	16:30	CC		13	PS	13
Lawrie, C. H.	48	INVESTIGATION OF THE MECHANISMS OF ANTI-COMPLEMENT ACTIVITY IN IXODES TICKS	I	12	23/08/00	16:30	CC		1	PS	1
Lawson, D. S.	1321	PEPPER WEEVIL CONTROL WITH ACTARA 25WG	I	333	22/08/00	16:30	CC		7	PS	7
Lax, A. R.	3542	A PILOT TEST FOR AREA WIDE MANAGEMENT OF THE FORMOSAN SUBTERRANEAN TERMITE IN THE FRENCH QUARTER, NEW ORLEANS, LOUISIANA	II	894	24/08/00	16:30	CC		19	PS	19
Lay-Yee, M.	3922	IMPACT OF QUARANTINE PESTS ON TRADE – A NEW ZEALAND PERSPECTIVE	II	990	25/08/00	16:20	HB	H	22	8	22
Lazzari, C. R.	937	DYNAMICS OF THERMOPREFERENCE IN TRIATOMA SORDIDA	I	237	21/08/00	16:30	CC		6	PS	6
Lazzari, C. R.	718	INTERACTION BETWEEN VISUAL AND OLFACTORY CUES IN THE ASSEMBLING BEHAVIOUR OF THE HAEMATOPHAGOUS BUG TRIATOMA INFESTANS	I	181	24/08/00	16:30	CC		4	PS	4
Lazzari, F. A.	4050	INSECT AND FUNGUS MANAGEMENT TO REDUCE MYCOTOXIN PRODUCTION IN STORED GRAIN	II	1023	24/08/00	11:30	HB	J	23	8	23
Lazzari, F. A.	4011	THE USE OF DIATOMACEOUS EARTH TO CONTROL INSECTS IN CORN STORED IN THE COB	II	1013	21/08/00	15:00	HB	J	23	2	23
Lazzari, F. A.	4098	MONITORING INSECTS (COLEOPTERA) OUTSIDE GRAIN STORAGE FACILITIES	II	1035	24/08/00	16:30	CC		23	PS	23
Lázzari, F. A.	4067	ENZYME LINKED IMMUNOASSAY TESTS FOR INSECT MYOSIN IN WHEAT: EFFECTS OF MYOSIN DEGRADATION	II	1027	21/08/00	16:30	CC		23	PS	23
Lázzari, F. A.	4068	ENZYME LINKED IMMUNOASSAY TESTS FOR INSECT MYOSIN IN WHEAT: EFFECTS OF MYOSIN DEGRADATION	II	1027	21/08/00	16:30	CC		23	PS	23
Lazzari, S. M. N.	208	IMPACT OF CHRYSOPERLA EXTERNA (NEUROPTERA: CHRYSOPIDAE) ON CINARA SPP. (HOMOPTERA: APHIDIDAE) IN LABORATORY	I	53	21/08/00	16:30	CC		2	PS	2
Lazzari, S. M. N.	4050	INSECT AND FUNGUS MANAGEMENT TO REDUCE MYCOTOXIN PRODUCTION IN STORED GRAIN	II	1023	24/08/00	11:30	HB	J	23	8	23
Lazzari, S. M. N.	2778	EFFECTS OF AGE AND SEX ON MORTALITY OF TRIBOLIUM CASTANEUM EXPOSED TO WHEAT TREATED WITH DIATOMACEOUS EARTH	II	701	24/08/00	16:30	CC		14	PS	14
Lazzari, S. M. N.	1957	APHIDS (HOMOPTERA: APHIDIDAE: LACHNINAE: CINARINI) ON PINUS SPP. AND CUPRESSUS SP. IN SOUTHERN BRAZIL	I	493	24/08/00	16:30	CC		10	PS	10
Le Torc'h, J. M.	3907	POST-HARVEST INSECT CONTROL: RADIO-FREQUENCIES AND MICROWAVES AND OTHER HEAT-SHOCK MEANS	II	986	24/08/00	13:30	HB	H	22	6	22
Le, D.	3289	PHOTOAFFINITY LABELED NON-STEROIDAL ECDYSONE AGONIST AS A TOOL TO STUDY LIGAND-ECDYSONE RECEPTOR COMPLEX INTERACTION	II	831	23/08/00	15:35	HB	K	18	5	18
Leaf, D. S.	3152	ANALYSIS OF HUNCHBACK IN NASONIA VITRIPENNIS	II	795	23/08/00	16:30	CC		16	PS	16
Leaf, D. S.	3070	ZYGOTIC ANTERO-POSTERIOR PATTERNING GENE FUNCTIONS IN THE PARASITOID WASP NASONIA	II	775	24/08/00	11:15	HB	G	16	6	16
Leal, J. B.	2138	ENTOMOPHTHORALEAN PATHOGENIC FUNGI (ZYGOMYCOTINA – ZYGOMYCETES) IN THE NATURAL CONTROL OF INSECTS – PROSPECTS IN THE SOUTH OF BAHIA, BRAZIL	I	539	24/08/00	16:30	CC		11	PS	11
Leal, J. G. T.	2647	USE OF INSECTICIDES FOR CONTROLLING THE BRAZILIAN TOMATO PINWORM AND THE DIAMONDBACK MOTH IN THE FEDERAL DISTRICT, BRAZIL: A CASE STUDY	II	669	22/08/00	16:30	CC		14	PS	14
Leal, N. R.	1382	RESISTANCE TO THE TOMATO PINWORM, TUTA ABSOLUTA, BY INTERSPECIFIC GENETIC CROSSES OF TOMATO PLANTS	I	349	24/08/00	16:30	CC		7	PS	7
Leal, W. S.	4160	SEXUAL BEHAVIOR AND DAILY ACTIVITY OF CITRUS BORER MOTH ECDYTOLOPHA AURANTIANA (LEPIDOPTERA: TORTRICIDAE)	II	1051	21/08/00	16:30	CC		Erratum	PS	4
Leal, W. S.	81	TOWARDS THE MANAGEMENT OF SCARAB BEETLES WITH SYNTHETIC SEX PHEROMONES AND OTHER SEMIOCHEMICALS	I	21	21/08/00	10:20	HB	A	2	1	2
Leal, W. S.	581	INSECT PHEROMONE BINDING PROTEINS FORM DIMER IN SOLUTION	I	147	21/08/00	15:45	Bol	S	4	1	4
Leal, W. S.	584	SEMIOCHEMICALLY-MEDIATED HOMO- AND HETEROSEXUAL BEHAVIOR IN TRUE BUGS	I	148	22/08/00	10:20	Bol	S	4	2	4

Sub-titles: (HB=Hotel Bourbon) - (HM=Hotel Mabu) - (CC=Convention Center) - (Bol=Foz Boulevard) - (PS=Poster Session) - (PL=Plenary Lecturer)

AUTHOR	Nº	TITLE	Book	Page	Date	Time	Local	Room	Session	Symp	New Session
Leal, W. S.	603	SEX PHEROMONE BIOSYNTHESIS IN SCARAB BEETLES	I	153	23/08/00	11:40	Bol	S	4	4	4
Leal, W. S.	1720	SEXUAL BEHAVIOR OF LONGHORN BEETLE MIGDOLUS FRYANUS (COLEOPTERA: CERAMBYCIDAE)	I	433	22/08/00	9:35	HB	F	9	2	9
Leal, W. S.	83	ERADICATION OF A SCARAB PEST FROM A NATIONAL WILDLIFE REFUGE	I	22	21/08/00	10:50	HB	A	2	1	2
Leal, W. S.	588	A PHEROMONE COMPONENT OF THE BEAN BUG, RIPTORTUS CLAVATUS, ATTRACTS AN EGG PARASITOID, OOENCYRTUS NEZARAE	I	149	22/08/00	11:05	Bol	S	4	2	4
Leaper, K.	3319	OOGENESIS IN DROSOPHILA	II	838	22/08/00	16:30	CC		18	PS	18
Learmonth, S. E.	2748	MANAGEMENT OF A SOIL INSECT PEST WITH FUMIGANT – A UNIQUE CHALLENGE TO ADOPTION OF IPM	II	694	24/08/00	16:30	CC		14	PS	14
Leather, S. R.	2029	VOLATILITY COMPARISONS OF DIFFERENT FORMULATIONS USED TO APPLY MYCOINSECTICIDES	I	512	21/08/00	16:30	CC		11	PS	11
Leather, S. R.	2030	EVALUATION OF APPLICATION TECHNIQUES OF AN EMULSIFIABLE ADJUVANT OIL FUNGAL FORMULATION	I	512	21/08/00	16:30	CC		11	PS	11
Leblanc, P.	2211	ZAM, A RETROVIRUS FROM DROSOPHILA MELANOGASTER	I	558	24/08/00	15:35	HB	L	12	8	12
LeBrun, R. A.	2168	MICROBIAL CONTROL OF IXODES SCAPULARIS	I	547	25/08/00	16:30	CC		11	PS	11
Leccese, A.	2277	MITOCHONDRIAL DNA ANALYSIS IN SPECIES OF DREYFUSIA IN ITALY	I	575	23/08/00	16:30	CC		12	PS	12
Leccese, A.	1920	DISTRIBUTION AND ABUNDANCE OF MONOCHAMUS SPECIES ON PINES IN ITALY	I	484	22/08/00	16:30	CC		10	PS	10
Lecoq, M.	143	MIGRATION AND DISPERSAL IN A SOUTH AMERICAN PLAGUE GRASSHOPPER, RHAMMATOCERUS SCHISTOCERCOIDES AND IMPACT ON MANAGEMENT STRATEGIES	I	37	25/08/00	11:45	HB	A	2	9	2
Lecoq, M.	892	RAINFALL AND RECENT OUTBREAKS OF THE AFRICAN MIGRATORY LOCUST IN THE LAKE CHAD BASIN	I	225	21/08/00	16:30	CC		6	PS	6
Lecoq, M.	958	SPREAD OF A MIGRATORY LOCUST PLAGUE IN MADAGASCAR	I	242	22/08/00	16:30	CC		6	PS	6
Lecoq, M.	1042	DEFORESTATION, DROUGHT AND EXCEPTIONAL OUTBREAKS OF THE ORIENTAL MIGRATORY LOCUST, LOCUSTA MIGRATORIA MANILENSIS (MEYEN 1835) IN INDONESIA	I	263	23/08/00	16:30	CC		6	PS	6
Lecoq, M.	2093	FIELD TRIAL WITH THE ENTOMOPATHOGENIC FUNGUS METARHIZIUM ANISOPLIAE VAR. ACRIDUM AGAINST BANDS OF THE GRASSHOPPER RHAMMATOCERUS SCHISTOCERCOIDES IN BRAZIL	I	528	23/08/00	16:30	CC		11	PS	11
Lecuona, R.	2991	CHARACTERIZATION AND CARBON METABOLISM IN FUNGI PATHOGENOUS TO CHAGAS DISEASE VECTORS	II	755	23/08/00	16:30	CC		15	PS	15
Ledesma, M.	302	INSECTS ASSOCIATED WITH TOBACCO CULTURE WITHOUT CHEMICAL MANAGEMENT IN MISIONES ARGENTINA	I	77	25/08/00	16:30	CC		2	PS	2
Lee Jr., R. E.	3282	USING ICE NUCLEATING BACTERIA TO REDUCE WINTER SURVIVAL OF COLORADO POTATO BEETLES: DEVELOPING A NOVEL STRATEGY FOR BIOLOGICAL CONTROL	II	829	23/08/00	10:50	HB	K	18	4	18
Lee, B. L.	2359	THE MOLECULAR RELATIONSHIP BETWEEN PROPHENOLOXIDASE AND PROPHENOLOXIDASE-ACTIVATING FACTORS IN COLEOPTERAN INSECTS	II	596	23/08/00	14:50	HB	I	13	5	13
Lee, C.Y.	3387	TERMITE PESTS AND THEIR CONTROL IN MALAYSIA	II	855	21/08/00	10:05	HM	Q	19	1	19
Lee, D.	204	INFLUENCE OF CULTURAL PRACTICES ON PRE-HARVEST INFESTATIONS OF CORN BY MAIZE WEEVILS (SITOPHILUS ZEAMAIS)	I	52	21/08/00	16:30	CC		2	PS	2
Lee, D. H.	3965	MONITORING OF TWO MAJOR FRUIT MOTHS WITH SEX PHEROMONE TRAPS IN KOREAN APPLE ORCHARDS	II	1001	23/08/00	16:30	CC		22	PS	22
Lee, H. J.	1195	ANALYSIS OF SPECIFIC ADAPTATION TO A DOMICILE HABITAT: A COMPARATIVE STUDY OF TWO CLOSELY RELATED COCKROACH SPECIES	I	301	25/08/00	16:30	CC		6	PS	6
Lee, H. J.	3321	THE RELATIONSHIP BETWEEN LOCOMOTOR PACEMAKER AND CIRCADIAN RHYTHM OF ERG IN THE GERMAN COCKROACH, BLATTELLA GERMMANICA	II	839	21/08/00	16:30	CC		18	PS	18
Lee, H. J.	3382	COMPARATIVE STUDY OF PHASE RESPONSE CURVES BETWEEN TWO CLOSE-RELATED COCKROACHES	II	854	25/08/00	16:30	CC		18	PS	18
Lee, H. J.	2273	CLONING AND THE EXPRESSION OF A CIRCADIAN CLOCK GENE PERIOD IN THE GERMAN COCKROACH, BLATTELLA GERMANICA	I	574	23/08/00	16:30	CC		12	PS	12
Lee, J.	2963	TAXONOMIC AND PHYLOGENETIC STUDIES OF PERUVIAN LUTZOMYIA SPECIES BASED ON MOLECULAR DATA	II	748	21/08/00	16:30	CC		15	PS	15
Lee, J. M.	3380	CLONING OF VITELLOGENIN cDNA OF PERILTANETA AMERICANA AND ITS STYRUCTURE AND EXPRESSION	II	853	25/08/00	16:30	CC		18	PS	18
Lee, J.-H.	1043	SPATIAL INTERACTION OF PIRATA SUBPIRATICUS (LYCOSIDAE) AND PACHYGNATHA CLERKI (TETRAGNATHIDAE) IN THE RICE FIELDS	I	263	23/08/00	16:30	CC		6	PS	6
Lee, J.-H.	2723	TEMPERATURE-DEPENDENT DEVELOPMENTS OF CARPOSINA SASAKII (LEPIDOPTERA: CARPOSINIDAE) AND ITS STAGE EMERGENCE MODELS	II	688	24/08/00	16:30	CC		14	PS	14
Lee, J.-H.	2863	ARTHROPOD COMMUNITY STRUCTURE AND ITS CHANGING PATTERNS IN RICE ECOSYSTEMS IN KOREA	II	723	25/08/00	16:30	CC		14	PS	14
Lee, J.-H.	1044	DAMAGE OF CUCUMBER, CUCUMIS SATIVUS LINNE CAUSED BY FEEDING OF THE COTTON APHID, APHIS GOSSYPII GLOVER	I	263	23/08/00	16:30	CC		6	PS	6
Lee, J.-O	2863	ARTHROPOD COMMUNITY STRUCTURE AND ITS CHANGING PATTERNS IN RICE ECOSYSTEMS IN KOREA	II	723	25/08/00	16:30	CC		14	PS	14
Lee, K.-Y.	3048	DEVELOPMENTAL REGULATION AND FUNCTIONS FOR FLRFAMIDE PEPTIDES IN MANDUCA SEXTA	II	769	22/08/00	11:35	HB	G	16	2	16
Lee, M. R.	3282	USING ICE NUCLEATING BACTERIA TO REDUCE WINTER SURVIVAL OF COLORADO POTATO BEETLES: DEVELOPING A NOVEL STRATEGY FOR BIOLOGICAL CONTROL	II	829	23/08/00	10:50	HB	K	18	4	18
Lee, P.	943	INFERRING ACTIVITIES AND POPULATION DENSITY FROM INCIDENTAL SOILBORNE SOUNDS OF WHITE GRUBS	I	238	21/08/00	16:30	CC		6	PS	6
Lee, P. C.	1691	FIELD AUGMENTATION OF ORIUS STRIGICOLLIS FOR THE CONTROL OF INSECT PESTS	I	426	22/08/00	16:30	CC		8	PS	8
Lee, S.	1545	AN EDIBLE ALGINATE FORMULATION OF STEINERNEMA CARPOCAPSAE - ITS INSECTICIDAL EFFECT AND MOISTURE-HOLDING PROPERTIES	I	390	22/08/00	16:30	CC		8	PS	8
Lee, S. W.	3965	MONITORING OF TWO MAJOR FRUIT MOTHS WITH SEX PHEROMONE TRAPS IN KOREAN APPLE ORCHARDS	II	1001	23/08/00	16:30	CC		22	PS	22
Lee, S. W.	641	TRIALS OF CONTROLLING LEPIDOPTERAN PESTS WITH SEX PHEROMONES IN KOREAN APPLE AND PEAR ORCHARDS	I	162	21/08/00	16:30	CC		4	PS	4
Lee, S. W.	3872	TRIALS OF CONTROLLING LEPIDOPTERAN PESTS WITH SEX PHEROMONES IN KOREAN APPLE AND PEAR ORCHARDS	II	977	21/08/00	11:05	HB	H	22	1	22
Lee, S.-W.	1044	DAMAGE OF CUCUMBER, CUCUMIS SATIVUS LINNE CAUSED BY FEEDING OF THE COTTON APHID, APHIS GOSSYPII GLOVER	I	263	23/08/00	16:30	CC		6	PS	6
Lee, T.	2042	LESSONS LEARNED DURING THE DESIGN OF AN ARTHROPOD AND PATHOGEN QUARANTINE FACILITY	I	515	21/08/00	16:30	CC		11	PS	11
Lee, W. J.	2269	GRAM-NEGATIVE BACTERIA BINDING PROTEIN, A PATTERN RECOGNITION RECEPTOR FOR LIPOPOLYSACCHARIDE AND b-1,3-GLUCAN, WHICH MEDIATES THE SIGNALING FOR THE INDUCTION OF INNATE IMMUNE GENES IN DROSOPHILA MELANOGASTER CELLS	I	573	22/08/00	16:30	CC		12	PS	12
Lee, W-J	2358	GENOMIC STRUCTURE AND ECDYSONE REGULATION OF THE PROPHENOLOXIDASE I GENE IN THE MALARIA VECTOR ANOPHELES GAMBIAE	II	596	23/08/00	14:20	HB	I	13	5	13
Lee, Y. H.	112	OVERVIEW OF FDA'S PESTICIDE RESIDUE MONITORING PROGRAM	I	29	23/08/00	11:35	HB	A	2	5	2
Lees, D. C.	412	PROSPECTS FOR MAXIMISING CONSERVATION OF MADAGASCAN BIODIVERSITY BASED ON KNOWN DISTRIBUTIONS AND GEOGRAPHY	I	105	23/08/00	14:05	HB	C	3	4	3

Sub-titles: (HB=Hotel Bourbon) - (HM=Hotel Mabu) - (CC=Convention Center) - (Bol=Foz Boulevard) - (PS=Poster Session) - (PL=Plenary Lecturer)

AUTHOR	Nº	TITLE	Book	Page	Date	Time	Local	Room	Session	Symp	New Session
Legard, D. E.	2790	TETRANYCHUS URTICAE RESISTANCE TO ABAMECTIN IN FLORIDA STRAWBERRY AND THE IMPACT ON ADOPTION OF BIOLOGICAL CONTROL BY PHYTOSEIULUS PERSIMILIS	II	704	24/08/00	16:30	CC		14	PS	14
Legaspi, B. C.	1564	JALISCO FLY (DIPTERA: TACHINIDAE) AS A BIOLOGICAL CONTROL AGAINST MEXICAN RICE BORER (LEPIDOPTERA: PYRALIDAE) IN TEXAS SUGARCANE	I	394	22/08/00	16:30	CC		8	PS	8
Legaspi, J. C.	1530	BIOLOGICAL CONTROL OF FLORIDA RED SCALE IN TEXAS CITRUS	I	386	22/08/00	16:30	CC		8	PS	8
Legaspi, J. C.	1564	JALISCO FLY (DIPTERA: TACHINIDAE) AS A BIOLOGICAL CONTROL AGAINST MEXICAN RICE BORER (LEPIDOPTERA: PYRALIDAE) IN TEXAS SUGARCANE	I	394	22/08/00	16:30	CC		8	PS	8
Leger, R. St.	1844	INSECT PATHOGENIC FUNGI AS RESOURCE OF GENES FOR INSECT PEST CONTROL	I	465	23/08/00	14:05	HB	M	10	4	10
Legg, T.	1035	THE ROLE OF LEARNING AND MEMORY IN LEAF-CUTTING ANT FORAGING ECOLOGY.	I	261	23/08/00	16:30	CC		6	PS	6
Lehane, M. J.	2334	WEAK EXPRESSION OF EGFP IN TRANSGENIC AEDES AEGYPTI AND STOMOXYS CALCITRANS DESPITE THE PRESENCE OF MULTIPLE COPIES OF THE TRANSGENE	I	589	25/08/00	16:30	CC		12	PS	12
Lehrach, H.	2322	FROM GENE OF HONEYBEE (APIS MELLIFERA) TO MOLECULAR PROPERTIES AND FUNCTION OF MAJOR PROTEINS OF ROYAL JELLY	I	586	25/08/00	16:30	CC		12	PS	12
Leibee, G. L.	1565	OBSERVATIONS ON CULTURING DIADEGMA INSULARE, AN IMPORTANT PARASITOID OF THE DIAMONDBACK MOTH	I	395	22/08/00	16:30	CC		8	PS	8
Leido, P.	3879	DEMOGRAPHY OF FRUIT FLIES: LINKS BETWEEN REPRODUCTION AND MORTALITY	II	979	22/08/00	10:05	HB	H	22	2	22
Leite Jr, R. P.	3231	DIVERSITY OF SHARPSHOOTERS IN COFFEE PLANTATIONS IN PARANÁ STATE, BRAZIL	II	816	23/08/00	16:30	CC		17	PS	17
Leite Jr., R. P.	3208	IMPACT OF XYLELLA FASTIDIOSA DISEASES IN SOUTH AMERICA	II	810	21/08/00	15:35	Bol	U	17	1	17
Leite Jr., R.P.	2088	IMPACT OF XYLELLA FASTIDIOSA DISEASES IN SOUTH AMERICA	I	527	23/08/00	16:30	CC		11	PS	11
Leite, G. L. D.	1045	EFFECTS OF TRICHOMES AND CRISTALIFEROUS IDIOBLASTS DENSITIES, CONCENTRATIONS OF MINERALS AND WEATHER ON THE BEMISIA ARGENTIFOLII IN TOMATO	I	264	23/08/00	16:30	CC		6	PS	6
Leite, L. G.	3318	EFFECT OF THE TEMPERATURE AND LIGHT REGIME ON THE PRODUCTION AND STORAGE OF SPOROTHRIX INSECTORUM	II	838	23/08/00	16:30	CC		18	PS	18
Lemaitre, B.	2269	GRAM-NEGATIVE BACTERIA BINDING PROTEIN, A PATTERN RECOGNITION RECEPTOR FOR LIPOPOLYSACCHARIDE AND b-1,3-GLUCAN, WHICH MEDIATES THE SIGNALING FOR THE INDUCTION OF INNATE IMMUNE GENES IN DROSOPHILA MELANOGASTER CELLS	I	573	22/08/00	16:30	CC		12	PS	12
Lemcoff, J.	1905	WATER STRESS EFFECT ON WORKER CUTTING-ANTS OF ACROMYRMEX HISPIDUS ON THREE ORIGINS OF EUCALYPTUS GLOBULUS GLOBULUS	I	480	21/08/00	16:30	CC		10	PS	10
Lemos, E. E. P. de	3795	CONFIRMING A NEW STATUS FOR ODONTOPUS BREVIROSTRIS (COLEOPTERA: CURCULIONIDAE) VERSUS ANNONA MURICATA (ANONACEAE)	II	958	24/08/00	16:30	CC		21	PS	21
Lemos, E. E. P. de	3796	FIRST RECORD OF A BUPRESTIDAE (COLEOPTERA) SPECIES IN ASSOCIATION WITH ANNONA MURICATA (ANONACEAE) IN BRAZIL	II	958	24/08/00	16:30	CC		21	PS	21
Lemos, M. A.	268	EFFICIENCY OF METHODS FOR SAMPLING THRIPS ON ONION	I	68	23/08/00	16:30	CC		2	PS	2
Lemos, T. A.	2271	THE COMPLETE MITOCHONDRIAL GENOME OF THE PRIMARY SCREWWORM FLY COCHLIOMYIA HOMINIVORAX (DIPTERA: CALLIPHORIDAE)	I	573	22/08/00	16:30	CC		12	PS	12
Lendler, E.	2075	DIFFERENTIAL TRANSMISSION OF ZUCCHINI YELLOW MOSAIC VIRUS AND TURNIP MOSAIC MOSAIC VIRUS BY MYZUS PERISCAE AND BREVICORYNE BRASSICAE	I	523	22/08/00	16:30	CC		11	PS	11
Lenicov, A. M. de R.	1663	OCCURRENCE AND REDESCRIPTION OF MEGAMELUS SCUTELLARIS BERG (HEMIPTERA: FULGOROMORPHA: DELPHACIDAE) IN ARGENTINA, A CANDIDATE FOR BIOCONTROL OF WATERHYACINTH	I	419	25/08/00	16:30	CC		8	PS	8
Lent, J. van	3217	A WAY TO DIFFERENTIATE VECTOR SPECIFICITY BY THRIPS IN TOMATO SPOTTED WILT VIRUS TRANSMISSION	II	812	22/08/00	16:30	Bol	U	17	2	17
Lenteren, J. C. van	1463	AUGMENTATION BIOLOGICAL CONTROL AS APPLIED IN LATIN AMERICA	I	369	24/08/00	11:05	HM	O	8	7	8
Lenz, C.	2341	STRATEGIES FOR FINDING NOVEL INSECT NEUROHORMONE RECEPTORS AND THEIR LIGANDS, USING THE POTENTIALS OF THE BERKELEY "DROSOPHILA GENOME PROJECT".	II	591	21/08/00	11:30	HB	I	13	1	13
Lenz, M.	2709	POTENTIAL OF JUVENOIDS IN BAIT TECHNOLOGY FOR THE MANAGEMENT OF SUBTERRANEAN TERMITES (ISOPTERA) - LABORATORY AND FIELD STUDIES WITH A CARBAMATE DERIVATIVE (W-328)	II	684	22/08/00	16:30	CC		14	PS	14
Lenz, M.	3385	TERMITE PROBLEM SPECIES AND MANAGEMENT OF TERMITE PROBLEMS IN AUSTRALIA	II	855	21/08/00	9:35	HM	Q	19	1	19
Lenz, M.	3480	ESTIMATING RELATIVE DECLINE IN POPULATIONS OF SUBTERRANEAN TERMITES (ISOPTERA: RHINOTERMITIDAE) DUE TO BAITING	II	878	22/08/00	16:30	CC		19	PS	19
Lenz, M.	2003	CURRENT STATUS ON MICROBIAL CONTROL OF TERMITES IN AUSTRALIA	I	505	22/08/00	13:35	HM	P	11	4	11
León M., G. A.	1566	PARASITOIDS OF THE CITRUS LEAFMINER PHYLLOCNISTIS CITRELLA (LEP: GRACILLARIDAE) IN THE PIEDMONT OF THE DEPARTMENT OF META	I	395	22/08/00	16:30	CC		8	PS	8
León M., G. A.	518	POPULATIONAL FLUCTUATION OF THE CITRUS LEAFMINER PHYLLOCNISTIS CITRELLA (LEPIDOPTERA: GRACILLARIDAE) IN THE PIEDMONT OF THE DEPARTMENT OF META	I	131	23/08/00	16:30	CC		3	PS	3
Leon, L. A. De	2089	DOSAGE-RESPONSE VALUES OF B.t.i. AGAINST AEDES AEGYPTI IN VARIOUS CONTAINER HABITATS	I	527	23/08/00	16:30	CC		11	PS	11
Leon, L. A. De	2090	DOSAGE-RESPONSE VALUES OF ACROBE ® BIOLARVICIDE AGAINST AEDES AEGYPTI LARVAE IN VARIOUS CONTAINER HABITATS	I	527	23/08/00	16:30	CC		11	PS	11
Leon,T.A.	4053	EFFICACY OF CHENOPODIUM AMBROSIOIDES, PIPER GUINENSE, AND XYLOPIA AETHIOPICA AS GRAIN PROTECTANTS AGAINST STORED PRODUCT PESTS	II	1023	24/08/00	14:00	HB	J	23	9	23
Leonard, C. J.	2678	THERMAL IMAGING FOR THE DETECTION OF SUBTERRANEAN TERMITES AND DAMAGE	II	676	22/08/00	16:30	CC		14	PS	14
Leonard, R.	2564	IPM IN COTTON: THE CHALLENGE OF INTEGRATING NEW TOOLS TO MINIMISE PESTICIDE DEPENDENCE	II	648	22/08/00	14:20	HB	B	14	4	14
Leonardi, M. G.	2456	ROLE OF ACTIVATORS OF THE ABSORPTION OF AMINO ACIDS BY THE MIDGUT IN BOMBYX MORI LARVAL NUTRITION	II	620	23/08/00	16:30	CC		13	PS	13
Leonardo, F. C.	940	FORAGING POPULATION ESTIMATES FOR TWO COLONIES OF COPTOTERMES HAVILANDI (ISOPTERA, RHINOTERMITIDAE) USING MARK-RECAPTURE STUDIES	I	237	21/08/00	16:30	CC		6	PS	6
Léoncini, I.	3475	ADDITIVE PRIMER AND RELEASER EFFECTS OF BROOD AND QUEEN PHEROMONE ON ADULTS WORKERS IN THE HONEY BEE	II	877	22/08/00	16:30	CC		19	PS	19
Leon-Lopez, R.	2555	HISTORY AND CURRENT STATUS OF BEMISIA	II	646	22/08/00	9:50	HB	B	14	3	14
Leponce, M.	519	LEAF LITTER ANT AND TERMITE DIVERSITY IN IGUASSU AND RIO PILCOMAYO NATIONAL PARKS, ARGENTINA	I	131	23/08/00	16:30	CC		3	PS	3
Leppla, N. C.	1446	TECHNOLOGY TRANSFER IN AUGMENTATIVE BIOLOGICAL CONTROL: AUTOMATION FOR COMMERCIAL PRODUCTION AND APPLICATION OF NATURAL ENEMIES	I	365	22/08/00	15:05	HM	O	8	4	8
Lerat, E.	2212	CODON USAGE OF TRANSPOSABLE ELEMENTS AND HOST GEMONE	I	558	24/08/00	15:55	HB	L	12	8	12
Leschen, R. A. B.	3701	LEIODIDAE BEETLES: A NEW ZEALAND PERSPECTIVE	II	934	26/08/00	13:35	HB	E	21	10	21
Leskey, T. C.	609	ATTRACTION OF PLUM CURCULIOS TO INTERACTING, HOST ODOR, PHEROMONAL AND VISUAL STIMULI	I	154	24/08/00	9:35	Bol	S	4	6	4
Leslie Tolbert	XIII	Development of the insect nervous system	I	LVI	25/08/00	8:00	HB			PL	
Lesna, I.	1567	PREDATOR-PREY INTERACTIONS AT VARIOUS SPATIAL SCALES: BIOLOGICAL CONTROL OF THE BULB MITE, RHIZOGLYPHUS ROBINI, BY THE PREDATORY MITE, HYPOASPIS ACULEIFER, ON LILIES	I	395	22/08/00	16:30	CC		8	PS	8

Sub-titles: (HB=Hotel Bourbon) - (HM=Hotel Mabu) - (CC=Convention Center) - (Bol=Foz Boulevard) - (PS=Poster Session) - (PL=Plenary Lecturer)

AUTHOR	Nº	TITLE	Book	Page	Date	Time	Local	Room	Session	Symp	New Session
Lesna, I.	1712	DIET-DEPENDENT FEMALE CHOICE FOR MALES WITH GOOD GENES	I	431	21/08/00	13:30	HB	F	9	1	9
Lesna, I.	2170	GENETIC POLYMORPHISM IN PREY PREFERENCE AT A SMALL SPATIAL SCALE: A CASE STUDY OF SOIL PREDATORY MITES (HYPOASPIS ACULEIFER) AND TWO SPECIES OF ASTIGMATIC MITES AS PREY	I	548	21/08/00	10:35	HB	L	12	I	12
Lessinger, A. C.	2270	CHRYSOMYA (CALLIPHORIDAE) MITOCHONDRIAL DNA CONTROL REGION: CHARACTERIZATION OF C. MEGACEPHALA tRNA REPEAT	I	573	22/08/00	16:30	CC		12	PS	12
Lessinger, A. C.	2271	THE COMPLETE MITOCHONDRIAL GENOME OF THE PRIMARY SCREWWORM FLY COCHLIOMYIA HOMINIVORAX (DIPTERA: CALLIPHORIDAE)	I	573	22/08/00	16:30	CC		12	PS	12
Lessinger, A. C.	2261	RECOVERY OF MITOCHONDRIAL DNA SEQUENCES FROM MUSEUM SPECIMENS: METHODS AND EVOLUTIONARY PERSPECTIVES	I	571	22/08/00	16:30	CC		12	PS	12
Lessinger, A. C.	2242	CHARACTERIZATION OF MOLECULAR MARKERS ON CHRYSOMYA ALBICEPS BY PCR-RFLP OF MITOCHONDRIAL DNA	I	566	21/08/00	16:30	CC		12	PS	12
Leszczynski, B.	690	BIOCHEMICAL ADAPTATION OF BIRD CHERRY-OAT APHID TO PLANT PHENOLICS	I	174	23/08/00	16:30	CC		4	PS	4
Leszczynski, B.	735	FEEDING BEHAVIOUR OF PEA APHID ON ALFALFA	I	186	23/08/00	16:30	CC		4	PS	4
Leszczynski, B.	737	APHID ENZYMES INVOLVED IN DETOXICATION OF CEREAL ALLELOCHEMICALS	I	186	25/08/00	16:30	CC		4	PS	4
Leszczynski, B.	1213	GRAIN APHID PERFORMANCE ON TRITICALE	I	306	25/08/00	16:30	CC		6	PS	6
Leuchtmann, A.	852	ROLE OF THE PHORBIA FLIES IN THE EVOLUTION PROCESS OF EPICHLOE TAXA	I	215	24/08/00	14:00	HB	D	6	6	6
Leuchtmann, A.	1046	EPICHLOË GRASS ENDOPHYTES AND THEIR INTERACTION WITH A SYMBIOTIC FLY	I	264	23/08/00	16:30	CC		6	PS	6
Levada, M. M.	2282	A PARTHENOGENETIC NEW SPECIES OF THE GRYLLACRIDID GENUS APOTETAMENUS	I	576	23/08/00	16:30	CC		12	PS	12
Levashina, E.A.	2353	THIOESTER-CONTAINING PROTEINS IN INNATE IMMUNITY OF MOSQUITO ANOPHELES GAMBIAE	II	594	23/08/00	10:45	HB	I	13	4	13
Levin, M. L.	2892	INTERACTION AMONG MULTIPLE IXODES SCAPULARIS-BORNE PATHOGENS AND THEIR HOSTS	II	730	22/08/00	15:35	Bol	R	15	4	15
Levine, E.	4169	BEHAVIORAL VARIANTS OF DIABROTICA VIRGIFERA VIRGIFERA IN MAIZE/ SOYBEAN ROTATIONS	II	1053	26/08/00	14:50	HB	A	Erratum	11	2
Levine, E.	159	CROP ROTATION COLLAPSES AS A VIABLE PEST MANAGEMENT STRATEGY FOR WESTERN CORN ROOTWORMS, DIABROTICA VIRGIFERA VIRGIFERA LECONTE, IN THE EASTERN CORN BELT OF THE USA	I	41	26/08/00	14:05	HB	A	2	11	2
Levitan, M.	2200	CLINES, LEAPS, GAPS AND REVERSES IN INVERSION POLYMORPHISM	I	555	23/08/00	15:35	HB	L	12	6	12
Levy, R.	1353	MATRICAP®: NOVEL SYSTEMS FOR CONTROLLED DELIVERY OF PESTICIDES IN AQUATIC OR TERRESTRIAL HABITATS	I	341	23/08/00	16:30	CC		7	PS	7
Lewandowski, M.	1467	LIFE HISTORY OF PARASITUS CONSANGUINEUS FED ON THREE SPECIES OF PESTS OCCURRING IN MUSHROOM HOUSES	I	370	24/08/00	14:50	HM	O	8	7	8
Lewinsohn, T. M.	520	MONITORING REGIONAL AND GLOBAL CHANGES IN BIODIVERSITY: CHALLENGES FOR ENTOMOLOGISTS IN THE 21ST. CENTURY	I	132	23/08/00	16:30	CC		3	PS	3
Lewinsohn, T. M.	2171	DIVERSITY AND EVOLUTION OF INSECT-PLANT INTERACTIONS	I	548	21/08/00	11:05	HB	L	12	I	12
Lewis, O. T.	1568	STRUCTURE OF A TROPICAL LEAFMINER-PARASITOID COMMUNITY	I	395	22/08/00	16:30	CC		8	PS	8
Lewis, O. T.	817	RAPID EVOLUTION OF FLIGHT POTENTIAL IN LEPIDOPTERA	I	207	22/08/00	11:20	HB	D	6	3	6
Lewis, T.	1228	MOLECULAR STUDIES OF INSECT ACETYLCHOLINESTERASE: IS THERE NEW LIFE IN AN OLD TARGET?	I	310	21/08/00	14:05	HM	N	7	2	7
Lewis, W. J.	3932	MECHANISMS OF FOOD FORAGING BY PARASITOIDS: SIGNIFICANCE IN GOVERNING TRITROPHIC INTERACTIONS	II	992	24/08/00	14:05	HM	Q	22	9	22
Lfqvist, J.	654	SEX PHEROMONE OF THE BRAZILIAN APPLE LEAFROLLER, BONAGOTACRANAODES (LEPIDOPTERA: TORTRICIDAE): EFFECT OF GEOMETRICISOMERS ON MALE ATTRACTION TO (E,Z)-3,5-DODECADIENYL ACETATE	I	165	22/08/00	16:30	CC		4	PS	4
Lhano, M. G.	2457	RELATION BETWEEN WEIGHT AND VOLUME OF CORNOPS AQUATICUM (ORTHOPTERA: ACRIDIDAE) IN THE SURROUNDINGS OF RIO CLARO, BRAZIL	II	621	23/08/00	16:30	CC		13	PS	13
Lhano, M. G.	2458	RESPIROMETRIC STUDIES OF CORNOPS AQUATICUM (ORTHOPTERA: ACRIDIDAE) IN THE SURROUNDINGS OF RIO CLARO, BRAZIL	II	621	23/08/00	16:30	CC		13	PS	13
Li	3384	CATHEPSIN B-LIKE CYSTEINE PROTEINASE FROM HELICOVERPA ARMIGERA	II	854	25/08/00	16:30	CC		18	PS	18
Li, C.	3301	ECDYSTEROID-TRIGGERED REGULATORY HIERARCHIES IN INSECT REPRODUCTION	II	834	25/08/00	14:05	HB	K	18	7	18
Li, D. M.	356	GENETIC VARIATION AND GENE FLOW AMONG POPULATIONS OF THE COTTON BOLLWORM HELICOVERPA ARMIGERA (LEPIDOPTERA: NOCTUIDAE) IN CHINA	I	90	24/08/00	16:30	CC		2	PS	2
Li, D. M.	691	MONITORING MASSON PINE CATERPILLAR (DENDROLIMUS PUNCTATUS (WALKER)) WITH SYNTHETIC SEX PHEROMONE IN CHINA	I	175	23/08/00	16:30	CC		4	PS	4
Li, D. M.	3559	KIN RECOGNITION ANALYSIS OF CAMPONOTUS JAPONICUS (HYMENOPTERA: FORMICIDAE) COMBINED WITH AGGRESSIVE BEHAVOUR TEST AND RAPD-PCR METHOD	II	898	25/08/00	16:30	CC		19	PS	19
Li, F. X.	3384	CATHEPSIN B-LIKE CYSTEINE PROTEINASE FROM HELICOVERPA ARMIGERA	II	854	25/08/00	16:30	CC		18	PS	18
Li, H	254	SOYBEAN STEM BORER IN KANSAS: LIFE HISTORY, SAMPLING, AND SEVERITY OF RECENT INFESTATIONS	I	65	23/08/00	16:30	CC		2	PS	2
Li, L.	1432	IN VITRO REARING OF TRICHOGRAMMA OSTRINIAE PANG ET CHENS	I	361	21/08/00	15:05	HM	O	8	2	8
Li, M.	3039	REGULATION OF OVARIAN MORPHOGENESIS IN DROSOPHILA	II	767	21/08/00	14:00	HB	G	16	I	16
Li, M. H.	40	THE CAPTURE EFFECT OF PREDACEOUS MITE AMBLYSEIUS ORIENTALIS TO THE RED MITE PANONYCHUS CITRI AT DIFFERENT TEMPERATURES	I	10	23/08/00	16:30	CC		1	PS	1
Li, S. P.	356	GENETIC VARIATION AND GENE FLOW AMONG POPULATIONS OF THE COTTON BOLLWORM HELICOVERPA ARMIGERA (LEPIDOPTERA: NOCTUIDAE) IN CHINA	I	90	24/08/00	16:30	CC		2	PS	2
Li, T.	1704	APPLIED TECHNOLOGY OF PEST CONTROLLING BY TRICHOGRAMMA FROM ARTIFICIAL HOST EGG IN SHANXI, CHINA	I	429	25/08/00	16:30	CC		8	PS	8
Li, T. Y.	2733	BIOLOGY OF SWEET POTATO WHITEFLY, (HOMOPTERA: ALEYRODIDAE) ON TRANSGENIC TOBACCO AND INTERACTIONS WITH A PARASITE	II	690	23/08/00	16:30	CC		14	PS	14
Li, X.	1267	INSECTICIDE RESISTANCE GENES IN CULEX PIPIENS COMPLEX MOSQUITOES FROM CHINA	I	320	24/08/00	15:50	HM	N	7	8	7
Li, Y. S.	1276	SUCCESSES AND FUTURE CHALLENGES OF MANAGING WHITEFLY RESISTANCE IN ARIZONA	I	322	25/08/00	14:05	HM	N	7	10	7
Lian, M.	1704	APPLIED TECHNOLOGY OF PEST CONTROLLING BY TRICHOGRAMMA FROM ARTIFICIAL HOST EGG IN SHANXI, CHINA	I	429	25/08/00	16:30	CC		8	PS	8
Liang, G. W.	3996	INTEGRATED MEASURES FOR CONTROLLING THE DIAMONDBACK MOTH (DBM) IN SOUTHERN CHINA	II	1008	25/08/00	16:30	CC		22	PS	22
Liang, G. W.	4001	EFFECTS OF INTEGRATED MEASURES FOR CONTROLLING THE DIAMONBACK MOTH (DBM) ON ARTHROPOD DIVERSITIES IN VEGETABLE PLANTATIONS	II	1010	25/08/00	16:30	CC		22	PS	22
Liburd, O. E.	264	APPLICATION OF BIODEGRADABLE, SUGAR-STARCH SPHERES TREATED WITH REDUCED-RISK INSECTICIDES FOR MANAGEMENT OF KEY RHAGOLETIS SPECIES	I	67	23/08/00	16:30	CC		2	PS	2
Lieutier, F.	1862	POSSIBILITIES TO UTILIZE TREE RESISTANCE TO INSECTS IN FOREST PEST MANAGEMENT IN CENTRAL AND WESTERN EUROPE	I	469	24/08/00	15:05	HB	M	10	6	10
Lieutier, F.	1855	MECHANISMS OF RESISTANCE IN TREES TO BARK BEETLES	I	468	24/08/00	11:05	HB	M	10	5	10
Lievaart, R.	746	COMPUTERIZED VIDEO TRACKING, MOVEMENT ANALYSIS AND BEHAVIOR RECOGNITION IN INSECTS	I	188	21/08/00	10:55	Bol	T	5	I	5
Lih, M. P.	1818	EFFECTS OF A MULTI-YEAR GYPSY MOTH ERADICATION PROGRAM ON DIVERSITY OF NONTARGET FOREST CANOPY ARTHROPODS AND THEIR BIRD PREDATORS IN THE OZARK MOUNTAINS	I	458	21/08/00	14:20	HB	M	10	I	10

Sub-titles: (HB=Hotel Bourbon) - (HM=Hotel Mabu) - (CC=Convention Center) - (Bol=Foz Boulevard) - (PS=Poster Session) - (PL=Plenary Lecturer)

AUTHOR	Nº	TITLE	Book	Page	Date	Time	Local	Room	Session	Symp	New Session
Liljesthrom, G.	3235	RESOURCE AVAILABILITY AND SPATIAL DISTRIBUTION OF DELPHACODES KUSCHELI (FULGOROMORPHA: DELPHACIDAE)	II	817	23/08/00	16:30	CC		17	PS	17
Liljesthröm, G.	281	PHYTOPHAGOUS PENTATOMIDS ASSOCIATED WITH DIFFERENT LEGUMINOSAE IN PROVINCE OF BUENOS AIRES, ARGENTINA	I	71	23/08/00	16:30	CC		2	PS	2
Liljesthröm, G. G.	1637	LARVAL ENDOPARASITOIDS OF EPINOTIA APOREMA (LEPIDOPTERA:TORTRICIDAE) IN THE PROVINCE OF BUENOS AIRES, ARGENTINA	I	413	24/08/00	16:30	CC		8	PS	8
Lill, J. T.	1051	TRITROPHIC EFFECTS OF A LEAFTYING LEPIDOPTERAN AS A KEYSTONE ECOSYSTEM ENGINEER	I	265	23/08/00	16:30	CC		6	PS	6
Lill, J. T.	1874	IMPACT OF TIMBER HARVESTING ON INSECT HERBIVORE POPULATIONS OF QUERCUS IN A NORTH AMERICAN TEMPERATE DECIDUOUS FOREST	I	472	25/08/00	13:35	HB	M	10	8	10
Lima Filho, M.	1473	EFFECT OF DIATRAEA SACCHARALIS SCALES ON MASS PRODUCTION OF TRICHOGRAMMA GALLOI REARED ON ANAGASTA KUEHNIELLA EGGS	I	372	26/08/00	10:50	HM	O	8	8	8
Lima, J. O. G. de	2124	MICROBIAL CONTROL OF THE COFFEE BERRY BORER HYPOTHENEMUS HAMPEI	I	536	25/08/00	16:30	CC		11	PS	11
Lima, A. C. S.	2840	OVIPOSITION PREFERENCE OF SILVERLEAF WHITEFLY (HEMIPTERA: ALEYRODIDAE) FOR SQUASH GENOTYPES	II	717	22/08/00	16:30	CC		14	PS	14
Lima, C. A.	1569	EFFECT OF THE FILARIAL PARASITE WUCHERERIA BANCROFTI (NEMATODA: FILARIDAE) ON THE REPRODUCTION OF CULEX QUINQUEFASCIATUS (DIPTERA:CULICIDAE)	I	396	23/08/00	16:30	CC		8	PS	8
Lima, C. P. F. de	203	AREA-WIDE CONTROL OF MEDFLY (CERATITIS CAPITATA) IN CITRUS IN SOUTH WEST AUSTRALIA	I	52	22/08/00	16:30	CC		2	PS	2
Lima, E. R.	1778	IS ELASMOPALPUS LIGNOSELLUS BEHAVIOR INFLUENCED BY SMOKE OF BURNED SUGAR CANE?	I	448	23/08/00	16:30	CC		9	PS	9
Lima, E. R.	365	SCARABAEIDAE S. STR. (COLEOPTERA: SCARABAEOIDEA) FROM VIÇOSA, MINAS GERAIS STATE, BRAZIL	I	92	25/08/00	16:30	CC		2	PS	2
Lima, I. M. de M.	1047	THE LYFE TABLE PARAMETERS FOR ZAGLOBA BEAUMONTI (COLEOPTERA: COCCINELLIDAE) AS A PREDATOR OF DIASPIS ECHINOCACTI (HEMIPTERA: DIASPIDIDAE)	I	264	23/08/00	16:30	CC		6	PS	6
Lima, I. M. de M.	3795	CONFIRMING A NEW STATUS FOR ODONTOPUS BREVIROSTRIS (COLEOPTERA: CURCULIONIDAE) VERSUS ANNONA MURICATA (ANONACEAE)	II	958	24/08/00	16:30	CC		21	PS	21
Lima, I. M. de M.	3796	FIRST RECORD OF A BUPRESTIDAE (COLEOPTERA) SPECIES IN ASSOCIATION WITH ANNONA MURICATA (ANONACEAE) IN BRAZIL	II	958	24/08/00	16:30	CC		21	PS	21
Lima, J. B.	2406	CHARACTERIZATION OF THE DIGESTIVE PROCESS IN NEOTROPICAL ANOPHELINES	II	608	21/08/00	16:30	CC		13	PS	13
Lima, J. B. P.	1303	EVALUATION OF THE STATUS OF RESISTANCE OF AEDES AEGYPTI TOTEMEPHOS IN THE STATE OF RIO DE JANEIRO - BRAZIL	I	329	21/08/00	16:30	CC		7	PS	7
Lima, J. B. P.	1146	COMPARISON OF FOUR METHODS FOR COLLECTING ADULT ANOPHELINE MOSQUITOES IN AN ENDEMIC AREA IN PORTO VELHO – RONDONIA – BRAZIL	I	289	24/08/00	16:30	CC		6	PS	6
Lima, J. H. S.	1523	ECOLOGICAL ASPECTS AND DAMAGE EVALUATION OF FUIT FLIES IN CAGAITA IN THE SAVANNAS OF GOIAS STATE, BRAZIL.	I	384	21/08/00	16:30	CC		8	PS	8
Lima, J. O. G. de	2734	FRUIT BAGGING FOR PROTECTION OF CUCUMBER AGAINST TIIE PICKLEWORM, DIAPHANIA HYALINATA	II	690	23/08/00	16:30	CC		14	PS	14
Lima, J. O. G. de	1473	EFFECT OF DIATRAEA SACCHARALIS SCALES ON MASS PRODUCTION OF TRICHOGRAMMA GALLOI REARED ON ANAGASTA KUEHNIELLA EGGS	I	372	26/08/00	10:50	HM	O	8	8	8
Lima, J. O. G. de	708	INFLUENCE OF PRE- AND POST- IMAGINAL EXPERIENCE ON HOST-FINDING BEHAVIOR OF HYPOTHENEMUS HAMPEI	I	179	24/08/00	16:30	CC		4	PS	4
Lima, J. O. G. de	2044	THE SPECIFICITY OF BEAUVERIA BASSIANA FOR THE CONTROL OF MITE PESTS OF PAPAYA	I	516	21/08/00	16:30	CC		11	PS	11
Lima, J. O. G. de	187	BIOLOGY OF THE GUAJAVA WEEVIL, CONOTRACHELUS PSIDII (COLEOPTERA: CURCULIONIDAE), REARED UNDER LABORATORY CONDITIONS	I	48	21/08/00	16:30	CC		2	PS	2
Lima, J. O. G. de	265	A GASOLINE-DRIVEN SUCTION APPARATUS FOR SAMPLING BLISSUS ANTILLUS (HEMIPTERA: LYGAEIDAE) AND OTHER ARTHROPODS IN PASTURES	I	67	24/08/00	16:30	CC		2	PS	2
Lima, J. T.	940	FORAGING POPULATION ESTIMATES FOR TWO COLONIES OF COPTOTERMES HAVILANDI (ISOPTERA, RHINOTERMITIDAE) USING MARK-RECAPTURE STUDIES	I	237	21/08/00	16:30	CC		6	PS	6
Lima, L. H. C.	2272	BEMISIA TABACI POPULATIONS IN BRAZIL: GENETIC DIVERSITY REVEALED BY RAPD MARKERS	I	573	23/08/00	16:30	CC		12	PS	12
Lima, L. H. C.	2296	MORPHOLOGICAL AND MOLECULAR IDENTIFICATION OF WHITEFLIES SPECIES IN BRAZIL	I	579	24/08/00	16:30	CC		12	PS	12
Lima, L. S.	2138	ENTOMOPHTHORALEAN PATHOGENIC FUNGI (ZYGOMYCOTINA – ZYGOMYCETES) IN THE NATURAL CONTROL OF INSECTS – PROSPECTS IN THE SOUTH OF BAHIA, BRAZIL	I	539	24/08/00	16:30	CC		11	PS	11
Lima, M. F. D. de	2735	TONIC EFFECT OF SOIL INSECTICIDE ON THE COFFEE (COFFEA ARABICA) PLANT AND ITS COST-BENEFICE	II	691	23/08/00	16:30	CC		14	PS	14
Lima, M. G. A.	906	SURVEY OF FRUIT FLIES (DIPTERA: TEPHRITIDAE) IN FOUR CITIES IN PARAÍBA	I	229	21/08/00	16:30	CC		6	PS	6
Lima, M. G. A.	2151	LARVAL PARASITOIDS AND PATHOGENS OF SPODOPTERA FRUGIPERDA (LEPIDOPTERA: NOCTUIDAE) IN FOUR CITIES IN PARAÍBA	I	542	25/08/00	16:30	CC		11	PS	11
Lima, M. G. A.	1582	BIOLOGICAL ASPECTS OF PODISUS NIGRISPINUS (HETEROPTERA: PENTATOMIDAE) BEING AS PREY SPODOPTERA FRUGIPERDA (LEPIDOPTERA: NOCTUIDAE)	I	399	23/08/00	16:30	CC		8	PS	8
Lima, M. P. L.	1371	CONTROL OF BEAN LEAFHOPPER EMPOASCA KRAEMERI (HEMIPTERA: CICADELLIDAE) WITH THIAMETHOXAM ON COWPEA	I	346	22/08/00	16:30	CC		7	PS	7
Lima, M. P. L.	2714	CONTROL OF POTATO LEAFHOPPER EMPOASCA KRAEMERI (HEMIPTERA: CICADELLIDAE) WITH THIAMETHOXAM ON COWPEA	II	685	23/08/00	16:30	CC		14	PS	14
Lima, M. P. L.	1372	INTERCROPPING SYSTEM AND THIAMETHOXAM SPRAYING FOR EMPOASCA KRAEMERI (HEMIPTERA: CICADELLIDAE) CONTROL IN COWPEA	I	346	22/08/00	16:30	CC		7	PS	7
Lima, M. P. L. de	4085	IDENTIFICATION OF COWPEA VIGNA UNGUICULATA GENOTYPES RESISTANT TO CALLOSOBRUCHUS MACULATUS	II	1031	23/08/00	16:30	CC		23	PS	23
Lima, N. L. N. L.	3833	DIPTERA CALIPTRATA SUCESSION IN A CARCASS OF SUS SCROFA, IN TWO ECOSYSTEMS OF RIO DE JANEIRO, RJ	II	967	24/08/00	16:30	CC		21	PS	21
Lima, R.	3477	DAMAGES CAUSED BY THE NASUTITERMES SPP. (ISOPTERA : TERMITIDAE) IN ERIOTHECA CRENULATICALYX (BOMBACACEAE) AT THE UNIVERSIDADE FEDERAL DA PARAÍBA, JOÃO PESSOA (PB), BRAZIL	II	878	22/08/00	16:30	CC		19	PS	19
Lima, R. S.	175	SURVEY OF THE ARTHROPODS ASSOCIATED TO MALPIGHIA GLABRA IN ANGULO, PARANA, BRAZIL	I	45	22/08/00	16:30	CC		2	PS	2
Lin, F.-J.	3270	PHOTIC ENTRAINMENT OF THE DROSOPHILA CIRCADIAN CLOCK	II	826	23/08/00	13:50	HB	K	18	3	18
Lin, H.	3038	THE SELF-RENEWING MECHANISM OF GERMLINE STEM CELLS IN DIVERSE ORGANISMS	II	767	21/08/00	13:30	HB	G	16	1	16
Lin, H.	1274	PERFORMANCE OF THIACLOPRID, A NEW FOLIAR APPLIED INSECTICIDE IN THE USA	I	322	25/08/00	11:35	HM	N	7	9	7
Lin, J. Z.	49	CHECKLIST OF MITES FROM MOSO BAMBOO IN FUJIAN, CHINA	I	13	23/08/00	16:30	CC		1	PS	1
Lin, J. Z.	1986	KEY FACTORS AFFECTING POPULATIONS OF SCHIZOTETRANYCHUS NANJINGENSIS, APONYCHUS CORPUZAE AND ACULUS BAMBUSAE IN FUJIAN BAMBOO FORESTS DURING DIFFERENT SEASONS: AN ANALYSIS USING METHODS OF GREY SEQUENCE	I	500	21/08/00	16:30	CC		10	PS	10
Lin, J. Z.	77	POTENTIAL OF AMBLYSEIUS CUCUMERIS (ACARI: PHYTOSEIIDAE) AS A BIOCONTROL AGENT AGAINST SCHIZOTETRANYCHUS NANJINGENSIS (ACARI: TETRANYCHIDAE) IN CHINA	I	20	25/08/00	16:30	CC		1	PS	1
Lin, J. Z.	2866	AN OVERVIEW OF OCCURRENCE, DEVELOPMENT AND DAMAGE OF BAMBOO MITES AND THEIR INTEGRATED MANAGEMENT IN FUJIAN, CHINA	II	723	22/08/00	16:30	CC		14	PS	14

Sub-titles: (HB=Hotel Bourbon) - (HM=Hotel Mabu) - (CC=Convention Center) - (Bol=Foz Boulevard) - (PS=Poster Session) - (PL=Plenary Lecturer)

AUTHOR	Nº	TITLE	Book	Page	Date	Time	Local	Room	Session	Symp	New Session
Lin, K. H.	2273	CLONING AND THE EXPRESSION OF A CIRCADIAN CLOCK GENE PERIOD IN THE GERMAN COCKROACH, BLATTELLA GERMANICA	I	574	23/08/00	16:30	CC		12	PS	12
Linardi, M. S.	672	ATTRACTIVITY OF PROTEIN HIDROLISATE AND SUGARCANE MOLASSES ON ADULT FRUIT FLIES ANASTREPHA SP. AND CERATITIS CAPITATA (DIPTERA:TEPHRITIDAE) ON CITRUS ORCHARD	I	170	23/08/00	16:30	CC		4	PS	4
Linardi, P. M.	4066	SMALL WILD MAMMALS SIPHONAPTERA FROM ITAPEVI COUNTY, STATE OF SÃO PAULO, BRAZIL	II	1027	21/08/00	16:30	CC		23	PS	23
Linares, M.	361	ARMADILLIDIUM VULGARE (CRUSTACEA: ISOPODA). NEW PEST TO SOYBEANS IN ARGENTINA?	I	91	25/08/00	16:30	CC		2	PS	2
Linares, M.	316	SAMPLING DISTRIBUTION PATTERNS OF RACHIPLUSIA NU (LEPIDOPTERA: NOCTUIDAE) AND DESIGN OF SAMPLE PLANS	I	80	24/08/00	16:30	CC		2	PS	2
Lind, R. J.	1223	CHARACTERISATION OF NEONICOTINOID MODE OF ACTION AT INSECT NICOTINIC ACETYLCHLOINE RECEPTORS	I	309	21/08/00	10:05	HM	N	7	1	7
Lindelöw, Å.	1152	ATTACK DYNAMICS OF THE SPRUCE BARK BEETLE IPS TYPOGRAPHUS IN STANDS WITH AND WITHOUT REMOVAL OF WINDTHROWN TREES AFTER A STORM FELLING	I	290	24/08/00	16:30	CC		6	PS	6
Lindgren, E.	2880	TICKS AND GLOBAL CHANGE - A HOT TOPIC IN NORTHERN EUROPE!	II	727	21/08/00	16:05	Bol	R	15	2	15
Lindroth, R. L.	1485	FIELD SCALE RESPONSES OF APHIDS AND THEIR NATURAL ENEMIES TO ELEVATED CO2 AND O3	I	375	21/08/00	16:30	CC		8	PS	8
Lindsay, S. W.	2964	THE IMPORTANCE OF MOSQUITO LARVAL SURVEYS IN THE MAPPING OF MALARIA TRANSMISSION RISK	II	748	21/08/00	16:30	CC		15	PS	15
Lindström, A.	3003	MOSQUITO REPELLENT PLANTS	II	758	24/08/00	16:30	CC		15	PS	15
Linduska, J. J.	1354	TIMING INSECTICIDE APPLICATIONS FOR DUSKY SAP BEETLE (COLEOPTERA: NITIDULIDAE) CONTROL IN BT SWEET CORN.	I	342	23/08/00	16:30	CC		7	PS	7
Linhares, A. X.	2948	FLIES AND DRUGS IN SOUTHEASTERN BRAZIL	II	744	26/08/00	13:30	Bol	R	15	11	15
Linhares, A. X.	3020	SARCOSAPROPHAGOUS INSECTS ASSOCIATED WITH DECOMPOSITION OF PIG CARCASSES EXPOSED TO DIFFERENT ALTITUDES AND PLUVIOMETRIC REGIONS IN THE SERRA DO JAPI RESERVATION-SP, BRAZIL	II	762	25/08/00	16:30	CC		15	PS	15
Linit, M. J.	1048	ARTHROPOD DIVERSITY IN AN AGROFORESTRY SYSTEM OF BLACK WALNUT AND FORAGE CROPS	I	264	23/08/00	16:30	CC		6	PS	6
Link, D.	266	CHEMICAL CONTROL OF THE TOBACCO FLEA BEETLE	I	68	23/08/00	16:30	CC		2	PS	2
Link, D.	1937	CHEMICAL PROTECTION OF EUCALYPTUS SEEDLINGS FOR LEAF CUTTING ANT DAMAGE	I	488	24/08/00	16:30	CC		10	PS	10
Lino Neto, J.	3153	STRUCTURAL AND ULTRASTRUCTURAL OBSERVATIONS OF SPERM OF TWO SPECIES OF PARASITOIDS (HYMENOPTERA: EULOPHIDAE)	II	795	23/08/00	16:30	CC		16	PS	16
Lino Neto, J.	3201	CHARACTERISTICS OF SPERMATOZOA OF A STINGLESS BEE MELIPONA MARGINATA (HYMENOPTERA: APIDAE: MELLIPONINI)	II	807	25/08/00	16:30	CC		16	PS	16
Lins, V. S.	267	NATURAL AND ARTIFICIAL INFESTATION OF THE SITOPHILUS SPP IN GRAINS OF FIVE CULTIVATE OF CORN	I	68	23/08/00	16:30	CC		2	PS	2
Linsenmair, K. E.	1124	TEMPORAL AND SPATIAL DISTRIBUTION OF DIVING BEETLES IN A HIGHLY SEASONAL ENVIRONMENT (COMOÉ NATIONAL PARK, IVORY COAST)	I	283	24/08/00	16:30	CC		6	PS	6
Liou, R. F.	2273	CLONING AND THE EXPRESSION OF A CIRCADIAN CLOCK GENE PERIOD IN THE GERMAN COCKROACH, BLATTELLA GERMANICA	I	574	23/08/00	16:30	CC		12	PS	12
Liou, Y-C.	3283	WHEN YOU CAN'T FLY TO BRAZIL: SURVIVING WINTER WITH ANTIFREEZE PROTEIN GENES	II	829	23/08/00	11:05	HB	K	18	4	18
Lipinska, R.	1213	GRAIN APHID PERFORMANCE ON TRITICALE.	I	306	25/08/00	16:30	CC		6	PS	6
Liu, E. Y.	2935	MICROBIAL PESTICIDES FOR MOSQUITO CONTROL IN CHINA: CURRENT AND FUTURE CONSIDERATIONS	II	741	25/08/00	15:00	Bol	R	15	10	15
Liu, G.-T.	741	ANTENNAL AND BEHAVIORAL RESPONSES TO NONHOST ANGIOSPERM LEAF AND BARK VOLATILES BY CONIFER INSECT	I	187	25/08/00	16:30	CC		4	PS	4
Liu, J.	2035	THE BENEFICIAL NEMATODE, HETERORHABDITIS MARELATUS : ITS PROMISE IN BIOCONTROL OF PESTS IN NURSERY AND FIELD CROPS	I	513	21/08/00	16:30	CC		11	PS	11
Liu, L. L.	3389	TERMITE FAUNA IN CHINA, AND THEIR ECONOMIC IMPORTANCE	II	856	21/08/00	10:35	HM	Q	19	1	19
Liu, N.	1355	MOLECULAR BASIS OF INSECTICIDE RESISTANCE IN THE HOUSE FLY, Musca domestica	I	342	23/08/00	16:30	CC		7	PS	7
Liu, Q. Y.	49	CHECKLIST OF MITES FROM MOSO BAMBOO IN FUJIAN, CHINA	I	13	23/08/00	16:30	CC		1	PS	1
Liu, Q.Y.	2866	AN OVERVIEW OF OCCURRENCE, DEVELOPMENT AND DAMAGE OF BAMBOO MITES AND THEIR INTEGRATED MANAGEMENT IN FUJIAN, CHINA	II	723	22/08/00	16:30	CC		14	PS	14
Liu, Q.Y.	76	CAUSES OF MITE PEST OUTBREAKS IN BAMBOO FORESTS IN FUJIAN, CHINA: ANALYSES OF MITE DAMAGE IN MONOCULTURE VERSUS POLYCULTURE STANDS	I	19	25/08/00	16:30	CC		1	PS	1
Liu, Q.Y.	1986	KEY FACTORS AFFECTING POPULATIONS OF SCHIZOTETRANYCHUS NANJINGENSIS, APONYCHUS CORPUZAE AND ACULUS BAMBUSAE IN FUJIAN BAMBOO FORESTS DURING DIFFERENT SEASONS: AN ANALYSIS USING METHODS OF GREY SEQUENCE	I	500	21/08/00	16:30	CC		10	PS	10
Liu, R. Y.	356	GENETIC VARIATION AND GENE FLOW AMONG POPULATIONS OF THE COTTON BOLLWORM HELICOVERPA ARMIGERA (LEPIDOPTERA: NOCTUIDAE) IN CHINA	I	90	24/08/00	16:30	CC		2	PS	2
Liu, S. S.	1339	THE STUDIES OF THE INSECTICIDE SUSCEPTIBILITY AND DETOXIFICATION ENZYMES OF APIS CERANA AND APIS MELLIFERA	I	338	22/08/00	16:30	CC		7	PS	7
Liu, W.	596	PHEROMONE BIOSYNTHESIS: UNIQUE DESATURASE GENES	I	151	23/08/00	9:35	Bol	S	4	4	4
Liu, W.	1432	IN VITRO REARING OF TRICHOGRAMMA OSTRINIAE PANG ET CHENS	I	361	21/08/00	15:05	HM	O	8	2	8
Liu, W-C.	1141	INVASION SEQUENCE DETERMINES PREDATOR-PREY DYNAMICS IN A MULTISPECIES ASSEMBLAGE	I	288	24/08/00	16:30	CC		6	PS	6
Liu, X.	3883	MOLECULAR MARKERS IN WHEAT LINKED TO GENES EXPRESSING RESISTANCE TO THE GREENBUG AND THE RUSSIAN WHEAT APHID	II	980	22/08/00	13:35	HB	H	22	3	22
Liu, X. Q.	1416	COMPARISON OF ROTENONE CONTENT AND INSECT BIOACTIVITY BETWEEN ROOTS AND CALLUS CULTURES OF DERRIS ELLIPTICA	I	357	25/08/00	16:30	CC		7	PS	7
Liu, Y. B.	1251	PINK BOLLWORM RESISTANCE TO BT COTTON	I	316	23/08/00	15:05	HM	N	7	6	7
Liu, Z.	1229	SODIUM CHANNEL MUTATIONS AND PYRETHROID RESISTANCE	I	310	21/08/00	14:35	HM	N	7	2	7
Liu, Z. B.	3559	KIN RECOGNITION ANALYSIS OF CAMPONOTUS JAPONICUS (HYMENOPTERA: FORMICIDAE) COMBINED WITH AGGRESSIVE BEHAVOUR TEST AND RAPD-PCR METHOD	II	898	25/08/00	16:30	CC		19	PS	19
Liu, D.	4175	EFFECTS OF LITCHI ORCHARD GROUNDCOVER ON ARTHROPOD COMMUNITIES	II	1054	21/08/00	16:30	CC		Erratum	PS	6
Livdahl, T.	3025	VARIABLE TIMING OF EGG HATCH AND ITS RELATION TO ANNUAL PRECIPITATION IN POPULATIONS OF AEDES TRISERIATUS	II	763	25/08/00	16:30	CC		15	PS	15
Lizárraga T., A.	409	BIODIVERSITY AND THE SOCIEDAD ENTOMOLOGICA DEL PERU	I	104	23/08/00	11:20	HB	C	3	3	3
Lizarraga, A.	3966	DEFINITION OF ECOLOGICAL PEST MANAGEMENT	II	1001	23/08/00	16:30	CC		22	PS	22
Ljutikova, L. I.	2455	EXPERIMENTAL STUDY OF HAEMOCYTES AND HEMOPOIETIC TISSUE OF ADULT OF NAUPHOETA CINEREA	II	620	23/08/00	16:30	CC		13	PS	13
Llewellyn, K. S.	147	STUDIES OF APHID MIGRATION USING MICROSATELLITE MARKERS	I	38	25/08/00	14:15	HB	A	2	9	2
Llorente-Bousquets, J.	456	BIODIVERSITY OF PAPILIONOIDEA FROM MEXICO	I	116	26/08/00	14:35	HB	C	3	10	3
Lloyd, R. J.	1999	POTENTIAL IN AUSTRALIA FOR A HELICOVERPA BACULOVIRUS	I	504	22/08/00	9:20	HM	P	11	3	11
Lloyd, R. J.	2106	POTENTIAL IN AUSTRALIA FOR A HELICOVERPA BACULOVIRUS	I	531	23/08/00	16:30	CC		11	PS	11
Lluberas, M. F.	2736	REDEFINING "INTEGRATED VECTOR MANAGEMENT"	II	691	23/08/00	16:30	CC		14	PS	14
Lluberas, M. F.	2737	ESSENTIAL ELEMENTS OF A VECTOR MANAGEMENT PROGRAM	II	691	23/08/00	16:30	CC		14	PS	14

Sub-titles: (HB=Hotel Bourbon) - (HM=Hotel Mabu) - (CC=Convention Center) - (Bol=Foz Boulevard) - (PS=Poster Session) - (PL=Plenary Lecturer)

AUTHOR	Nº	TITLE	Book	Page	Date	Time	Local	Room	Session	Symp	New Session
Lluberas, M. F.	410	SOCIEDAD ENTOMOLÓGICA DE PUERTO RICO PRESERVING BIODIVERSITY	I	104	23/08/00	11:35	HB	C	3	3	3
Lo, N.	2161	PROTOZOAN AND ENDOGENOUS CELLULASES FROM TERMITES OF THE GENUS COPTOTERMES	I	545	25/08/00	16:30	CC		11	PS	11
Lo, N.	2326	MOLECULAR PHYLOGENETIC INSIGHTS INTO THE ORIGIN OF TERMITE WORKERS	I	587	25/08/00	16:30	CC		12	PS	12
Loayza, R. M.	2763	DETERMINATION OF THE OPTIMAL AND UPPER THRESHOLD OF TEMPERATURE FOR THE DEVELOPMENT OF SELENASPIDUS ARTICULATUS IN CITRUS	II	698	23/08/00	16:30	CC		14	PS	14
Lobinske, R. J.	786	A PRELIMINARY COMPUTER MODEL OF GLYPTOTENDIPES PARIPES (DIPTERA: CHIRONOMIDAE) LARVAL DISTRIBUTION IN LAKES OF CENTRAL FLORIDA, USA	I	198	21/08/00	16:30	CC		5	PS	5
Lobo, J. M.	523	PREDICTING SPECIES RICHNESS BY ASSESSING THE SAMPLING EFFORT: THE CASE OF THE IBERIAN DUNG BEETLES (COLEOPTERA SCARABAEINAE)	I	132	23/08/00	16:30	CC		3	PS	3
Locali, E. C.	3203	GENOME AND FUNCIONAL GENOMICS OF XYLELLA FASTIDIOSA	II	809	21/08/00	13:35	Bol	U	17	1	17
Locci, M. Y.	3037	OVARIAN FOLLICLE DIFFERENTIATION IN INSECT OVARIOLES	II	766	21/08/00	11:30	HB	G	16	1	16
Loch, A. D.	1893	TRENDS IN INSECT PEST PROBLEMS OF LOCALLY EXOTIC EUCALYPT PLANTATIONS: THE EXAMPLE OF TASMANIAN BLUE GUM IN WESTERN AUSTRALIA	I	477	26/08/00	15:20	HB	M	10	10	10
Locke, M.	3090	INSECT LUNGS	II	780	25/08/00	16:05	HB	G	16	8	16
Lockhart, B. E. L.	3240	APHID ALERT: RESEARCH/OUTREACH ADDRESSING POTATO VIRUS PROBLEMS IN THE NORTH CENTRAL U.S.	II	818	24/08/00	16:30	CC		17	PS	17
Lodge, J. D.	2123	FUNGI ASSOCIATED TO SCOLYTIDAE BEETLES IN PUERTO RICO	I	535	24/08/00	16:30	CC		11	PS	11
Loeb, M. J.	3250	TESTIS ECDYSIOTROPIN, AN INSECT GONADOTROPIN THAT INDUCES SYNTHESIS OF ECDYSTEROID	II	821	21/08/00	9:50	HB	K	18	1	18
Loeb, M. J.	1554	DEVELOPMENT OF AN ARTIFICIAL DIET FOR REARING EDOVUM PUTTLERI, AN EGG PARASITOID OF THE COLORADO POTATO BEETLE, LEPTINOTARSA DECEMLINEATA	I	392	22/08/00	16:30	CC		8	PS	8
Loeck, A. E.	521	OCCURENCE OF LEAF-CUTTING ANTS IN DIFFERENT REGIONS OF RIO GRANDE DO SUL STATE	I	132	23/08/00	16:30	CC		3	PS	3
Loeck, A. E.	2091	GROWTH OF FUNGI CULTIVATED BY CUTTING ANTS ON MURASHIGE & SKOOG NUTRIENT SOLUTION IN DIFFERENT pH	I	527	24/08/00	16:30	CC		11	PS	11
Loeck, A. E.	2092	EFFICIENCY OF DIFFERENT CULTURE MEDIA IN THE IN VITRO GROWTH OF FUNGI CULTIVATED BY DIFFERENT LEAF CUTTING ANT SPECIES	I	528	24/08/00	16:30	CC		11	PS	11
Loeck, A. E.	1531	PARASITISM OF EGGS OF APPLE LEAF ROLLER BONAGOTA CRANAODES (LEPIDOPTERA: TORTRICIDAE) BY TRICHOGRAMMA SP. IN FIELD CONDITIONS	I	386	22/08/00	16:30	CC		8	PS	8
Loetti, V.	4086	ANALYSIS OF VARIATION OF SPECIFIC CHARACTERS OF CULEX (CULEX) IN TWO ENVIROMENTS AND DETECTION OF NEW SPECIES IN THE CITY OF BUENOS AIRES	II	1032	23/08/00	16:30	CC		23	PS	23
Lofego, A. C.	2104	ANOTHER CASE OF INSECT AND TARSONEMID MITE (ACARI: TARSONEMIDAE) ASSOCIATION.	I	531	23/08/00	16:30	CC		11	PS	11
Löfqvist, J.	1966	NON-HOST SIGNALS INHIBITING FEEDING IN HYLOBIUS PINE WEEVILS: LABORATORY ASSAYS AND FIELD TESTS	I	495	24/08/00	16:30	CC		10	PS	10
Löfstedt, C.	712	BEHAVIOURAL AND ELECTROPHYSIOLOGICAL RESPONSES OF SILVER Y MOTH, AUTOGRAPHA GAMMA (LEPIDOPTERA: NOCTUIDAE), TO FLORAL VOLATILES	I	180	24/08/00	16:30	CC		4	PS	4
Löfstedt, C.	721	MALE EMITTED SEX PHEROMONES IN CONFUSED FLOUR BEETLE-BEHAVIOUR AND POSSIBLE PRODUCTION SITE	I	182	25/08/00	16:30	CC		4	PS	4
Löfstedt, C.	734	PHEROMONE-BASED MATING DISRUPTION OF THE INDIAN MEAL MOTH PLODIA INTERPUNCTELLA (LEPIDOPTERA: PYRALIDAE) USING SINGLE- AND MULTI-COMPONENT BLENDS	I	185	25/08/00	16:30	CC		4	PS	4
Löfstedt, C.	3708	MOLECULAR PHYLOGENY OF THE SUBFAMILIES IN GEOMETRIDAE (GEOMETROIDEA: LEPIDOPTERA)	II	936	21/08/00	16:30	CC		21	PS	21
Logarzo, G. A.	3862	A NEW SPECIES OF LEIOPHRON (HYMENOPTERA: BRACONIDAE) FROM ARGENTINA	II	975	25/08/00	16:30	CC		21	PS	21
Loges, V.	268	EFFICIENCY OF METHODS FOR SAMPLING THRIPS ON ONION	I	68	23/08/00	16:30	CC		2	PS	2
Logrieco, A.	987	APHIDS: NOT ONLY A PEST INSECT	I	249	22/08/00	16:30	CC		6	PS	6
Loguercio, L. L.	3941	EFFECTS OF TROPICAL BACULOVIRUS ISOLATES AGAINST SPODOPTERA FRUGIPERDA (LEPIDOPTERA: NOCTUIDAE) LARVAE	II	995	21/08/00	16:30	CC		22	PS	22
Loguercio, L. L.	3967	ANALYSIS OF SUPERNATANTS FROM CULTURES OF 'B.t.' STRAINS CONTAINING VIP3A-LIKE GENES AND THEIR RELATIVE EFICIENCY IN THE CONTROL OF TROPICAL FALL ARMYWORM LARVAE	II	1001	23/08/00	16:30	CC		22	PS	22
Loguercio, L. L.	3968	TEMPORAL PATTERN OF PROTEIN SECRETION AND INSECTICIDAL ACTIVITY AGAINST TROPICAL FALL ARMYWORM IN THE SUPERNATANT OF THE 'B.t.' STRAIN 'HD125'	II	1001	23/08/00	16:30	CC		22	PS	22
Loguercio, L. L.	2158	EFFECT OF TREATMENT TIMING OF BACULOVIRUS SPODOPTERA AND BACILLUS THURINGIENSIS ON SPODOPTERA FRUGIPERDA	I	544	25/08/00	16:30	CC		11	PS	11
Loiácono, M. S.	1570	NEOTROPICAL MYRMECOPHILIC DIAPRIID WASPS ASSOCIATED WITH MYRMICINAE AND FORMICINAE ANTS (HYMENOPTERA, PROCTOTRUPOIDEA, DIAPRIIDAE)	I	396	23/08/00	16:30	CC		8	PS	8
Loiácono, M. S.	1571	THE TYPES OF ENCYRTIDAE (HYMENOPTERA, CHALCIDOIDEA) HOUSED IN THE MUSEO DE LA PLATA	I	396	23/08/00	16:30	CC		8	PS	8
Lola-Luz, D.	1573	INTERACTIONS BETWEEN THE APHID PARASITOID PRAON VOLUCRE AND THE PREDATOR COCCINELLA SEPTEMPUCTATA	I	397	23/08/00	16:30	CC		8	PS	8
Lomas, L. O.	4	ECDYSTEROID SYNTHESIS AND ACTION IN THE IXODID TICKS	I	1	24/08/00	15:05	HB	F	1	1	1
Lombarkia, N.	659	WHY METABOLITES PRESENT ON THE PLANT SURFACE HAVE TO BE CONSIDERED IN HOST SELECTION : APPLICATION TO TWO LEPIDOPTERA OVIPOSITION	I	167	22/08/00	16:30	CC		4	PS	4
Lombarkia, N.	2738	IDENTIFICATION WITHIN A BLEND OF THE ACTIVITY OF APPLE TREE ORGAN SURFACES METABOLITES ON CYDIA POMONELLA.(LEPIDOPTERA, TORTRICIDAE) OVIPOSITION	II	691	23/08/00	16:30	CC		14	PS	14
Lonergan, G. C.	3873	DISRUPTION OF MATING IN SPARGANOTHIS FRUITWORM (TORTRICIDAE) IN CRANBERRIES	II	978	21/08/00	13:30	HB	H	22	1	22
Long, R. F.	269	EGYPTIAN ALFALFA WEEVIL (HYPERA BRUNNEIPENNIS) CONTROL AND WATER QUALITY	I	68	23/08/00	16:30	CC		2	PS	2
Longino, J. T.	3580	ESTIMATING THE ARBOREAL COMPONENT OF THE ANT COMMUNITY (HYMENOPTERA: FORMICIDAE) IN A COSTA RICAN RAINFOREST	II	903	24/08/00	11:35	Bol	U	20	2	20
Longo, S.	331	SCALE INSECTS OF CITRUS IN ITALY (HOMOPTERA COCCOIDEA)	I	84	24/08/00	16:30	CC		2	PS	2
Longo, S.	1487	STATUS OF BIOLOGICAL CONTROL OF THE CITRUS LEAFMINER (PHYLLOCNISTIS CITRELLA) IN ITALY	I	375	21/08/00	16:30	CC		8	PS	8
Longstaff, B. C.	4036	MODELLING A NEW AND EFFECTIVE TOOL IN STORED PRODUCT PEST CONTROL	II	1019	23/08/00	13:35	HB	J	23	7	23
Lonneborg, A.	1364	RESISTANCE IN NORWAY SPRUCE AGAINST THE GREEN SPRUCE APHID	I	344	23/08/00	16:30	CC		7	PS	7
Loof, A. De	3250	TESTIS ECDYSIOTROPIN, AN INSECT GONADOTROPIN THAT INDUCES SYNTHESIS OF ECDYSTEROID	II	821	21/08/00	9:50	HB	K	18	1	18
Loof, A. De	3249	MALE-FEMALE DIFFERENCES IN NEUROPEPTIDE PROFILES IN LOCUSTS	II	821	21/08/00	9:35	HB	K	18	1	18
Loof, A. De	2344	DIFFERENTIAL ACTIVATION OF AN INSECT G PROTEIN-COUPLED PEPTIDE RECEPTOR BY INSECTATACHYKININ-LIKE AGONISTS	II	592	21/08/00	14:35	HB	I	13	2	13
Loof, A. De	3261	ANGIOTENSIN CONVERTING ENZYME-LIKE ACTIVITY IN THE FLESHFLY NEOBELLIERIA BULLATA	II	824	21/08/00	16:15	HB	K	18	1	18

Sub-titles: (HB=Hotel Bourbon) - (HM=Hotel Mabu) - (CC=Convention Center) - (Bol=Foz Boulevard) - (PS=Poster Session) - (PL=Plenary Lecturer)

AUTHOR	Nº	TITLE	Book	Page	Date	Time	Local	Room	Session	Symp	New Session
Loof, A. De	2528	INSECT G PROTEIN-COUPLED RECEPTORS AND SIGNAL TRANSDUCTION	II	638	25/08/00	16:30	CC		13	PS	13
Loof, A. De	2529	INSECT G PROTEIN-COUPLED RECEPTORS AND SIGNAL TRANSDUCTION	II	639	25/08/00	16:30	CC		13	PS	13
Loof, A. De	3258	NEUROPEPTIDES IN LOCUSTS: PROGRESS IN THE SEARCH FOR FUNCTIONS	II	823	21/08/00	15:00	HB	K	18	1	18
Loof, A. De	2259	MOLECULAR CLONING OF NEUROPARSIN PRECURSOR cDNAs IN THE DESERT LOCUST SCHISTOCERCA GREGARIA	I	570	22/08/00	16:30	CC		12	PS	12
Loof, A. De	2447	MOLECULAR CLONING OF NEUROPARSIN PRECURSOR CDNAS IN THE DESERT LOCUST SCHISTOCERCA GREGARIA	II	618	25/08/00	16:30	CC		13	PS	13
Loof, A. De	2321	THE 4-kDa PROTEASE INHIBITOR FAMILY IN THE DESERT LOCUST SCHISTOCERCA GREGARIA: MOLECULAR CLONING AND ANALYSIS OF TISSUE- AND STAGE-DEPENDENT EXPRESSION	I	586	23/08/00	16:30	CC		12	PS	12
Loof, A. De	2509	THE 4-KDA PROTEASE INHIBITOR FAMILY IN THE DESERT LOCUST SCHISTOCERCA GREGARIA: MOLECULAR CLONING AND ANALYSIS OF TISSUE- AND STAGE-DEPENDENT EXPRESSION	II	634	24/08/00	16:30	CC		13	PS	13
Lopes, A.R.	2459	EVOLUTION OF TRYPSIN SPECIFICITY IN INSECTS	II	621	23/08/00	16:30	CC		13	PS	13
Lopes, D. K.	2959	ANOPHELES GAMBIAE MIDGUT MICROVILLI: EFFECTS OF INDUCED IMMUNITY ON LONGEVITY, FERTILITY AND TRANSMISSION OF MALARIA	II	747	21/08/00	16:30	CC		15	PS	15
Lopes, E. T.	1938	SPATIAL DISTRIBUTION OF NESTS OF THE LEAF CUTTING ANT ATTA SEXDENS RUBROPILOSA (HYMENOPTERA: FORMICIDAE) IN PLANTATIONS OF EUCALYPTUS UROPHYLLA IN BRAZIL	I	488	23/08/00	16:30	CC		10	PS	10
Lopes, E. T.	1985	LEPIDOPTERAN COLLECTED IN AN EUCALYPTUS PLANTATION IN GOIÁS, BRAZIL, FROM MAY 1995 TO APRIL 1996 - EFFECT OF TEMPERATURE AND RAINFALL ON POPULATION DYNAMICS	I	500	25/08/00	16:30	CC		10	PS	10
Lopes, J.	4115	CULEX SALTANENSIS EGG AND IMMATURE MORPHOMETRICS OBTAINED IN LABORATORY AND FIELD	II	1039	25/08/00	16:30	CC		23	PS	23
Lopes, J. F. S.	3513	EFFECT OF TOXIC-BAITS ON THE ANT COMMUNITY STRUCTURE IN AN AREA OF EUCALYPTUS SPP. PLANTATION	II	887	23/08/00	16:30	CC		19	PS	19
Lopes, J. F. S.	3514	EFFECTS OF TOXIC BAITS ON NON-TARGET ANT SPECIES	II	887	23/08/00	16:30	CC		19	PS	19
Lopes, J. R. S.	3209	VECTOR AND EPIDEMIOLOGICAL ASPECTS OF CITRUS VARIEGATED CHLOROSIS	II	810	21/08/00	15:50	Bol	U	17	1	17
Lopes, J. R. S.	3157	OVIPOSITION PATTERNS OF PROCONIINI SHARPSHOOTERS (CICADELLIDAE: CICADELLINAE) IN CITRUS	II	796	23/08/00	16:30	CC		16	PS	16
Lopes, J. R. S.	3732	TAXONOMIC STATUS AND NOTES ON BIOLOGY OF ACROGONIA FROM CITRUS: ACROGONIA TERMINALIS OR A NEW SPECIES?	II	942	21/08/00	16:30	CC		21	PS	21
Lopes, J. R. S.	3234	MIGRATION AS A STRATEGY FOR SURVIVAL OF DALBULUS MAIDIS (HEMIPTERA: CICADELLIDAE) DURING CORN OVERSEASON IN CENTRAL BRAZIL	II	816	23/08/00	16:30	CC		17	PS	17
Lopes, L.M.X.	1081	NUTRITIONAL AND BIOLOGICAL ASPECTS OF VELVETBEAN CATERPILLAR ON SOYBEAN GENOTYPES WITH AND WITHOUT INJURY	I	273	23/08/00	16:30	CC		6	PS	6
Lopes, L.M.X.	1082	VELVETBEAN CATERPILLARS PREFERENCE TO SOYBEAN GENOTYPES WITH AND WITHOUT INJURY	I	273	23/08/00	16:30	CC		6	PS	6
Lopes, M. T. R.	2739	ENVIRONMENT PROTECTION THROUGH RESISTANT POTATO: RESEARCH, EDUCATION AND DELIVERING INFORMATION IN BRAZIL	II	692	23/08/00	16:30	CC		14	PS	14
Lopes, M. V. F.	3238	THE USE OF LEAF DISC LOCAL LESION TEST ON THE STUDY OF PLANT VIRUS TRANSMISSION	II	817	24/08/00	16:30	CC		17	PS	17
Lopes, N. P.	726	SAPONINS IN THREE ALFALFA (MEDICAGO SATIVA) VARIETIES AND THEIR RELATION TO APHID RESISTANCE	I	183	25/08/00	16:30	CC		4	PS	4
Lopes, R. B.	270	OCCURENCE OF THRIPS ON NIAGARA TABLE GRAPE AND ITS CONTROL WITH THE INSECTICIDES THIACLOPRID AND METHIOCARB ASSOCIATED WITH METARHIZIUM ANISOPLIAE	I	69	23/08/00	16:30	CC		2	PS	2
Lopes-Andrade, C.	365	SCARABAEIDAE S. STR. (COLEOPTERA: SCARABAEOIDEA) FROM VIÇOSA, MINAS GERAIS STATE, BRAZIL	I	92	25/08/00	16:30	CC		2	PS	2
Lopez, A.	1939	APPLICATION OF A GEOGRAPHICAL INFORMATION SYSTEM TO THE STUDY OF SIREX NOCTILIO (HYMENOPTERA-SIRICIDAE) IN CALAMUCHITA VALLEY, CÓRDOBA, ARGENTINA	I	489	23/08/00	16:30	CC		10	PS	10
López, A. D.	1381	RESISTANCE MECHANISMS IN ANOPHELES ALBIMANUS DURING A LARGE-SCALE FIELD TRIAL USING A SINGLE INSECTICIDE, ROTATION AND MOSAIC STRATEGIES IN MEXICO	I	348	24/08/00	16:30	CC		7	PS	7
López, E.	3154	MORPHOMETRIC DIFFERENCES OF TRIATOMA INFESTANS FROM THE EASTERN AND WESTERN REGIONS OF PARAGUAY	II	796	23/08/00	16:30	CC		16	PS	16
López, E.	2958	ISOENZYMATIC CHARACTERIZATION OF TRIATOMA INFESTANS POPULATIONS FROM EASTERN AND WESTERN REGIONS OF PARAGUAY	II	746	21/08/00	16:30	CC		15	PS	15
López, S. N.	1689	BIOLOGICAL STUDIES ON ENCARSIA PORTERI (HYMENOPTERA: APHELINIDAE)	I	426	22/08/00	16:30	CC		8	PS	8
López, S. N.	2852	BIOLOGICAL STUDIES ON THE ARG1 BIOTYPE OF THE BEMISIA TABACI COMPLEX (HEMIPTERA: ALEYRODIDAE)	II	720	25/08/00	16:30	CC		14	PS	14
López, Y.	246	LIPOLYTIC AND PROTEOLYTIC ACTIVITY OF BEAUVERIA BASSIANA AND METARHIZIUM ANISOPLIAE AND THEIR RELATIONSHIP WITH PATHOGENICITY TO HYPOTHENEMUS HAMPEI	I	63	22/08/00	16:30	CC		2	PS	2
López, Y.	26	STUDIES ON INFECTION MECHANISMS OF THE FUNGI BEAUVERIA BASSIANA AND METARHIZIUM ANISOPLIAE ON HYPOTHENEMUS HAMPEI USING FLUORESCENCE MICROSCOPY AND SCANNING ELECTRON MICROSCOPY	I	7	23/08/00	16:30	CC		1	PS	1
López-Olguín, J. F.	2460	ANTIFEEDANT ACTIVITY AND POST-INGESTIVE EFFECT OF TERPENOIDS ISOLATED FROM TRICHILIA HAVANENSIS AND SCUTELLARIA ALPINA ON COLORADO POTATO BEETLE LARVAE	II	621	25/08/00	16:30	CC		13	PS	13
López-Portillo, J.	960	SEEDLINGS AS EPHEMERAL UNDERSTORY IN MANGROVES : IMPACT OF HERBIVORES AND WATER LEVEL ON SEEDLING SURVIVAL	I	242	22/08/00	16:30	CC		6	PS	6
López-Vaamonde, C.	3916	ASSESSING HOST RANGE OF A GYPSY MOTH PARASITOID: APHANTORHAPHOPSIS SAMARENSIS (DIPTERA: TACHINIDAE)	II	988	25/08/00	14:00	HB	H	22	7	22
Lord, J. C.	1991	MICROBIAL CONTROL: DREAM OR REALITY FUNGI: ADVANCEMENTS AND SUCCESSES	I	502	21/08/00	11:05	HM	P	11	1	11
Lord, W. D.	2952	EFFECTS OF HANGING AND BURNING ON DECOMPOSITION PATTERNS AND ARTHROPOD INVASION OF REMAINS	II	745	26/08/00	14:30	Bol	R	15	11	15
Lorenz, G. M.	271	DEVELOPMENT OF AN EXTENSION-BASED SAMPLING SERVICE FOR COTTON APHID FUNGUS, NEOZYGITES FRESENII	I	69	23/08/00	16:30	CC		2	PS	2
Lorenz, G. M.	257	FACTORS AFFECTING COTTON BOLL WEEVIL SURVIVAL IN VARIOUS OVERWINTERING HABITAT IN THE MIDDLE SOUTH REGION OF THE UNITED STATES	I	65	23/08/00	16:30	CC		2	PS	2
Lorenz, J. I.	3340	A FACTOR FROM THE CRICKET TESTIS THAT INHIBITS OVARIAN ECDYSTEROID BIOSYNTHESIS	II	843	22/08/00	16:30	CC		18	PS	18
Lorenz, M. W.	2453	HORMONAL REGULATION OF FLIGHT METABOLISM IN A MIGRATORY BUTTERFLY, VANESSA CARDUI (LEPIDOPTERA: NYMPHALIDAE)	II	620	23/08/00	16:30	CC		13	PS	13
Lorenz, M. W.	2492	JUVENILE HORMONE BIOSYNTHESIS AND REGULATION OF VITELLOGENESIS IN THE FALL ARMYWORM, SPODOPTERA FRUGIPERDA (LEPIDOPTERA: NOCTUIDAE)	II	629	24/08/00	16:30	CC		13	PS	13
Lorenz, M. W.	3255	ALLATOSTATINS: DIVERSITY IN STRUCTURES, FUNCTIONS, AND OCCURRENCE	II	822	21/08/00	13:30	HB	K	18	1	18
Lorenz, M. W.	3339	THE FIRST ADIPOKINETIC HORMONE ISOLATED FROM A DERMAPTERAN INSECT	II	843	22/08/00	16:30	CC		18	PS	18
Lorenz, M. W.	3340	A FACTOR FROM THE CRICKET TESTIS THAT INHIBITS OVARIAN ECDYSTEROID BIOSYNTHESIS	II	843	22/08/00	16:30	CC		18	PS	18
Lorenzini, D.	2351	GOMESIN, AN ANTIMICROBIAL PEPTIDE OF THE SPIDER HEMOCYTES: SPECTRUM OF ACTIVITY AND cDNA CLONING	II	594	23/08/00	10:05	HB	I	13	4	13

Sub-titles: (HB=Hotel Bourbon) - (HM=Hotel Mabu) - (CC=Convention Center) - (Bol=Foz Boulevard) - (PS=Poster Session) - (PL=Plenary Lecturer)

AUTHOR	Nº	TITLE	Book	Page	Date	Time	Local	Room	Session	Symp	New Session
Lorenzini, D.	4154	GOMESIN, AN ANTIMICROBIAL PEPTIDE OF THE SPIDER HEMOCYTES: SPECTRUM OF ACTIVITY AND cDNA CLONING	II	1049	21/08/00	16:30	CC		Erratum	PS	13
Lorenzo Figueiras, A. N.	718	INTERACTION BETWEEN VISUAL AND OLFACTORY CUES IN THE ASSEMBLING BEHAVIOUR OF THE HAEMATOPHAGOUS BUG TRIATOMA INFESTANS	I	181	24/08/00	16:30	CC		4	PS	4
Lorenzo, M. G.	620	CHEMICAL ECOLOGY OF TRIATOMINAE	I	157	25/08/00	10:05	Bol	S	4	7	4
Lorini, H.	915	DOES GALLING AND FOLIVOROUS INSECTS SUPPORT THE RESOURCE CONCENTRATION HYPOTHESIS? THE CASE OF SCHINUS POLYGAMUS (ANACARDIACEAE)	I	231	21/08/00	16:30	CC		6	PS	6
Lorini, I.	4059	STORED GRAIN PESTS RESISTANCE TO PESTICIDES IN BRAZIL: EVOLUTION AND FUTURE	II	1025	25/08/00	11:15	HB	J	23	10	23
Lorini, L. M.	4087	INCUBATION PERIOD AND EGGS VIABILITY OF LONOMIA OBLIQUA WALKER, 1855 (LEPIDOPTERA; SATURNIIDAE) IN LABORATORY	II	1032	23/08/00	16:30	CC		23	PS	23
Lorio, P. L.	1930	INTERACTIONS BETWEEN BEETLE ATTACK RATE AND PINE TREE DEFENSES PRODUCE POSITIVE DENSITY DEPENDENCE IN DENDROCTONUS FRONTALIS	I	486	22/08/00	16:30	CC		10	PS	10
Losey, J. E.	864	PREDATORS, PARASITOIDS, PATHOGENS, AND POLYMORPHISM: ECOLOGICAL INTERACTIONS AND EVOLUTION IN AN AGROECOSYSTEM	I	218	25/08/00	15:05	HB	D	6	8	6
Lou, Y.	1572	HOW THE EFFICIENCY OF A PREDATOR VARIES WITH RICE VARIETY: FORAGING BEHAVIOR, POPULATION INCREASE AND FUNCTIONAL RESPONSE+B201	I	396	23/08/00	16:30	CC		8	PS	8
Loudon, C.	576	AIR FLOW THROUGH PECTINATE INSECT ANTENNAE AND ODORANT INTERCEPTION RATES	I	146	21/08/00	10:00	Bol	S	4	1	4
Loukeris, T.	2918	STABLE TRANSFORMATION OF ANOPHELINE MOSQUITOES WITH THE MINOS TRANSPOSABLE ELEMENT FROM DROSOPHILA HYDEI	II	736	24/08/00	15:35	Bol	R	15	8	15
Loureiro, E. S.	2629	EFFECT OF PHYSIOLOGICAL PRODUCTS ON ADULTS OF ANTICARSIA GEMMATALIS	II	664	22/08/00	16:30	CC		14	PS	14
Loureiro, E. S.	3318	EFFECT OF THE TEMPERATURE AND LIGHT REGIME ON THE PRODUCTION AND STORAGE OF SPOROTHRIX INSECTORUM	II	838	23/08/00	16:30	CC		18	PS	18
Lourenção, A. L.	2740	RESISTANCE OF STRAWBERRIES TO TETRANYCHUS URTICAE (ACARI: TETRANYCHIDAE)	II	692	23/08/00	16:30	CC		14	PS	14
Lourenção, A. L.	2846	EFFECT OF INSECTICIDES ON NYMPHS OF BEMISIA TABACI B BIOTYPE	II	718	25/08/00	16:30	CC		14	PS	14
Louw, C. E.	2741	THE BLACK COTTON BEETLE, SYAGRUS RUGIFRONS BALY (CHRYSOMELIDAE: COLEOPTERA): ITS IMPACT ON COTTON PRODUCTION IN SOUTH AFRICA AND PROBLEMS PERTAINING TO INTEGRATED PEST MANAGEMENT	II	692	23/08/00	16:30	CC		14	PS	14
Louw, E.	3944	TRANSGENIC COTTON COTTON, AN ALTERNATIVE TO CONVENTIONAL (NON-TRANSGENIC) COTTON FOR SOUTH AFRICA	II	995	21/08/00	16:30	CC		22	PS	22
Louw, S. vdM.	450	BIODIVERSITY MEASUREMENT: THE SOUTH AFRICAN GRASSLAND INSECT EXAMPLE	I	114	26/08/00	11:20	HB	C	3	9	3
Louw, S. vdM.	3604	PISTACHIO NUT CULTIVATION IN AN ATYPICAL ENVIRONMENT – PATTERN AND PROCESS IN PEST AND DISEASE PREDICTION	II	909	24/08/00	16:30	CC		20	PS	20
Louw, S. vdM.	3625	WEEVILS AS VECTORS OF PLANT PATHOGENS: A CASE STUDY ON AMARANTH IN SOUTH AFRICA	II	915	21/08/00	15:50	HB	E	21	2	21
Louzada, J. N. C.	365	SCARABAEIDAE S. STR. (COLEOPTERA: SCARABAEOIDEA) FROM VIÇOSA, MINAS GERAIS STATE, BRAZIL	I	92	25/08/00	16:30	CC		2	PS	2
Lovei, G. L.	1246	EFFECTS OF TRANSGENIC PLANTS ALONG THE FOOD CHAIN: CAN THEORY HELP?	I	315	23/08/00	11:05	HM	N	7	5	7
Lovei, G. L.	1573	INTERACTIONS BETWEEN THE APHID PARASITOID PRAON VOLUCRE AND THE PREDATOR COCCINELLA SEPTEMPUCTATA	I	397	23/08/00	16:30	CC		8	PS	8
Lovrin•evi•, I.	324	BT CORN IN CONTROLING ECB IN CROATIA.	I	82	24/08/00	16:30	CC		2	PS	2
Lowenberger, C.	2354	THE ROLE OF INNATE IMMUNE PEPTIDES TO REDUCE PARASITE DEVELOPMENT IN AEDES AEGYPTI	II	595	23/08/00	11:05	HB	I	13	4	13
Loxdale, H. D.	818	MOVEMENT OF APHID PARASITOIDS OVER DIFFERENT SPATIAL SCALES STUDIED USING MOLECULAR MARKERS	I	207	22/08/00	11:35	HB	D	6	3	6
Loxdale, H. D.	147	STUDIES OF APHID MIGRATION USING MICROSATELLITE MARKERS	I	38	25/08/00	14:15	HB	A	2	9	2
Lu, B.	2920	STUDIES OF WOLBACHIA IN CULEX PIPIENS COMPLEX IN CHINA	II	737	25/08/00	9:35	Bol	R	15	9	15
Lu, B.	2921	STUDIES ON THE POSSIBILITY OF TRANSMISSION OF DENGUE VIRUS BY CULEX PIPIENS QUINQUEFASCIATUS IN LABORATORY	II	737	25/08/00	9:50	Bol	R	15	9	15
Lu, B.	4048	THE INFORMATION OF URBAN MEDICAL INSECTS MANAGEMENT SYSTEM	II	1022	24/08/00	11:00	HB	J	23	8	23
Lu, D.	3048	DEVELOPMENTAL REGULATION AND FUNCTIONS FOR FLRFAMIDE PEPTIDES IN MANDUCA SEXTA	II	769	22/08/00	11:35	HB	G	16	2	16
Lu, F.	602	MOLECULAR STUDIES ON THE ENDOCRINE REGULATION AND TISSUE LOCALIZATION OF DE NOVO MONOTERPENOID PHEROMONE COMPONENT BIOSYNTHESIS IN PINE BARK BEETLES	I	152	23/08/00	11:25	Bol	S	4	4	4
Lu, H.	2822	A STUDY ON LIRIMYZA SATIVAE	II	712	25/08/00	16:30	CC		14	PS	14
Lu, L.	2921	STUDIES ON THE POSSIBILITY OF TRANSMISSION OF DENGUE VIRUS BY CULEX PIPIENS QUINQUEFASCIATUS IN LABORATORY	II	737	25/08/00	9:50	Bol	R	15	9	15
Lucas, B. V.	1356	AGRONOMIC EFFICIENCY OF NEW MOLECULES FOR CONTROL OF THE FIELD BEAN WHITE FLY	I	342	23/08/00	16:30	CC		7	PS	7
Lucas, B. V.	1357	AGRONOMIC EFFICIENCY OF THE INSECTICIDE THIAMETHOXAN FOR CONTROL OF THE PINEAPPLE MEALYBUG AND THE TERMITE	I	342	23/08/00	16:30	CC		7	PS	7
Lucas, B. V.	1358	AGRONOMIC EFFICIENCY OF NEW MITICIDES FOR CONTROL OF THE COFFEE LEPROSIS	I	343	23/08/00	16:30	CC		7	PS	7
Lucas, M. B.	1356	AGRONOMIC EFFICIENCY OF NEW MOLECULES FOR CONTROL OF THE FIELD BEAN WHITE FLY	I	342	23/08/00	16:30	CC		7	PS	7
Lucas, M. B.	1357	AGRONOMIC EFFICIENCY OF THE INSECTICIDE THIAMETHOXAN FOR CONTROL OF THE PINEAPPLE MEALYBUG AND THE TERMITE	I	342	23/08/00	16:30	CC		7	PS	7
Lucas, M. B.	1358	AGRONOMIC EFFICIENCY OF NEW MITICIDES FOR CONTROL OF THE COFFEE LEPROSIS	I	343	23/08/00	16:30	CC		7	PS	7
Lucas, W. J.	3214	DO GEMINIVIRUSES LEAD A DUAL LIFE STYLE: MOVEMENT WITHIN THE PLANT VS. PLANT-TO-PLANT	II	811	22/08/00	15:00	Bol	U	17	2	17
Lucchese, M. E. de P.	3478	EPIGEIC ANT FAUNA OF AREAS WITH HIGH COPPER CONCENTRATION	II	878	22/08/00	16:30	CC		19	PS	19
Lucchini, F.	1676	NON-SUITABILITY OF THE BRAZILIAN SUGARCANE BORER, DIATRAEA SACCHARALIS, (LEPIDOPTERA: PYRALIDAE) AS A HOST FOR PEDIOBIUS FURVUS (HYMENOPTERA: EULOPHIDAE)	I	422	25/08/00	16:30	CC		8	PS	8
Lucchini, F.	1675	TEN YEARS OF INTERNATIONAL EXCHANGE AND QUARANTINE OF BENEFICIAL ORGANISMS BY THE BRAZILIAN QUARANTINE LABORATORY FOR BIOLOGICAL CONTROL	I	422	25/08/00	16:30	CC		8	PS	8
Luchen, S. W. S.	47	TETRANYCHUS EVANSI – A NEW CHALLENGE TO SMALL-HOLDER TOMATO GROWERS IN SOUTHERN AFRICA	I	12	23/08/00	16:30	CC		1	PS	1
Luciáñez, M. J.	4077	PARSIMONY ANALYSIS OF ENDEMICITY AND ITS APPLICATION TO DETECT HIGH ENDEMISM AREAS USING COMBINED DATA FROM INSECTS, VERTEBRATES, AND PLANTS, FROM THE IBERIAN PENINSULA	II	1029	21/08/00	16:30	CC		23	PS	23
Luck, R. F.	1552	EFFECT OF TEMPORARY HOST DEPRIVATION ON THE REPRODUCTION AND SURVIVAL OF WOLBACHIA-INFECTED AND UNINFECTED TRICHOGRAMMA KAYKAI PINTO AND STOUTHAMER (HYMENOPTERA: TRICHOGRAMMATIDAE)	I	391	22/08/00	16:30	CC		8	PS	8
Luck, R. F.	1553	SUPERPARASITISM IN ARRHENOTOKOUS AND THELYTOKOUS Trichogramma kaykai PINTO AND STOUTHAMER (HYMENOPTERA: TRICHOGRAMMATIDAE)	I	392	22/08/00	16:30	CC		8	PS	8
Ludueña Almeida, F.	1328	INSECTICIDE AND REPELLENT EFFECTS OF MELIA AZEDARACH EXTRACTS AGAINST AEDES AEGYPTI (DIPTERA: CULICIDAE)	I	335	22/08/00	16:30	CC		7	PS	7

Sub-titles: (HB=Hotel Bourbon) - (HM=Hotel Mabu) - (CC=Convention Center) - (Bol=Foz Boulevard) - (PS=Poster Session) - (PL=Plenary Lecturer)

AUTHOR	Nº	TITLE	Book	Page	Date	Time	Local	Room	Session	Symp	New Session
Ludwig, M. Z.	3291	EVOLUTION OF ANTEROPOSTERIOR AXIS FORMATION IN INSECTS: THE ROLE OF HUNCHBACK AND NANOS IN THE GRASSHOPPER	II	831	24/08/00	9:35	HB	K	18	6	18
Ludwig, M. Z.	3066	EVOLUTION OF ANTEROPOSTERIOR AXIS FORMATION IN INSECTS: THE ROLE OF HUNCHBACK AND NANOS IN THE GRASSHOPPER	II	774	21/08/00	16:30	CC		16	PS	16
Luebke-Al Hussein, L.	3999	ECOLOGICAL STUDIES ACCOMPANYING THE CULTIVATION OF TRANSGENIC RAPE AND MAIZE IN THURINGIA (GERMANY)	II	1009	25/08/00	16:30	CC		22	PS	22
Luft, E.	3816	PHYLOGENETIC STUDIES OF THE SUBFAMILY ERIOPINAE (LEPIDOPTERA: NOCTUIDAE): FIRST RESULTS	II	963	24/08/00	16:30	CC		21	PS	21
Luft, P.	3970	A HIGHLY INTEGRATED MONITORING SYSTEM TO SUPPORT ON-TIME, ON-LINE DECISION-MAKING IN AGRICULTURE	II	1002	24/08/00	16:30	CC		22	PS	22
Luhman, J. C.	3969	PUBLIC EDUCATION AND DEMONSTRATION OF BIOLOGICAL CONTROL PRINCIPLES IN INDOOR PLANTSCAPES IN MINNESOTA, U.S.A.	II	1002	23/08/00	16:30	CC		22	PS	22
Luhman, J. C.	1666	BIOLOGICAL CONTROL AGENTS: IMPLICATIONS IN HOME AND INTERIOR PLANTSCAPES	I	420	25/08/00	16:30	CC		8	PS	8
Luhring, K.	1891	DIFFERENTIAL PARASITISM BY AN EGG PARASITOID, AVETIANELLA LONGOI, OF TWO PHORACANTHA SPP. ATTACKING EUCALYPTUS	I	477	26/08/00	14:50	HB	M	10	10	10
Luis-Martinez, A.	456	BIODIVERSITY OF PAPILIONOIDEA FROM MEXICO	I	116	26/08/00	14:35	HB	C	3	10	3
Lukasik, I.	690	BIOCHEMICAL ADAPTATION OF BIRD CHERRY-OAT APHID TO PLANT PHENOLICS	I	174	23/08/00	16:30	CC		4	PS	4
Luke, A.	2635	DEVELOPMENT OF A METHOD OF RISK ASSESSMENT TO FACILITATE INTEGRATED MANAGEMENT OF SPOTTED WILT DISEASE OF PEANUT IN GEORGIA	II	666	22/08/00	16:30	CC		14	PS	14
Lumaret, J. -P.	3675	DUNG BEETLE COMMUNITIES IN MOUNTAIN SYSTEMS (COLEOPTERA: SCARABAEIDAE)	II	928	24/08/00	15:35	HB	E	21	7	21
Lumbo, S. G.	3984	ACCELERATING ADOPTION OF AGRICULTURAL RECOMMENDATIONS THROUGH PARTNERSHIPS BETWEEN GOs, NGOs, And Pos	II	1005	24/08/00	16:30	CC		22	PS	22
Luna, M. G.	272	COMPARATIVE PARASITOID GUILD ANALYSIS OF RACHIPLUSIA NU (LEPIDOPTERA: NOCTUIDAE) LARVAE IN DIFFERENT PLANT HABITATS	I	69	23/08/00	16:30	CC		2	PS	2
Lung, O.	3300	CONTROL OF DROSOPHILA REPRODUCTION BY MALE-DERIVED PROTEINS IN THE SEMINAL FLUID	II	833	25/08/00	13:35	HB	K	18	7	18
Lunke, M.	3304	GENE REGULATION DURING OVARIAN DEVELOPMENT IN THE SILKMOTH	II	834	25/08/00	15:35	HB	K	18	7	18
Lunz, A. M.	1049	DETERMINATION OF THE INFLUENCE OF THE MATURITY OF THE LEAVES OF CLITORIA FAIRCHILDIANA IN THE DEVELOPMENT OF URBANUS ACAWOIOS (LEPIDOPTERA: HESPERIIDAE)	I	265	23/08/00	16:30	CC		6	PS	6
Lunz, A. M.	1940	ANALYSIS OF THE DEGRADATION OF THE WOOD OF SIX FOREST SPECIES FOR SCOLYTIDAE (COLEOPTERA)	I	489	24/08/00	16:30	CC		10	PS	10
Lunz, A. M.	3533	INFESTATION OF TERMITES IN EUCALYPTUS SP. AT THE "UNIVERSIDADE FEDERAL RURAL DO RIO DE JANEIRO"	II	891	25/08/00	16:30	CC		19	PS	19
Lunz, A. M.	2055	EVALUATION OF THE EFFICIENCY OF BACILLUS THURINGIENSIS IN THE CONTROL OF URBANUS ACAWOIOS (LEPIDOPTERA: HESPERIIDAE)	I	518	21/08/00	16:30	CC		11	PS	11
Lunz, A. M.	3359	BIOLOGY OF URBANUS ACAWOIOS (LEPIDOPTERA, HESPERIIDAE) IN LABORATORY	II	848	23/08/00	16:30	CC		18	PS	18
Lunz, A. M.	1906	ANALYSIS OF THE DAMAGES CAUSED FOR ONCIDERES SAGA (COLEOPTERA: CERAMBYCIDAE) IN A FORESTRY REMNANT IN THE CAMPUS OF UFRRJ, BRASIL	I	480	21/08/00	16:30	CC		10	PS	10
Lunz, A. M.	1964	OCCURRENCE OF WOOD BORING BEETLES IN THE NATIONAL FOREST MÁRIO XAVIER, RJ, BRASIL	I	495	21/08/00	16:30	CC		10	PS	10
Lunz, A. M.	1965	WOOD BORING BEETLES IN PLANTATION OF SAPUCAIA, LECYTHIS PISONIS (LECYTHIDACEAE), IN THE NATIONAL FOREST MÁRIO XAVIER, SEROPÉDICA, RJ, BRASIL	I	495	24/08/00	16:30	CC		10	PS	10
Lunz, A. M.	1907	OCCURRENCE AND DAMAGES CAUSED FOR ONCIDERES SAGA (COLEOPTERA: CERAMBYCIDAE) IN ARBORIZATION	I	481	21/08/00	16:30	CC		10	PS	10
Luo, C.	1574	STUDIES ON THE KAIROMONE INFLUENCING PARASITE OF TRICHOGRAMMA OSTRINIAE ON ARTIFICIAL EGGS	I	397	23/08/00	16:30	CC		8	PS	8
Luong-Skovmand, M. H.	1042	DEFORESTATION, DROUGHT AND EXCEPTIONAL OUTBREAKS OF THE ORIENTAL MIGRATORY LOCUST, LOCUSTA MIGRATORIA MANILENSIS (MEYEN 1835) IN INDONESIA	I	263	23/08/00	16:30	CC		6	PS	6
Lupetti, P.	3098	THE GIANT SPERM AXONEME OF THE GALL-MIDGE FLY ASPHONDYLIA RUEBSAAMENI KERTESZ: FINE STRUCTURE AND DEVELOPMENT	II	782	26/08/00	13:45	HB	G	16	9	16
Lurie, S.	3902	HEAT TREATMENTS FOR DISINFESTATION: MINIMIZING DELETERIOUS EFFECTS ON TREATED COMMODITIES	II	985	24/08/00	9:35	HB	H	22	6	22
Lushai, G.	2274	MOLECULAR ANALYSIS OF THE EVOLUTIONARY DYNAMICS OF THE AFRICAN QUEEN BUTTERFLY DANAUS CHRYSIPPUS.	I	574	23/08/00	16:30	CC		12	PS	12
Lux, S.	1661	FRUIT FLY BIOLOGICAL CONTROL IN LATIN AMERICA: MINIMIZING THE RISKS POSED BY TEPHRITIDAE IN MEXICO AND CENTRAL AMERICA	I	419	25/08/00	16:30	CC		8	PS	8
Lux, S. A.	273	LIFE-TIME ACTIVITY BUDGET OF MANGO (MARULA) FRUIT FLY, CERATITIS COSYRA, AND ITS RESPONSE TO ATTRACTANTS	I	69	23/08/00	16:30	CC		2	PS	2
Luz, F.	1499	A FIRST APPROACH ON THE POTENTIAL ROLE OF DICYPHUS CERASTII WAGNER (HEMIPTERA: MIRIDAE), AS NATURAL CONTROL AGENT IN PORTUGUESE GREENHOUSES	I	378	21/08/00	16:30	CC		8	PS	8
Luz, F.	1619	FIRST APPROACH ON THE POTENTIAL ROLE OF DICYPHUS CERASTII WAGNER (HEMIPTERA: MIRIDAE), AS NATURAL CONTROL AGENT IN PORTUGUESE GREENHOUSES	I	408	25/08/00	16:30	CC		8	PS	8
Luz, F. J. F.	2764	OCCURRENCE OF GRASSHOPPER SCHISTOCERCA PALLENS, (ORTHOPTERA:ACRIDIDAE) IN RORAIMA, BRAZIL	II	698	25/08/00	16:30	CC		14	PS	14
Luzzardi, R.	2703	INFLUENCE OF LIBERTY LINK IRRIGATED RICE TECHNOLOGY ON ORYZOPHAGUS ORYZAE (COLEOPTERA: CURCULIONIDAE)	II	683	22/08/00	16:30	CC		14	PS	14
Ly, A.	3970	A HIGHLY INTEGRATED MONITORING SYSTEM TO SUPPORT ON-TIME, ON-LINE DECISION-MAKING IN AGRICULTURE	II	1002	24/08/00	16:30	CC		22	PS	22
Lyal, C. H. C.	3626	PHYLOGENY AND EVOLUTION OF DRYOPHTHORIDAE (COLEOPTERA: CURCULIONOIDEA)	II	916	21/08/00	16:05	HB	E	21	2	21
Lyal, C. H. C.	3790	ON THE GENERA OF THE ORIENTAL AND AUSTRALIAN CONODERINAE (ZYGOPINAE AUCTT) (COLEOPTERA: CURCULIONIDAE)	II	957	23/08/00	16:30	CC		21	PS	21
Lyal, C.H.C.	3621	A PHYLOGENY OF THE WEEVIL MAJOR GROUPS: MORPHOLOGICAL AND MOLECULAR EVIDENCE.	II	914	21/08/00	14:50	HB	E	21	2	21
Lykouressis, D. P.	1558	THE INFLUENCE OF CITRUS SPECIES ON THE PARASITIZATION OF APHIS GOSSYPII BY VARIOUS PARASITOIDS	I	393	22/08/00	16:30	CC		8	PS	8
Lykouressis, D. P.	1621	THERMAL REQUIREMENTS FOR DEVELOPMENT OF THE PREDATOR mACROLOPHUS PYGMAEUS (HEMIPTERA:MIRIDAE)	I	409	24/08/00	16:30	CC		8	PS	8
Lykouressis, D. P.	3227	NEW APHID VECTORS OF ZUCCHINI YELLOW MOSAIC VIRUS AND THEIR ROLE IN THE EPIDEMIOLOGY OF THE VIRUS IN GREECE	II	815	22/08/00	16:30	CC		17	PS	17
Lynn, D. E.	1554	DEVELOPMENT OF AN ARTIFICIAL DIET FOR REARING EDOVUM PUTTLERI, AN EGG PARASITOID OF THE COLORADO POTATO BEETLE, LEPTINOTARSA DECEMLINEATA	I	392	22/08/00	16:30	CC		8	PS	8
Lyons, D.	1929	AZADIRACHTIN FROM THE NEEM TREE: AN EFFECTIVE NATURAL PRODUCT FOR FOREST INSECT PEST MANAGEMENT	I	486	22/08/00	16:30	CC		10	PS	10
Lyra Netto, A. M. C. de	262	CONTROL OF DIABROTICA SPECIOSA (COLEOPTERA, CHRYSOMELIDAE) NA CULTURA DA BATATA	I	67	23/08/00	16:30	CC		2	PS	2
Lyytikäinen-Saarenmaa, P.	1872	GROWTH LOSSES AND ECONOMIC CONSEQUENCES OF PINE SAWFLY DEFOLIATION	I	472	25/08/00	11:35	HB	M	10	7	10

Sub-titles: (HB=Hotel Bourbon) - (HM=Hotel Mabu) - (CC=Convention Center) - (Bol=Foz Boulevard) - (PS=Poster Session) - (PL=Plenary Lecturer)

AUTHOR	Nº	TITLE	Book	Page	Date	Time	Local	Room	Session	Symp	New Session
M. Davidovich, M	3230	HYTOPLASMA-BEARING LEAFHOPPERS/PLANTHOPPERS, SUSPECTED TO BE VECTORS, IN VINEYARDS IN THE GOLAN HEIGHTS, ISRAEL	II	815	23/08/00	16:30	CC		17	PS	17
M. F. Whiting	3689	PHYLOGENY OF MECOPTERA AND SIPHONAPTERA: EVIDENCE FOR TWO NEW HOLOMETABOLOUS INSECT ORDERS	II	931	25/08/00	16:05	HB	E	21	8	21
M. Pizzi	1776	BIOETHOLOGY OF PHYLLOCNISTIS CITRELLA IN APULIA (SOUTH ITALY)	I	447	23/08/00	16:30	CC		9	PS	9
M. Tsukada	4117	NEW BIOMATERIALS FROM SILK PROTEINS IN THE MEDICAL FIELD	II	1040	25/08/00	10:05	HM	Q	24	1	24
M.B. Isman	594	PHYTOCHEMICAL PROSPECTING FOR INSECTICIDES:IMPROVING THE ODDS OF DISCOVERY	I	150	22/08/00	14:35	Bol	S	4	3	4
Ma, Y.	1505	THE OCCURRENCE OF LEAFMINERS AND THEIR PARASITOIDS ON VEGETABLE CROPS AND WEEDS IN SOUTHEAST CHINA	I	380	21/08/00	16:30	CC		8	PS	8
Maa, C. J. W.	692	TIME-DEPENDENT VARIATIONS IN ESTERASE 9B FREQUENCY AND MALATHION-RESISTANCE OF THE DIAMONDBACK MOTH (PLUTELLA XYLOSTELLA) IN TAIWAN	I	175	23/08/00	16:30	CC		4	PS	4
Maa, C.-J. W.	1359	TIME-DEPENDENT VARIATIONS IN ESTERASE 9b FREQUENCY AND MALATHION-RESISTANCE OF THE DIAMONDBACK MOTH (PLUTELLA XYLOSTELLA) IN TAIWAN	I	343	24/08/00	16:30	CC		7	PS	7
Maas, U.	3092	TESTIS DIFFERENTIATION - ROLE OF APICAL COMPLEX	II	780	26/08/00	10:00	HB	G	16	9	16
Maccari Jr, A.	2002	FUNDAMENTAL ISSUES THAT LIMIT SCALE UP OF FUNGAL BIOPESTICIDES USING SOLID STATE FERMENTATION PROCESSES	I	505	22/08/00	10:50	HM	P	11	3	11
Macedo, D. M.	2994	INFLUENCE OF DIFFERENT MIXTURES OF BOVINE FECES WITH SOME INGREDIENTS TO REAR STOMOXYS CALCITRANS UNDER LABORATORY CONDITIONS	II	755	21/08/00	16:30	CC		15	PS	15
Macedo, L. P. M.	1576	INFLUENCE OF TEMPERATURE ON THE WEIGHT OF LARVAE AND ADULTS OF CHRYSOPERLA EXTERNA (NEUROPTERA: CHRYSOPIDAE) FED ON SCHIZAPHIS GRAMINUM (HEMIPTERA: APHIDIDAE)	I	397	24/08/00	16:30	CC		8	PS	8
Macedo, M. V.	2742	ECOLOGICAL AND BIOLOGICAL STUDIES ON THE POLYMORPHIC SPECIES CHELYMORPHA CRIBRARIA (COL.: CHRYSOMELIDAE) IN RIO DE JANEIRO, BRAZIL	II	692	23/08/00	16:30	CC		14	PS	14
Macedo, M. V.	4132	POLYMORPHISM IN A CASSIDINAE SPECIES	II	1044	25/08/00	15:40	HM	P	24	2	24
Macedo, N.	201	CHEMICAL CONTROL OF MAHANARVA FIMBRIOLATA (HEMIPTERA-HOMOPTERA: CERCOPIDAE) IN SUGARCANE	I	51	21/08/00	16:30	CC		2	PS	2
Macedo, N.	1203	ADAPTIVE POTENTIAL OF THE SWEET-POTATO WHITEFLY BEMISIA ARGENTIFOLII TO SEVERAL HOST PLANTS	I	303	25/08/00	16:30	CC		6	PS	6
Macedo, N.	274	THIAMETHOXAM ON THE CONTROL OF SUGARCANE BORER DIATRAEA SACCHARALIS (LEP., CRAMBIDAE)	I	70	23/08/00	16:30	CC		2	PS	2
Macedo, N.	917	FORAGING ACTIVITY OF HETEROTERMES TENUIS (ISOPTERA: RHINOTERMITIDAE) IN SUGARCANE AREA ACCORDING TO YEAR SEASONS	I	232	21/08/00	16:30	CC		6	PS	6
Macedo, T. E.	2611	MANAGING HETEROPTERAN PESTS: FROM THEORY TO PRACTICAL IMPLEMENTATION	II	660	26/08/00	15:00	HB	B	14	9	14
Machado Neto, J. G.	535	SAFETY OF PROTECTIVE CLOTHING AND SEMI-CABIN FOR TRACTOR DRIVER APPLYING INSECTICIDES AND ACARICIDES BY TRACTOR-TRAILED AIR-CARRIED SPRAYER IN CITRUS (CITRUS SINENSIS)	I	135	24/08/00	16:30	CC		3	PS	3
Machado Neto, J. G.	1373	SAFETY OF TWO TRACTOR CABINS IN APPLICATION OF INSECTICIDE AND ACARICIDE BY TRACTOR-TRAILED AIR-CARRIED SPRAYER IN CITRUS (CITRUS SINENSIS)	I	346	25/08/00	16:30	CC		7	PS	7
Machado Neto, J. G.	1374	SAFETY OF PROTECTIVE CLOTHING AND SEMI-CABIN IN INSECTICIDES AND ACARICIDES APPLICATIONS BY TRACTOR-TRAILED HAND GUN SPRAYER IN CITRUS	I	347	25/08/00	16:30	CC		7	PS	7
Machado Neto, J. G.	2773	SAFETY OF PROTECTIVE CLOTHING AND SEMI-CABIN FOR TRACTOR DRIVER APPLYING INSECTICIDES AND ACARICIDES BY TRACTOR-TRAILED AIR-CARRIED SPRAYER IN CITRUS (CITRUS SINENSIS)	II	700	21/08/00	16:30	CC		14	PS	14
Machado, L. P. de B.	1777	HYBRID MALE STERILITY AND COURTSHIP ANALYSIS IN DROSOPHILA BUZZATII CLUSTER SPECIES (DIPTERA, DROSOPHILIDAE)	I	448	23/08/00	16:30	CC		9	PS	9
Machado, M. A.	3203	GENOME AND FUNCIONAL GENOMICS OF XYLELLA FASTIDIOSA	II	809	21/08/00	13:35	Bol	U	17	1	17
Machado, M. C.	1050	BIOECOLOGY OF URBANUS ACAWOIOS (LEPIDOPTERA, HESPERIIDAE) IN CLITORIA FAIRCHILDIANA IN CONTROLLED TEMPERATURE	I	265	22/08/00	16:30	CC		6	PS	6
Machado, M. C.	1906	ANALYSIS OF THE DAMAGES CAUSED FOR ONCIDERES SAGA (COLEOPTERA: CERAMBYCIDAE) IN A FORESTRY REMNANT IN THE CAMPUS OF UFRJ, BRASIL	I	480	21/08/00	16:30	CC		10	PS	10
Machado, M. C.	3359	BIOLOGY OF URBANUS ACAWOIOS (LEPIDOPTERA, HESPERIIDAE) IN LABORATORY	II	848	23/08/00	16:30	CC		18	PS	18
Machado, P. R.	1371	CONTROL OF BEAN LEAFHOPPER EMPOASCA KRAEMERI (HEMIPTERA: CICADELLIDAE) WITH THIAMETHOXAM ON COWPEA	I	346	22/08/00	16:30	CC		7	PS	7
Machado, P. R.	1372	INTERCROPPING SYSTEM AND THIAMETHOXAM SPRAYING FOR EMPOASCA KRAEMERI (HEMIPTERA: CICADELLIDAE) CONTROL IN COWPEA	I	346	22/08/00	16:30	CC		7	PS	7
Machado, P. R.	1399	REPELLENCY OF VEGETABLE OILS ON ADULTS OF ZABROTES SUBFASCIATUS (COLEOPTERA: BRUCHIDAE) IN BEAN GRAINS	I	353	25/08/00	16:30	CC		7	PS	7
Machado, P. R.	4096	EFFECT OF VEGETABLE OILS ON THE PREFERENCE FOR OVIPOSITION AND VIABILITY OF IMATURE PHASE OF CALLOSOBRUCHUS MACULATUS (COLEOPTERA: BRUCHIDAE) IN COWPEA GRAINS	II	1034	23/08/00	16:30	CC		23	PS	23
Machado, P. R.	2714	CONTROL OF POTATO LEAFHOPPER EMPOASCA KRAEMERI (HEMIPTERA: CICADELLIDAE) WITH THIAMETHOXAM ON COWPEA	II	685	23/08/00	16:30	CC		14	PS	14
Machado, R. Z.	3018	ANTIBODY AND BLOOD LEUKOCYTE RESPONSE IN RHIPICEPHALUS SANGUINEUS TICK INFESTED DOGS AND GUINEA PIGS	II	761	25/08/00	16:30	CC		15	PS	15
Machado-Santelli, G. M.	3033	OOCYTE DIFFERENTIATION AND MEIOSIS INITIATION IN RHYNCHOSCIARA AMERICANA: DECISION MAKING IN A TWO CELL MEROISTIC SYSTEM	II	765	21/08/00	10:30	HB	G	16	1	16
Maciá, A.	1000	COMPARISON OF SENSITIVITY TO COLD IN SOUTH AMERICAN FRUIT FLY AND MEDFLY (DIPTERA: TEPHRITIDAE)	I	252	22/08/00	16:30	CC		6	PS	6
Macías-Sámano, J. E.	1837	THE EXOTIC FOREST PEST INFORMATION SYSTEM FOR NORTH AMERICA	I	463	22/08/00	16:05	HB	M	10	3	10
Macías-Sámano, J. E.	1885	REFORESTATION PEST PROBLEMS IN TROPICAL AMERICA	I	475	26/08/00	11:35	HB	M	10	9	10
Macintosh, S.	1236	CURRENT STATUS OF TRANSGENICS FOR INSECT CONTROL	I	312	22/08/00	13:35	HM	N	7	4	7
Mackintosh, J. A.	3470	ANTIMICROBIAL COMPOUNDS FROM ANTS AND OTHER INSECTS AND THEIR ROLE IN THE EVOLUTION OF SOCIALITY	II	876	23/08/00	16:30	CC		19	PS	19
Maclean, N.	2274	MOLECULAR ANALYSIS OF THE EVOLUTIONARY DYNAMICS OF THE AFRICAN QUEEN BUTTERFLY DANAUS CHRYSIPPUS.	I	574	23/08/00	16:30	CC		12	PS	12
Mácola, G. S.	2464	A NEW CAGE FOR GRAPHOLITA MOLESTA FEMALES OVIPOSITION	II	622	23/08/00	16:30	CC		13	PS	13
Macours, N.	3261	ANGIOTENSIN CONVERTING ENZYME-LIKE ACTIVITY IN THE FLESHFLY NEOBELLIERIA BULLATA	II	824	21/08/00	16:15	HB	K	18	1	18
MacRae, I. V.	3240	APHID ALERT: RESEARCH/OUTREACH ADDRESSING POTATO VIRUS PROBLEMS IN THE NORTH CENTRAL U.S.	II	818	24/08/00	16:30	CC		17	PS	17
Madden, J. L.	1825	ADVANTAGES AND LIMITATIONS IN THE USE OF PATHOGENS AS BIOCIDES FOR CONTROL OF FOREST PESTS	I	460	22/08/00	10:20	HB	M	10	2	10
Maddison, D. R.	770	THE TREE OF LIFE PROJECT: A MULTI-AUTHORED, DISTRIBUTED INTERNET PROJECT CONTAINING INFORMATION ABOUT PHYLOGENY AND BIODIVERSITY	I	194	24/08/00	10:20	Bol	T	5	5	5
Maddison, D. R.	3684	PHYLOGENY OF THE BEETLE SUBORDER ADEPHAGA AND FAMILY CARABIDAE, AS INFERRED USING RIBOSOMAL DNA AND THE WINGLESS GENE	II	930	25/08/00	14:50	HB	E	21	8	21
Maddison, D. R.	3819	PHYLOGENETIC RELATIONSHIPS OF THE CARABID (COLEOPTERA) SUBFAMILY HARPALINAE BASED ON MOLECULAR SEQUENCE DATA	II	964	24/08/00	16:30	CC		21	PS	21

Sub-titles: (HB=Hotel Bourbon) - (HM=Hotel Mabu) - (CC=Convention Center) - (Bol=Foz Boulevard) - (PS=Poster Session) - (PL=Plenary Lecturer)

AUTHOR	Nº	TITLE	Book	Page	Date	Time	Local	Room	Session	Symp	New Session
Madeira, B. G.	964	PLANT QUALITY AND GALLING HERBIVORE POPULATION ECOLOGY ON BACCHARIS DRACUNCULIFOLIA	I	243	22/08/00	16:30	CC		6	PS	6
Madeira, B. G.	853	ENDOPHYTES, TANNINS, AND HERBIVORES: THE INTERFACE IN A WOODY SHRUB	I	216	24/08/00	14:30	HB	D	6	6	6
Madeira, B. G.	1090	GALLING HERBIVORY MEDIATED BY MUTUALISTIC INTERACTIONS BETWEEN ANTS AND APHIDS IN BACCHARIS DRACUNCULIFOLIA (ASTERACEAE)	I	275	24/08/00	16:30	CC		6	PS	6
Madi-Ravazzi, L.	1777	HYBRID MALE STERILITY AND COURTSHIP ANALYSIS IN DROSOPHILA BUZZATII CLUSTER SPECIES (DIPTERA, DROSOPHILIDAE)	I	448	23/08/00	16:30	CC		9	PS	9
Madruga, C. R.	3248	SEROLOGY FOR BABESIA BOVIS IN HUMAN PATIENTS WITH LYME-LYKE DISEASE SYNDROME, SYPHILIS, SEPTICEMIA AND AUTOIMMUNE DISEASES	II	820	25/08/00	16:30	CC		17	PS	17
Maeda, S.	3510	STRUCTURAL ANALYSIS OF THE Z CHROMOSOME IN BOMBYX MORI BY USING THE BAC LIBRARY	II	886	23/08/00	16:30	CC		19	PS	19
Maeda, S.	3266	BOMBYX EST DATABASE, SILKBASE, FOR GENOME ANALYSIS OF BOMBYX MORI	II	825	22/08/00	11:05	HB	K	18	2	18
Maekawa, H.	3264	RELATIONSHIPS BETWEEN THE LOCATION AND THE RADIATION SENSITIVITY OF RETROTRANSPOSONS IN THE GENOME AND THE INSERTION MECHANISM	II	824	22/08/00	10:20	HB	K	18	2	18
Maekawa, H.	2525	PURIFICATION AND PROPERTIES OF TWO CAROTENOIDS BINDING PROTEINS FROM SILK GLAND OF BOMBYX MORI	II	638	25/08/00	16:30	CC		13	PS	13
Maekawa, H.	3167	ISOLATION AND COMPARISON OF MARINER-LIKE SEQUENCES (MLSS) AMONG SOME LEPIDOPTERAN INSECTS AND INVERTEBRATES	II	799	24/08/00	16:30	CC		16	PS	16
Maelfait, J. P.	1903	FOREST SOIL CLASSIFICATION BASED ON COLLEMBOLA FAUNA	I	480	22/08/00	16:30	CC		10	PS	10
Maelfait, J.-P.	470	RESPONSES OF COLLEMBOLA COMMUNITIES TO LEAD SHOT DEPOSITIONS IN A HEATHLAND ENVIRONMENT	I	119	21/08/00	16:30	CC		3	PS	3
Maelfait, J.-P.	1912	BEETLES, SPIDERS AND FLIES AS BIO-INDICATORS IN FORESTS: A LARGE SCALE RESEARCH PROJECT IN FLANDERS (BELGIUM)	I	482	21/08/00	16:30	CC		10	PS	10
Maelzer, D. A.	141	HELICOVERPA FORECASTING IN AUSTRALIA: STATISTICAL MODELS INCORPORATING LOCAL AND NON-LOCAL FACTORS	I	36	25/08/00	11:15	HB	A	2	9	2
Maes, R.	2321	THE 4-kDa PROTEASE INHIBITOR FAMILY IN THE DESERT LOCUST SCHISTOCERCA GREGARIA: MOLECULAR CLONING AND ANALYSIS OF TISSUE- AND STAGE-DEPENDENT EXPRESSION	I	586	23/08/00	16:30	CC		12	PS	12
Maes, R.	2509	THE 4-KDA PROTEASE INHIBITOR FAMILY IN THE DESERT LOCUST SCHISTOCERCA GREGARIA: MOLECULAR CLONING AND ANALYSIS OF TISSUE- AND STAGE-DEPENDENT EXPRESSION	II	634	24/08/00	16:30	CC		13	PS	13
Maeta, Y.	3653	WHY DO MALE AND FEMLAE PSEUDOXENOS IWATAI (STYLOPIDAE) EXTRUDE AT DEFINITE POSISITONS ON THE HOST METASOMA?	II	922	23/08/00	15:35	HB	E	21	5	21
Maeto, K.	1879	IMPACT OF FOREST UTILIZATION ON THE ASSEMBLAGE OF LONGICORN BEETLES (COLEOPTERA: CERAMBYCIDAE) IN THE WARM-TEMPERATE FORESTS OF JAPAN	I	474	25/08/00	16:05	HB	M	10	8	10
Mafra, L.	693	MANAGING TEMPERATE FRUIT PESTS IN BRAZIL USING SEMIOCHEMICALS	I	175	23/08/00	16:30	CC		4	PS	4
Mafra, L.	3970	A HIGHLY INTEGRATED MONITORING SYSTEM TO SUPPORT ON-TIME, ON-LINE DECISION-MAKING IN AGRICULTURE	II	1002	24/08/00	16:30	CC		22	PS	22
Mafra-Neto, A.	693	MANAGING TEMPERATE FRUIT PESTS IN BRAZIL USING SEMIOCHEMICALS	I	175	23/08/00	16:30	CC		4	PS	4
Mafra-Neto, A.	3970	A HIGHLY INTEGRATED MONITORING SYSTEM TO SUPPORT ON-TIME, ON-LINE DECISION-MAKING IN AGRICULTURE	II	1002	24/08/00	16:30	CC		22	PS	22
Mafra-Neto, A.	352	POPULATIONAL STUDIES OF LEPTOGLOSSUS ZONATUS (HETEROPTERA: COREIDAE) ON CORN (ZEA MAYS) IN BRAZIL	I	89	25/08/00	16:30	CC		2	PS	2
Mafra-Neto, A.	730	PHEROMONES SYSTEM OF LEPTOGLOSSUS ZONATUS (HETEROPTERA:COREIDAE)	I	184	24/08/00	16:30	CC		4	PS	4
Magalhães, B. P.	2093	FIELD TRIAL WITH THE ENTOMOPATHOGENIC FUNGUS METARHIZIUM ANISOPLIAE VAR. ACRIDUM AGAINST BANDS OF THE GRASSHOPPER RHAMMATOCERUS SCHISTOCERCOIDES IN BRAZIL	I	528	23/08/00	16:30	CC		11	PS	11
Magalhães, L. C.	1402	INSECTICIDE RESISTANCE IN POPULATIONS OF TUTA ABSOLUTA (LEPIDOPTERA: GELECHIIDAE)	I	354	25/08/00	16:30	CC		7	PS	7
Magalhães, T. C.	256	PERFORMANCE OF CERATITIS CAPITATA (DIPTERA, TEPHRITIDAE) ON FRUITS: COMPARISON OF TWO LABORATORY POPULATIONS	I	65	23/08/00	16:30	CC		2	PS	2
Magri, D. C.	1778	IS ELASMOPALPUS LIGNOSELLUS BEHAVIOR INFLUENCED BY SMOKE OF BURNED SUGAR CANE?	I	448	23/08/00	16:30	CC		9	PS	9
Magro, S. R.	1575	COMPARISON AND DEVELOPMENT OF ARTIFICIAL DIETS FOR BRACON HEBETOR (HYMENOPTERA: BRACONIDAE) REARING	I	397	21/08/00	16:30	CC		8	PS	8
Magro, S. R.	1428	IN VITRO REARING OF PARASITOIDS IN BRAZIL: AN OVERVIEW	I	360	21/08/00	14:05	HM	O	8	2	8
Magura, T.	1779	EDGE EFFECT ON GROUND BEETLES	I	448	23/08/00	16:30	CC		9	PS	9
Magura, T.	1915	EFFECTS OF NON-NATIVE SPRUCE PLANTATION ON CARABID BEETLES	I	483	21/08/00	16:30	CC		10	PS	10
Maheshwari, G.	2995	ADVANCES AND ACHIEVEMENT IN PHLEBOTOMINE (DIPTERA: NEMATOCERA) STUDIES IN INDIA: AN OVERVIEW	II	756	23/08/00	16:30	CC		15	PS	15
Mahr, D. L.	617	WIDELY SPACED, HIGH-EMISSION-RATE PHEROMONE SOURCES FOR MATING DISRUPTION OF LEPIDOPTEROUS PESTS	I	156	24/08/00	15:30	Bol	S	4	6	4
Maia, A. de H. N.	2162	NUCLEOPOLYHEDROVIRUS SPECIFIC TO FALL ARMYWORM SPODOPTERA FRUGIPERDA	I	545	22/08/00	16:30	CC		11	PS	11
Maia, A. O.	1145	THE STUDY OF ABUNDANCE, BITING BEHAVIOR AND PARITY OF ANOPHELINE IN ENDEMIC MALARIA AREA IN PORTO VELHO – RONDONIA – BRAZIL	I	289	24/08/00	16:30	CC		6	PS	6
Maia, V. B.	3515	#N/D	#N/D	#N/D	#N/D	#N/D	#N/D	#N/D	#N/D	#N/D	#N/D
Maia, V. C.	830	THE GALL MIDGES (DIPTERA: CECIDOMYIIDAE) FROM COASTAL SHRUB ZONE OF RIO DE JANEIRO STATE (BRAZIL)	I	210	23/08/00	10:50	HB	D	6	5	6
Maia, W. J. M. S.	275	OCCURRENCE OF DEFOLIATOR CATTERPILARS (LEPIDOPTERA) ON EUCALYPTUS IN THE REGION OF LAVRAS-MG, BRAZIL	I	70	23/08/00	16:30	CC		2	PS	2
Maia, W. J. M. S.	1576	INFLUENCE OF TEMPERATURE ON THE WEIGHT OF LARVAE AND ADULTS OF CHRYSOPERLA EXTERNA (NEUROPTERA: CHRYSOPIDAE) FED ON SCHIZAPHIS GRAMINUM (HEMIPTERA: APHIDIDAE)	I	397	24/08/00	16:30	CC		8	PS	8
Maile, R.	429	HOST-SPECIFICITY IN MACULINEA ALCON: A LARGE BLUE BUTTERFLY CONSERVATION ISSUE IN EUROPE	I	109	24/08/00	14:05	HB	C	3	6	3
Maingon, R.	3218	THE EFFECT OF MALARIA INFECTION ON MOSQUITO VITELLOGENESIS	II	812	22/08/00	16:30	CC		17	PS	17
Maistrello, L.	2094	EFFECTS OF VETIVER OIL AND ITS CONSTITUENTS ON COPTOTERMES FORMOSANUS AND ITS SYMBIOTIC FAUNA	I	528	23/08/00	16:30	CC		11	PS	11
Majer, J. D.	427	AN EVALUATION OF ARTHROPODS FOR POSSIBLE USE IN COMPLETION CRITERIA FOR MINESITE REHABILITATION	I	108	24/08/00	11:50	HB	C	3	5	3
Majer, J. D.	3410	INFLUENCE OF ARGENTINE AND COASTAL BROWN ANT (HYMENOPTERA: FORMICIDAE) INVASIONS ON RICHNESS AND SPECIES COMPOSITION OF ANTS IN GARDENS IN PERTH, AUSTRALIA	II	861	22/08/00	11:05	HM	Q	19	2	19
Makai, S.	3648	MORPHOLOGY AND BIOGEOGRAPHY OF FEMALE MYRMECOLACIDAE PARASITIC IN ORTHOPTERA IN PAPUA NEW GUINEA	II	921	23/08/00	14:20	HB	E	21	5	21
Makino, S.	3654	SEASONAL CHANGES IN PARASITISM LEVELS AND SEX RATIOS OF THE STREPSIPTERON XENOS MOUTONI PARASITIZING JAPANESE HORNETS COLLECTED WITH BAIT TRAPS	II	923	23/08/00	15:50	HB	E	21	5	21
Makino, S.	4007	DENSITY-DEPENDENT FLUCTUATIONS IN THE ANNUAL NUMBER OF NESTS OF THE HORNET VESPA SIMILLIMA DESTROYED IN AN URBAN AREA IN JAPAN	II	1012	21/08/00	11:30	HB	J	23	1	23
Makino, S.	53	PARASITIC AND MUTUALISTIC RELATIONSHIPS BETWEEN ASTIGMATID MITES AND BEES OR WASPS IN JAPAN	I	14	24/08/00	16:30	CC		1	PS	1
Malacrida, A. R.	2230	POLYMORPHIC MICROSATELLITE MARKERS TO ASSESS THE GENETIC VARIABILITY IN THE MEDITERRANEAN FRUIT FLY, CERATITIS CAPITATA, SPECIES RANGE	I	563	21/08/00	16:30	CC		12	PS	12

Sub-titles: (HB=Hotel Bourbon) - (HM=Hotel Mabu) - (CC=Convention Center) - (Bol=Foz Boulevard) - (PS=Poster Session) - (PL=Plenary Lecturer)

AUTHOR	Nº	TITLE	Book	Page	Date	Time	Local	Room	Session	Symp	New Session
Malacrida, A. R.	2209	TRANSPOSABLE ELEMENT ABUNDANCE, DISTRIBUTION AND EVOLUTION IN TEPHRITID FLIES	I	558	24/08/00	14:35	HB	L	12	8	12
Malagnini, V.	135	PHYTOSEIID-POLLEN RELATIONSHIPS IN ITALIAN VINEYARDS	I	35	24/08/00	15:35	HB	A	2	8	2
Malagodi-Braga, K. S.	3971	FACTORS INFLUENCING THE ABUNDANCE AND DISTRIBUTION OF FLORAL VISITORS IN DIFFERENT STRAWBERRY CULTIVARS (FRAGARIA X ANANASSA): CONSEQUENCES TO POLLINATION, POLLINATORS' CONSERVATION AND COMMERCIAL STRAWBERRY PRODUCTION	II	1002	23/08/00	16:30	CC		22	PS	22
Malagodi-Braga, K. S.	3972	THE ADAPTATION AND CONTRIBUTION OF DIFFERENT SPECIES OF STINGLESS BEES IN STRAWBERRY PRODUCTION WITHIN GREENHOUSE AT ATIBAIA COUNTY – SP	II	1002	23/08/00	16:30	CC		22	PS	22
Malaguido, A. B.	1785	DISTRIBUTION OF SCAPTOCORIS CASTANEA POPULATION IN THE SOIL PROFILE	I	450	25/08/00	16:30	CC		9	PS	9
Malaguido, A. B.	2605	MANAGING HETEROPTERAN OF GRASSLANDS, CORN AND WHEAT IN THE TROPICS	II	658	26/08/00	10:35	HB	B	14	9	14
Malaspina, O.	1309	METANOLIC EXTRACTS FROM DIMORPHANDRA MOLLIS (BARBATIMÃO) AND THEIR ACTIVITY IN WORKERS OF APIS MELLIFERA	I	330	21/08/00	16:30	CC		7	PS	7
Malausa, J. C.	1892	BIOLOGICAL CONTROL OF INSECT PESTS OF EUCALYPTUS IN FRANCE	I	477	26/08/00	15:05	HB	M	10	10	10
Malavasi, A.	3882	STRATEGIES FOR AREA-WIDE CONTROL OF FRUIT FLIES	II	980	22/08/00	11:20	HB	H	22	2	22
Malavasi, A.	278	EVALUATION OF TWO COFFEE SPECIES AS HOST OF FRUIT FLIES (DIPTERA: TEPHRITIDAE) IN THE ESPÍRITO SANTO STATE, BRAZIL	I	71	23/08/00	16:30	CC		2	PS	2
Malavasi, A.	279	HOST PLANTS OF FRUIT FLIES (DIPTERA: TEPHRITIDAE) IN THE STATE OF ESPÍRITO SANTO, BRAZIL	I	71	23/08/00	16:30	CC		2	PS	2
Malcolm, C. A.	2275	THE ORIGIN AND MOLECULAR EVOLUTION OF MOSQUITO NON-LTR RETROTRANSPOSONS BELONGING TO THE CR1 AND JOCKEY CLADES	I	574	23/08/00	16:30	CC		12	PS	12
Maldonado, M.	2974	PRELIMINARY FOUNDINGS OF NECROPHAGOUS FAUNA ON DOMESTIC PIG IN ARGENTINA	II	750	22/08/00	16:30	CC		15	PS	15
Malecova, B.	2322	FROM GENE OF HONEY BEE (APIS MELLIFERA) TO MOLECULAR PROPERTIES AND FUNCTION OF MAJOR PROTEINS OF ROYAL JELLY	I	586	25/08/00	16:30	CC		12	PS	12
Malinin, ° A.	290	HF-ENERGY INFLUENCE ON GRANARY PESTS	I	74	23/08/00	16:30	CC		2	PS	2
Malkowski, S. R.	3516	OCCURRENCE OF SWARMS OF AFRICANIZED BEES AND WASP NESTS IN THE METROPOLITAN REGION OF CURITIBA, STATE OF PARANA, BRAZIL	II	887	23/08/00	16:30	CC		19	PS	19
Malkowski, S. R.	3517	STINGLESS BEES OF THE PARANA STATE ASSOCIATION OF BEEKEEPERS	II	887	23/08/00	16:30	CC		19	PS	19
Mallet, J. L. B.	2231	PREDATION AS A POST-MATING ISOLATION MECHANISM IN HELICONIUS CYDNO AND H.MELPOMENE	I	563	21/08/00	16:30	CC		12	PS	12
Mallet, J. L. B.	2292	GENETICS ACROSS THE SPECIES BOUNDARY: HOST PLANT PREFERENCE AND COLOUR PATTERN IN HELICONIUS CYDNO AND H. MELPOMENE	I	578	23/08/00	16:30	CC		12	PS	12
Mallet, J. L. B.	2293	MULTIPLE PARTIAL BARRIERS TO GENE FLOW BETWEEN HELICONIUS CYDNO AND H. MELPOMENE	I	579	23/08/00	16:30	CC		12	PS	12
Malone, F.	3336	JH APPLICATION MODIFIES THE ADULT DEVELOPMENT PROGRAM AND ECDYSONE RECEPTOR EXPRESSION IN THE TOBACCO HORNWORM, MANDUCA SEXTA	II	842	22/08/00	16:30	CC		18	PS	18
Malosse, C.	640	NO PLEIOTROPIC EFFECT OF INSECTIDE RESISTANCE ON SEXUAL COMMUNICATION IN CYDIA POMOMELLA	I	162	21/08/00	16:30	CC		4	PS	4
Malutan, T.	2461	A HIGH-AFFINITY OCTOPAMINE/TYRAMINE TRANSPORTER CLONED FROM THE INSECT CENTRAL NERVOUS SYSTEM	II	622	23/08/00	16:30	CC		13	PS	13
Malva, C.	3041	FEMALE STERILE MUTATIONS AND EGG CHAMBER DEVELOPMENT IN DROSOPHILA MELANOGASTER	II	767	21/08/00	15:00	HB	G	16	1	16
Malva, C.	2372	EXPRESSION OF CARDIOCHILES NIGRICEPS POLYDNAVIRUS IN PARASITIZED HELIOTHIS VIRESCENS LARVAE AND INDUCED HOST FUNCTIONAL ALTERATIONS	II	599	24/08/00	14:05	HB	I	13	7	13
Mamani, F.	302	INSECTS ASSOCIATED WITH TOBACCO CULTURE WITHOUT CHEMICAL MANAGEMENT IN MISIONES ARGENTINA	I	77	25/08/00	16:30	CC		2	PS	2
Mammri, Z.	2327	LIFE CYCLE, MORPHOLOGICAL AND GENETIC VARIATION IN CLONES OF MYZUS PERSICAE (HOMOPTERA: APHIDIDAE)	I	587	25/08/00	16:30	CC		12	PS	12
Mancini, K. C.	2462	APYRENE AND EUPYRENE SPERMATOZOA IN THE SEMINAL VESICLE OF EUPTOIETA HEGESIA (LEPIDOPTERA: NYMPHALIDAE)	II	622	23/08/00	16:30	CC		13	PS	13
Mandrioli, M.	2276	THE PRESENCE OF THE TRANSPOSABLE ELEMENTS R1 AND R2 IS ASSOCIATED TO MITOTIC CROSSING OVER IN SEVERAL APHID SPECIES	I	574	23/08/00	16:30	CC		12	PS	12
Mandrioli, M.	1299	RELATIONSHIP BETWEEN EXPRESSION, AMPLIFICATION AND METHYLATION OF FE4 GENE IN MYZUS PERSICAE (HOMOPTERA, APHIDIDAE)	I	328	21/08/00	16:30	CC		7	PS	7
Manessi, O. G.	276	RESULTS FROM 3 YEARS OF BWACT USE IN THE NATIONAL BOLL WEEVIL SUPRESSION PROGRAM OF PARAGUAY	I	70	23/08/00	16:30	CC		2	PS	2
Manetti, A.G.O	2358	GENOMIC STRUCTURE AND ECDYSONE REGULATION OF THE PROPHENOLOXIDASE 1 GENE IN THE MALARIA VECTOR ANOPHELES GAMBIAE	II	596	23/08/00	14:20	HB	I	13	5	13
Manfred Kern	XVII	Entomological challenges for the next century	I	LXIX	26/08/00	8:00	HB			PL	
Manfrin, M. H.	2290	STUDY OF HYBRID ZONE AMONG DROSOPHILA SERIDO AND DROSOPHILA SP D, SPECIES OF THE CLUSTER BUZZATII	I	578	23/08/00	16:30	CC		12	PS	12
Manfrini de Brewer, M.	1164	DIVERSITY OF NATIVE BEES (HYMENOPTERA: APOIDEA) AND USE OF FLORAL RESOURCES IN A SECTION OF THE CHACO SERRANO (BOSQUE SERRANO) IN CENTRAL ARGENTINA.	I	293	25/08/00	16:30	CC		6	PS	6
Manfrini de Brewer, M.	1165	RELATIONSHIP BETWEEN CARPENTER BEES (HYMENOPTERA: APIDAE) AND THE FLORA OF THE CHACO SERRANO IN CENTRAL ARGENTINA.	I	294	25/08/00	16:30	CC		6	PS	6
Mangan, R. L.	3903	POSTHARVEST INSECT CONTROL: TEMPERATURE AND CONTROLLED ATMOSPHERE TREATMENTS	II	985	24/08/00	10:05	HB	H	22	6	22
Mangeaud, A.	565	ESTIMATING INSECT DIVERSITY IN CENTRAL ARGENTINA: A COMPARISON AMONG TAXA AND HABITATS	I	143	25/08/00	16:30	CC		3	PS	3
Mangiafico, J. A.	3006	THE IMPORTANCE OF DEVELOPING NOVEL STRATEGIES FOR PESTICIDE USE IN CONTROLLING VECTOR-BORNE DISEASES	II	758	24/08/00	16:30	CC		15	PS	15
Mangione, S.	3195	THE MORPHOLOGY OF THE POSTEMBRYONIC STAGES OF GONATOPUS CHILENSIS (HYMENOPTERA: DRYINIDAE), WITH CONSIDERATIONS ABOUT THE INMATURE LARVAE NUTRITION AND IT'S RELATED STRUCTURES	II	806	25/08/00	16:30	CC		16	PS	16
Mani, S.	4041	CANADIAN GRAIN STORAGE CD-ROM	II	1020	23/08/00	15:30	HB	J	23	7	23
Manicardi, G. C.	2276	THE PRESENCE OF THE TRANSPOSABLE ELEMENTS R1 AND R2 IS ASSOCIATED TO MITOTIC CROSSING OVER IN SEVERAL APHID SPECIES	I	574	23/08/00	16:30	CC		12	PS	12
Manicardi, G. C.	1299	RELATIONSHIP BETWEEN EXPRESSION, AMPLIFICATION AND METHYLATION OF FE4 GENE IN MYZUS PERSICAE (HOMOPTERA, APHIDIDAE)	I	328	21/08/00	16:30	CC		7	PS	7
Manjula, T. R.	1599	DEVELOPING A COMMERCIALLY VIABLE SYSTEM USING CHRYSOPERLA CARNEA FOR CONTROL OF COTTON PESTS IN INDIA	I	403	23/08/00	16:30	CC		8	PS	8
Manjula, T. R.	1598	DEVELOPING A COMMERCIALLY VIABLE SYSTEM USING TRICHOGRAMMA CHILONIS FOR CONTROL OF COTTON BOLLWORM HELIOTHIS ARMIGERA IN INDIA	I	403	23/08/00	16:30	CC		8	PS	8
Mankin, R.	943	INFERRING ACTIVITIES AND POPULATION DENSITY FROM INCIDENTAL SOILBORNE SOUNDS OF WHITE GRUBS	I	238	21/08/00	16:30	CC		6	PS	6
Mankin, R. W.	800	ACOUSTIC DETECTION AND MONITORING OF CEPHUS CINCTUS SAWFLY LARVAE IN WHEAT STEMS	I	202	21/08/00	10:20	HB	D	6	1	6
Mann, D. D.	4041	CANADIAN GRAIN STORAGE CD-ROM	II	1020	23/08/00	15:30	HB	J	23	7	23
Mannion, C. M.	83	ERADICATION OF A SCARAB PEST FROM A NATIONAL WILDLIFE REFUGE	I	22	21/08/00	10:50	HB	A	2	1	2

Sub-titles: (HB=Hotel Bourbon) - (HM=Hotel Mabu) - (CC=Convention Center) - (Bol=Foz Boulevard) - (PS=Poster Session) - (PL=Plenary Lecturer)

AUTHOR	Nº	TITLE	Book	Page	Date	Time	Local	Room	Session	Symp	New Session
Manole, T.	1847	A NEW VIRAL PRODUCT "Inf-Ld" USED IN THE CONTROL OF POPULATIONS DENSITY OF LYMANTRIA DISPAR L. AND EUPROCTIS CHRYSORRHOEA	I	466	23/08/00	15:35	HB	M	10	4	10
Manole, T.	2041	THE EXPERIMENTAL TRIALS WITH THE VIRAL PRODUCT "Inf-Hc" FOR DENSITY CONTROL OF PEST POPULATIONS OF HYPHANTRIA CUNEA	I	515	21/08/00	16:30	CC		11	PS	11
Manoukas, A. G.	1577	COMPOSITION AND EFFICIENCY OF A YEAST FREE LARVAL DIET FOR THE MEDITERRANEAN FRUIT FLY	I	398	23/08/00	16:30	CC		8	PS	8
Manoussopoulos, I. N.	3227	NEW APHID VECTORS OF ZUCCHINI YELLOW MOSAIC VIRUS AND THEIR ROLE IN THE EPIDEMIOLOGY OF THE VIRUS IN GREECE	II	815	22/08/00	16:30	CC		17	PS	17
Månsson, P.	1966	NON-HOST SIGNALS INHIBITING FEEDING IN HYLOBIUS PINE WEEVILS: LABORATORY ASSAYS AND FIELD TESTS	I	495	24/08/00	16:30	CC		10	PS	10
Mantovani, B.	2277	MITOCHONDRIAL DNA ANALYSIS IN SPECIES OF DREYFUSIA IN ITALY	I	575	23/08/00	16:30	CC		12	PS	12
Mantovani, E. C.	4063	INTERATION BETWEEN CROPPING FACTORS AND ACTION OF INSECTS AND MOLDS IN THE DEPRECIATION OF THE NUTRITIONAL QUALITIES OF THE CORN BR 2121-QPM DURING THE STORAGE	II	1026	21/08/00	16:30	CC		23	PS	23
Manzi, A.	3041	FEMALE STERILE MUTATIONS AND EGG CHAMBER DEVELOPMENT IN DROSOPHILA MELANOGASTER	II	767	21/08/00	15:00	HB	G	16	1	16
Manzo, M. V.	495	STRUCTURE AND DIVERSITY OF STREAM INSECT ASSEMBLAGES APPLIED TO ASSESSMENT: THE LULES RIVER (TUCUMAN, ARGENTINA)	I	125	22/08/00	16:30	CC		3	PS	3
Manzo, M. V.	3797	FIRST CITE OF AUSTRELMIS PERUANA FOR ARGENTINA, WITH A REDESCRIPTION OF THE SPECIES	II	958	23/08/00	16:30	CC		21	PS	21
Mao, L.	3542	A PILOT TEST FOR AREA WIDE MANAGEMENT OF THE FORMOSAN SUBTERRANEAN TERMITE IN THE FRENCH QUARTER, NEW ORLEANS, LOUISIANA	II	894	24/08/00	16:30	CC		19	PS	19
Marais, E.	3586	AFRICAN CAVES, TROGLOPHILES, CLIMATE AND ENVIRONMENT	II	905	25/08/00	9:45	Bol	U	20	3	20
Maramorosch, K	2463	PIONEERS OF INVERTEBRATE CELL CULTURE	II	622	23/08/00	16:30	CC		13	PS	13
Maranhão, L. M. de A. C.	2095	LARGE SCALE BACILLUS SPHAERICUS PRODUCTION	I	528	23/08/00	16:30	CC		11	PS	11
Maranhão, L. M. de A. C.	2150	BIOLOGIC CONTROL OF CULEX QUINQUEFASCIATUS IN CITIES FROM PERNAMBUCO STATE APPLYING BACILLUS SPHAERICUS	I	542	25/08/00	16:30	CC		11	PS	11
Marassá, A. M.	4069	BEHAVIOUR'S ESTIMATION OF PANSTRONGYLUES MESGISTUS (HEMIPTERA-REDUVIIDAE) UNDER THE ACTION OF LIME (CAOH)	II	1027	21/08/00	16:30	CC		23	PS	23
Marcato, M. B.	2972	VECTOR-TRYPANOSOMA CRUZI RELATIONSHIP: CHANGES IN THE HEMOLYMPHATIC PROTEIN COMPOSITION OF DIPETALOGASTER MAXIMUS AFTER EXPERIMENTAL INFECTION	II	750	21/08/00	16:30	CC		15	PS	15
Marchenko, M. I.	2996	OVERVIEW OF FORENSIC ENTOMOLOGICAL INVESTIGATIONS AND RESEARCH IN RUSSIA	II	756	23/08/00	16:30	CC		15	PS	15
Marchesini, E.	2580	ORGANOPHOSPHATE RESISTANCE IN GRAPE LEAFHOPPERS AND IPM STRATEGIES	II	652	24/08/00	10:05	HB	B	14	6	14
Marchini, L. C.	3526	ATTRACTION OF ARNITICUS SP (COLEOPTERA: CURCULIONIDAE) IN THREE MULBERRY CULTIVARS (MORUS ALBA) IN PIRACICABA - SP	II	890	24/08/00	16:30	CC		19	PS	19
Marchini, L. C.	3527	PRESENCE OF THE ARNITICUS SP (COLEOPTERA: CURCULIONIDAE) IN MULBERRY (MORUS ALBA) IN PIRACICABA-SP	II	890	24/08/00	16:30	CC		19	PS	19
Marchini, L. C.	3461	BIOLOGICAL PERFORMANCE OF SILKWORM (BOMBYX MORI) FED WITH LEAVES FROM THREE MULBERRY HYBRIDS (MORUS SP.) FERTILIZED WITH ORGANIC MATTER OR ORGANIC MATTER PLUS GYPSUM	II	874	21/08/00	16:30	CC		19	PS	19
Marchini, L. C.	3463	NUTRITIONAL INDICES OF SILKWORM (BOMBYX MORI) FED WITH LEAVES FROM THREE MULBERRY HYBRIDS (MORUS SP.) FERTILIZED WITH ORGANIC MATTER OR ORGANIC MATTER PLUS GYPSUM	II	874	21/08/00	16:30	CC		19	PS	19
Marco, R. J. De	3534	NECTAR COLLECTING IN HONEY BEES: HOW DO CHANGES IN THE RELATIVE FOOD SOURCE PROFITABILITY EXPLOITED BY INDIVIDUAL BEES AFFECT THE SOCIAL FORAGING ACTIVITY?	II	892	24/08/00	16:30	CC		19	PS	19
Marçon, P.	1287	BT RESISTANCE SURVEILLANCE AND DETECTION IN MAJOR MAIZE INSECT PESTS	I	325	26/08/00	10:00	HM	N	7	11	7
Marcos Kogan	VII	Sustainable development and integrated pest management	I	XXV III	23/08/00	8:00	HB			PL	
Marcot, B. G.	52	THE UNIQUE INSECT BIODIVERSITY OF THE KLAMATH/SISKIYOU MOUNTAIN REGION IN NW USA; CHALLENGES FOR INVENTORY AND CONSERVATION	I	13	24/08/00	16:30	CC		1	PS	3
Marcu, F.	1506	BIOLOGYCAL CONTROL OF SOME PHYTOPHAGUE INSECTS WITH TRICHOGRAMMA SPP. (INSECT., HYM.)	I	380	21/08/00	16:30	CC		8	PS	8
Mare, R. A. Di	522	DISTRIBUTION OF THE GENUS ADELPHA (LEPIDOPTERA: NYMPHALIDAE: LIMENITINAE) IN THE AMERICAN CONTINENT	I	132	23/08/00	16:30	CC		3	PS	3
Mare, R. A. Di	3798	PHYLOGENETIC USEFULNESS OF THE ELONGATION FACTOR-1ALPHA (EF-1ALPHA) IN DITRYSIA GROUP (INSECTA: LEPIDOPTERA)	II	959	24/08/00	16:30	CC		21	PS	21
Maree, F.	2225	SUCCESSFULLY MANAGING LEPIDOPTERAN PESTS WITH GENETIC METHODS: THE FUTURE IS NOW	I	562	25/08/00	10:35	HB	L	12	11	12
Mareggiani, G.S.	2804	HARMFUL AND BENEFICAL INSECT SPECIES IN TWO VARIETIES OF LUPINUS SPP. IN ARGENTINA	II	708	25/08/00	16:30	CC		14	PS	14
Mareggiani, G.	1830	PLATYPUS SULCATUS: A RATIONAL APPROACH TO ITS CONTROL IN POPULUS SPP. IN ARGENTINA	I	461	22/08/00	11:35	HB	M	10	2	10
Mareggiani, G.	1310	IDENTIFICATION OF A CHEMICAL FRACTION FROM AROMATIC HERBS WITH INSECTICIDAL ACTIVITY AGAINST TRIBOLIUM CASTANEUM (COLEOPTERA, TENEBRIONIDAE)	I	331	21/08/00	16:30	CC		7	PS	7
Mareggiani, G.	2622	INSECT DEVELOPMENT DELAY PRODUCED BY WITHANOLIDES FROM SOLANACEAE	II	662	22/08/00	16:30	CC		14	PS	14
Mares, C. L.	3973	EFFICACY OF TRANSGENIC BT COTTON - RELATING BIOASSAY AND ELIZA TECHNIQUES	II	1003	23/08/00	16:30	CC		22	PS	22
Mares, M.	3338	ASPARTIC PROTEASES FROM LEPTINOTARSA DECEMLINEATA AND THEIR INHIBITORS	II	843	22/08/00	16:30	CC		18	PS	18
Marel, M.	2452	THE EFFECT OF PLANT INHIBITORS OF INSECT DIGESTIVE ENYZYMES ON GROWTH AND MORTALITY OF MODEL PESTS	II	619	23/08/00	16:30	CC		13	PS	13
Margaría, C. B.	1570	NEOTROPICAL MYRMECOPHILIC DIAPRIID WASPS ASSOCIATED WITH MYRMICINAE AND FORMICINAE ANTS (HYMENOPTERA, PROCTOTRUPOIDEA, DIAPRIIDAE)	I	396	23/08/00	16:30	CC		8	PS	8
Margaría, C. B.	1571	THE TYPES OF ENCYRTIDAE (HYMENOPTERA, CHALCIDOIDEA) HOUSED IN THE MUSEO DE LA PLATA	I	396	23/08/00	16:30	CC		8	PS	8
Margaritis, L. H.	3150	MOLECULAR CHARACTERIZATION AND IN SITU LOCALIZATION OF A PEROXIDASE GENE WITH RESPECT TO CHORIOGENESIS IN DROSO-PHILA MELANOGASTER	II	795	23/08/00	16:30	CC		16	PS	16
Margaritis, L. H.	3190	DIFFERENTIAL SORTING OF THE CONSTITUTIVELY CO-SECRETED VITELLINE MEMBRANE AND YOLK PROTEINS OF DROSOPHILA IN THE VITELLOGENIC OVARIAN FOLLICLE CELLS; A HIGH RESOLUTION IMMUNO-ELECTRON MICROSCOPY STUDY OF THE FOLLICLE CELLS SECRETORY AND OOCYTE ACCUMULATIVE PATHWAYS	II	805	25/08/00	16:30	CC		16	PS	16
Margaritis, L. H.	3196	CHORIOGENESIS IN DACUS OLEAE WITH RESPECT TO PEROXIDASES	II	806	25/08/00	16:30	CC		16	PS	16
Margaritis, L. H.	3168	THE EGGSHELL OF LEPTINOTARSA DECEMLINEATA: STRUCTURAL AND BIOCHEMICAL ANALYSIS OF THE CRYSTALLINE CHORION LAYER	II	799	24/08/00	16:30	CC		16	PS	16
Margaritis, L. H.	3200	MORPHOLOGICAL CHARACTERISTICS OF COMMUNICATION ORGANS OF ADULT BACTROCERA (DACUS) OLEAE (DIPTERA: TEPHRITIDAE)	II	807	25/08/00	16:30	CC		16	PS	16
Margaritis, L. H.	3042	STAGE SPECIFIC APOPTOTIC PATTERNS DURING DROSOPHILA OOGENESIS	II	768	21/08/00	15:30	HB	G	16	1	16

Sub-titles: (HB=Hotel Bourbon) - (HM=Hotel Mabu) - (CC=Convention Center) - (Bol=Foz Boulevard) - (PS=Poster Session) - (PL=Plenary Lecturer)

AUTHOR	N°	TITLE	Book	Page	Date	Time	Local	Room	Session	Symp	New Session
Margaritis, L.,H.	3656	HISTOCHEMICAL AND MOLECULAR EVIDENCE OF PEROXIDASE ACTIVITY IN SEGESTIDEA NOVAGUINEAE (ORTHOPTERA) AND STICHOTREMA DALLATORREANUM (STREPSIPTERA)	II	923	23/08/00	16:20	HB	E	21	5	21
Margaritopoulos, J. T.	4152	DIFFERENTIAL DISPLAY PCR WITH NON-RADIOACTIVE DETECTION OF DIFFERENTIALLY EXPRESSED mRNAs IN APHIDS.	II	1049	21/08/00	16:30	CC		Erratum	PS	21
Margaritopoulos, J. T.	2327	LIFE CYCLE, MORPHOLOGICAL AND GENETIC VARIATION IN CLONES OF MYZUS PERSICAE (HOMOPTERA: APHIDIDAE)	I	587	25/08/00	16:30	CC		12	PS	12
Margolis, J.	1846	MODEL ORGANISM GENETICS AND GENOMICS: TOOLS FOR TARGET DEVELOPMENT IN PEST CONTROL	I	465	23/08/00	15:05	HB	M	10	4	10
Margolis, J.	3994	MODEL ORGANISM GENETICS AND GENOMICS: TOOLS FOR TARGET DEVELOPMENT IN PEST CONTROL	II	1008	25/08/00	16:30	CC		22	PS	22
Mariani, R.	3236	DELPHACID PLANTHOPPERS AND THE "MAL DE RIO CUARTO" IN MAIZE IN THE NORTH OF ARGENTINA (INSECTA - FULGOROMORPHA)	II	817	23/08/00	16:30	CC		17	PS	17
Mariani, R.	1663	OCCURRENCE AND REDESCRIPTION OF MEGAMELUS SCUTELLARIS BERG (HEMIPTERA: FULGOROMORPHA: DELPHACIDAE) IN ARGENTINA, A CANDIDATE FOR BIOCONTROL OF WATERHYACINTH	I	419	25/08/00	16:30	CC		8	PS	8
Mariela, A.	1578	PERSPECTIVES IN THE BIOLOGICAL CONTROL OF NEMATUS OLIGOSPILUS FOERSTER (HYMENOPTERA; TENTHREDINIDAE) PEST OF WILLOWS IN ARGENTINA AND CHILE	I	398	23/08/00	16:30	CC		8	PS	8
Marin L., R.	3341	THERMAL REQUIREMENTS AND NUMBER OF GENERATIONS OF SELENASPIDUS ARTICULATUS (HEMIPTERA: DIASPIDIDAE) DURING THE YEAR IN THE STATE OF SÃO PAULO, BRAZIL	II	844	22/08/00	16:30	CC		18	PS	18
Marin L., R.	3342	FERTILITY LIFE TABLES OF SELENASPIDUS ARTICULATUS (HEMIPTERA: DIASPIDIDAE) REARED UNDER DIFFERENT TEMPERATURES AND RELATIVE HUMIDITIES	II	844	23/08/00	16:30	CC		18	PS	18
Marín, M. S.	2464	A NEW CAGE FOR GRAPHOLITA MOLESTA FEMALES OVIPOSITION	II	622	23/08/00	16:30	CC		13	PS	13
Mariño, F.	968	A STUDY OF MACROINVERTEBRATES IN RIVES ECOSYSTEMS (NW IBERIAN PENINSULA), AFFECTED BY SMALL HYDROELECTRIC DAMS	I	244	22/08/00	16:30	CC		6	PS	6
Marino, H. A.	2997	BASIC STUDIES OF HAEMATOPHAGOUS DIPTERA (MOSQUITOES) AS A MODEL FOR THE IMPLEMENTATION IN PROBLEM AREAS OF STRATEGIES OF BIOLOGICAL AND/OR INTEGRATED CONTROL	II	756	23/08/00	16:30	CC		15	PS	15
Marino, S.	3262	RECENT PROGRESS IN GENOMIC MAPPING IN BOMBYX MORI: WHERE SHOULD WE GO FROM HERE?	II	824	22/08/00	9:35	HB	K	18	2	18
Marinotti, O	2234	PROTEIN PURIFICATION AND cDNA CLONING OF SALIVARY GLANDS COMPONENTS OF ANOPHELES DARLINGI	I	564	21/08/00	16:30	CC		12	PS	12
Marinotti, O	2406	CHARACTERIZATION OF THE DIGESTIVE PROCESS IN NEOTROPICAL ANOPHELINES	II	608	21/08/00	16:30	CC		13	PS	13
Marinotti, O.	2927	STRUCTURE AND EXPRESSION OF THE LARVAL AND ADULT HEXAMERIN GENES, MDH1.1 AND MDH2.1, IN MUSCA DOMESTICA	II	739	25/08/00	11:20	Bol	R	15	9	15
Marinotti, O.	3794	INVESTIGATION OF THE VALIDITY OF SPECIES STATUS OF IXODES DIDELPHIDIS (ACARI: IXODIDAE) USING THE SECOND INTERNAL TRANSCRIBED SPACER (ITS2) OF RIBOSOMAL DNA	II	958	23/08/00	16:30	CC		21	PS	21
Marisic, M.	2483	THE DESIGN AND APPLICATION OF AN ACTIGRAPH TO STUDY THE CIRCADIAN RHYTHM OF THE DUMP FLY, HYDROTAEA AENESCENS	II	627	24/08/00	16:30	CC		13	PS	13
Markham, R. H.	4037	MODELLING AS A TOOL FOR INTEGRATED PEST MANAGEMENT IN THE RURAL MAIZE STORE ECOSYSTEM	II	1019	23/08/00	13:45	HB	J	23	7	23
Markham, P. G.	3720	MOLECULAR PHYLOGENY OF BEMISIA TABACI (HOMOPTERA; ALEYRODIDAE) USING A MITOCHONDRIAL MARKER, THE 16S RIBOSOMAL SUBUNIT GENE	II	939	21/08/00	16:30	CC		21	PS	21
Markham, R. H.	4047	SIMPLE EVALUATION PROCEDURES AS IPM TOOLS FOR STORED MAIZE IN WEST AFRICA	II	1022	24/08/00	10:45	HB	J	23	8	23
Markham, R. H.	4018	ANALYSING THE IMPACT OF TERETRIUS NIGRESCENS ON PROSTEPHANUS TRUNCATUS IN MAIZE STORES IN WEST AFRICA	II	1015	22/08/00	10:30	HB	J	23	3	23
Markova, E. P.	3312	MOLECULAR BIOLOGY OF INSECT CLOCKS FOR PHOTOPERIODISM	II	836	25/08/00	14:00	HB	K	18	8	18
Markova, E. P.	3557	PHOTOPERIODIC CLOCK-ENDOCRINE SWITCH AXIS IN DIAPAUSE REGULATION IN SILKMOTH	II	897	24/08/00	16:30	CC		19	PS	19
Markowski, J.	735	FEEDING BEHAVIOUR OF PEA APHID ON ALFALFA	I	186	23/08/00	16:30	CC		4	PS	4
Marlier, J. F.	3536	CONTACT POISONS IN THE ANT GENUS CREMATOGASTERY: CHEMICAL DIVERSITY AND BIOLOGICAL FUNCTIONS	II	892	24/08/00	16:30	CC		19	PS	19
Marling, E.	1966	NON-HOST SIGNALS INHIBITING FEEDING IN HYLOBIUS PINE WEEVILS: LABORATORY ASSAYS AND FIELD TESTS	I	495	24/08/00	16:30	CC		10	PS	10
Marneffe, V. de	3536	CONTACT POISONS IN THE ANT GENUS CREMATOGASTERY: CHEMICAL DIVERSITY AND BIOLOGICAL FUNCTIONS	II	892	24/08/00	16:30	CC		19	PS	19
Marques, A. C.	3588	SYSTEMATICS OF CAVE ANIMALS AND THE USE OF TROGLOMORPHISMS IN PHYLOGENETIC RECONSTRUCTION	II	905	25/08/00	10:45	Bol	U	20	3	20
Marques, B. H.	1941	DIVERSITY AND ABUNDANCE OF BEES IN AN ARAUCARIA FOREST OF RIO GRANDE DO SUL, BRAZIL	I	489	23/08/00	16:30	CC		10	PS	10
Marques, C.	2129	WHITEFLIES AND THEIR PARASITOIDS' STATEMENTS IN HORTICULTURAL PROTECTED CROPS IN PORTUGAL	I	537	24/08/00	16:30	CC		11	PS	11
Marques, C.	2757	IPM PROGRAMMES FOR PROTECTED VEGETABLE CROPS (IN OESTE REGION OF PORTUGAL)	II	696	23/08/00	16:30	CC		14	PS	14
Marques, E. S. A.	836	RESOURCE ALLOCATION VERSUS SEASONAL VARIATIONS AND THE COMMUNITY OF GALLING-INSECTS ON THE TROPICAL DIOECIOUS SHRUB BACCHARIS CONCINNA (ASTERACEAE)	I	211	23/08/00	13:45	HB	D	6	5	6
Marques, M. D.	3464	RHYTHMICITY STUDIES OF THE CLEANING TASK PERFORMED BY WORKERS IN SCAPTOTRIGONA AFF DEPILIS (HYMENOPTERA, APIDAE, MELIPONINAE)	II	874	21/08/00	16:30	CC		19	PS	19
Marques, M. I.	3605	ARTHROPODS OBTAINED BY CANOPY FOGGING FROM VOCHYSIADIVERGENS (VOCHYSIACEAE) IN PANTANAL OF BRAZIL	II	910	24/08/00	16:30	CC		20	PS	20
Marques, M. I.	3799	ANALYSIS CLADISTIC OF THE TRIBE RHOPALOPHORINI BLANCHARD, 1845 (COLEOPTERA, CERAMBYCINAE)	II	959	23/08/00	16:30	CC		21	PS	21
Marques, O. M.	3244	EXPERIMENTAL TRANSMISSION OF "STICKY DISEASE" OF PAPAYA BY BEMISIA ARGENTIFOLLI	II	819	25/08/00	16:30	CC		17	PS	17
Marques, R. M.	3155	COMPARATIVE ULTRAMORPHOLOGY OF THE HEART OF DOLICHODERUS AND CAMPONOTUS (FORMICIDAE)	II	796	23/08/00	16:30	CC		16	PS	16
Marquis, R. J.	806	ONTOGENY OF DEFENSE IN THE TEMPERATE ANT-PLANT SYSTEM INVOLVING CHAMAECRISTA FASCICULATA	I	204	24/08/00	14:05	HB	F	6	2	6
Marquis, R. J.	1874	IMPACT OF TIMBER HARVESTING ON INSECT HERBIVORE POPULATIONS OF QUERCUS IN A NORTH AMERICAN TEMPERATE DECIDUOUS FOREST	I	472	25/08/00	13:35	HB	M	10	8	10
Marquis, R. J.	1051	TRITROPHIC EFFECTS OF A LEAFTYING LEPIDOPTERAN AS A KEYSTONE ECOSYSTEM ENGINEER	I	265	23/08/00	16:30	CC		6	PS	6
Marra, F. F. M.	1358	AGRONOMIC EFFICIENCY OF NEW MITICIDES FOR CONTROL OF THE COFFEE LEPROSIS	I	343	23/08/00	16:30	CC		7	PS	7
Marrelli, M. T.	3794	INVESTIGATION OF THE VALIDITY OF SPECIES STATUS OF IXODES DIDELPHIDIS (ACARI: IXODIDAE) USING THE SECOND INTERNAL TRANSCRIBED SPACER (ITS2) OF RIBOSOMAL DNA	II	958	23/08/00	16:30	CC		21	PS	21
Marsden, D. A.	1285	INDUSTRIAL APPROACH FOR MANAGING RESISTANCE TO NOVEL INSECTICIDES A GLOBAL RESISTANCE MONITORING PROGRAM	I	324	25/08/00	16:20	HM	N	7	10	7
Marshall, D.	3122	HIGH RESOLUTION EXTENDED DEPTH OF FOCUS IMAGES FOR ENTOMOLOGY	II	788	21/08/00	16:30	CC		16	PS	16
Marshall, D. J.	50	INTERSPECIFIC PHYSIOLOGICAL DIFFERENTIATION IN MARINE AND TERRESTRIAL HALOZETES SPECIES (ACARI, ORIBATIDA)	I	13	23/08/00	16:30	CC		1	PS	1

Sub-titles: (HB=Hotel Bourbon) - (HM=Hotel Mabu) - (CC=Convention Center) - (Bol=Foz Boulevard) - (PS=Poster Session) - (PL=Plenary Lecturer)

AUTHOR	Nº	TITLE	Book	Page	Date	Time	Local	Room	Session	Symp	New Session
Marshall, D. J.	51	MORPHOLOGICAL DIFFERENCES IN AQUATIC AND TERRESTRIAL SUBANTARCTIC ALGOPHAGUS SPECIES (ACARI: ASTIGMATA)	I	13	23/08/00	16:30	CC		1	PS	1
Marti, S.	2546	CODLING MOTH ADAPTATIONS: HOST AND GEOGRAPHIC RACES	II	643	21/08/00	14:05	HB	B	14	2	14
Martin,	2917	ENGINEERING BLOOD MEAL-ACTIVATED SYSTEMIC IMMUNITY USING FAT BODY-SPECIFIC GENES IN THE MOSQUITO VECTOR	II	736	24/08/00	15:05	Bol	R	15	8	15
Martin, C.	3491	THE EFFECTS OF ELECTRICAL FIELDS ON THE BEHAVIOUR OF ANTS	II	881	22/08/00	16:30	CC		19	PS	19
Martín, C.	514	THE INSECTS COLLECTED BY THE COMISIÓN CIENTÍFICA DEL PACÍFICO: STUDYING BIODIVERSITY THROUGH HISTORICAL COLLECTIONS	I	130					3		3
Martín, C.	513	THE INSECTS COLLECTED BY THE COMISIÓN CIENTÍFICA DEL PACÍFICO: STUDYING BIODIVERSITY THROUGH HISTORICAL COLLECTIONS	I	130	23/08/00	16:30	CC		3	PS	3
Martín, D.	3302	MOLECULAR ASPECTS OF JUVENILE HORMONE ACTION UPON VITELLOGENIN PRODUCTION IN INSECTS	II	834	25/08/00	14:35	HB	K	18	7	18
Martín, J.	1052	SEX RATIO IN THE ADULTS OF THE BUTTERFLY EUPHYDRYAS DESFONTAINII IN CENTRAL SPAIN	I	265	23/08/00	16:30	CC		6	PS	6
Martín, J.	3599	AREAS OF HIGH ENDEMICITY IN THE IBERIAN PENINSULA (SOUTH-WEST EUROPE): ESTIMATION OF POPULATIONS OF OTIORHYNCHUS IN THE PYRENEES (SPAIN)	II	908	23/08/00	16:30	CC		20	PS	20
Martín, J.	4077	PARSIMONY ANALYSIS OF ENDEMICITY AND ITS APPLICATION TO DETECT HIGH ENDEMISM AREAS USING COMBINED DATA FROM INSECTS, VERTEBRATES, AND PLANTS, FROM THE IBERIAN PENINSULA	II	1029	21/08/00	16:30	CC		23	PS	23
Martin, J. H.	253	CURRENT STUDIES ON THE WHITEFLY FAUNA (HOMOPTERA: ALEYRODIDAE) OF THE CANARY ISLANDS (SPAIN)	I	64	22/08/00	16:30	CC		2	PS	2
Martin, L. D.	1144	AN AQUATIC INSECT FAUNA FROM THE SUNDANCE FORMATION (LATE JURASSIC), NORTHERN WYOMING AND SOUTHERN MONTANA, U.S.A.	I	288	24/08/00	16:30	CC		6	PS	6
Martinelli, N. M.	982	SURVEY OF INSECTS IN WEEDS DURING THE OFF-SEASON OF CORN CULTURE	I	248	22/08/00	16:30	CC		6	PS	6
Martinelli, S.	2743	EVALUATION OF INDOXACARB FOR LEPIDOPTEROUS PESTS CONTROL ON VEGETABLES	II	693	22/08/00	16:30	CC		14	PS	14
Martínez, A.	667	COPULATION PHEROMONE OF THE VECTOR OF CHAGAS DISEASE, TRIATOMA infestans: IDENTIFICATION AND BIOASSAY	I	169	22/08/00	16:30	CC		4	PS	4
Martinez, A. P.	3745	A NEW GENUS OF ACANTHOSOMATIDAE (HETEROPTERA) AND THE INMATURE STAGES	II	945	22/08/00	16:30	CC		21	PS	21
Martinez, M.	4088	INVASION OF AEDES AEGYPTI (DIPTERA: CULICIDAE) IN URUGUAY	II	1032	23/08/00	16:30	CC		23	PS	23
Martínez, M.	960	SEEDLINGS AS EPHEMERAL UNDERSTORY IN MANGROVES : IMPACT OF HERBIVORES AND WATER LEVEL ON SEEDLING SURVIVAL	I	242	22/08/00	16:30	CC		6	PS	6
Martinez, S. S.	1255	THE USE OF BOTANICAL INSECTICIDES IN BRAZIL	I	317	24/08/00	10:50	HM	N	7	7	7
Martinez-Carrillo, J. L.	105	IMPLEMENTATION AND ADOPTION OF IPM SYSTEMS	I	27	22/08/00	16:00	HB	A	2	4	2
Martinez, V.	1310	IDENTIFICATION OF A CHEMICAL FRACTION FROM AROMATIC HERBS WITH INSECTICIDAL ACTIVITY AGAINST TRIBOLIUM CASTANEUM (COLEOPTERA, TENEBRIONIDAE)	I	331	21/08/00	16:30	CC		7	PS	7
Martín-Piera, F.	523	PREDICTING SPECIES RICHNESS BY ASSESSING THE SAMPLING EFFORT: THE CASE OF THE IBERIAN DUNG BEETLES (COLEOPTERA SCARABAEINAE)	I	132	23/08/00	16:30	CC		3	PS	3
Martins, D. S.	277	EVALUATION OF SYSTEMIC INSECTICIDE THIAMETHOXAN ON THE VEGETATIVE GROWTH OF DRY BEAN PLANTS	I	70	23/08/00	16:30	CC		2	PS	2
Martins, D. S.	278	EVALUATION OF TWO COFFEE SPECIES AS HOST OF FRUIT FLIES (DIPTERA: TEPHRITIDAE) IN THE ESPÍRITO SANTO STATE, BRAZIL	I	71	23/08/00	16:30	CC		2	PS	2
Martins, D. S.	279	HOST PLANTS OF FRUIT FLIES (DIPTERA: TEPHRITIDAE) IN THE STATE OF ESPÍRITO SANTO, BRAZIL	I	71	23/08/00	16:30	CC		2	PS	2
Martins, D. S.	1360	TONIC EFFECT OF THIAMETHOXAN ON GROWTH OF DRY BEAN PLANT	I	343	24/08/00	16:30	CC		7	PS	7
Martins, D. S.	1325	EFFECT OF THIAMETHOXAN ON BEAN CROP DEVELOPMENT	I	334	22/08/00	16:30	CC		7	PS	7
Martins, G.	2681	FIELD EVALUATION OF SOYBEAN INSECT RESISTANT LINES	II	677	21/08/00	16:30	CC		14	PS	14
Martins, G. F.	3156	A COMPARATIVE STUDY OF THE SPERMATHECA IN BEES (HYMENOPTERA, APOIDEA)	II	796	23/08/00	16:30	CC		16	PS	16
Martins, J. C.	1361	EFFICIENCY OF SEEDS TREATMENTS WITH THIAMETHOXAM TO CONTROL Bemisia argentifolii ON COTTON CROP	I	343	23/08/00	16:30	CC		7	PS	7
Martins, J. C.	1362	SELECTIVITY OF GROWTH REGULATORS, PHOSPHORATES AND PYRETROIDS UPON NATURAL ENEMIES OF PESTS ON SOYBEAN CROP	I	344	23/08/00	16:30	CC		7	PS	7
Martins, J. C.	1363	DIFFERENT FORMULATIONS OF THIAMETHOXAM USED TO CONTROL LARVAE AND ADULTS OF DIABROTICA SPECIOSA ON SMALL POTATO CROP	I	344	23/08/00	16:30	CC		7	PS	7
Martins, J. C.	1410	PULVERIZATIONS WITH THIAMETHOXAM TO CONTROL ADULTS OF DIABROTICA SPECIOSA ON SMALL POTATO CROP	I	356	25/08/00	16:30	CC		7	PS	7
Martins, J. C.	1411	INSECTICIDE THIAMETHOXAM USED ON DIFFERENT FORMULATIONS TO CONTROL MYZUS PERSICAE ON SMALL POTATO CROP	I	356	25/08/00	16:30	CC		7	PS	7
Martins, J. F. da S.	2598	RICE INTEGRATED PEST MANAGEMENT STATUS IN BRAZIL	II	656	25/08/00	11:35	HB	B	14	8	14
Martins, J. F. da S.	2744	FOLIAR SPRAY STRATEGY FOR RATIONAL CHEMICAL CONTROL OF ORYZOPHAGUS ORYZAE ON FLOODED RICE	II	693	23/08/00	16:30	CC		14	PS	14
Martins, J. F. da S.	2745	REDUCTION OF CARBOFURAN INSECTICIDE DOSAGE FOR ORYZOPHAGUS ORYZAE LARVAL CONTROLING AND ENVIRONMENTAL IMPACT EVALUATION IN THE FLOODED RICE ECOSYSTEM	II	693	23/08/00	16:30	CC		14	PS	14
Martins, J. F. da S.	2702	STRATEGY OF SEED TREATMENT FOR RATIONALIZATION OF CHEMICAL CONTROL OF ORYZOPHAGUS ORYZAE ON FLOODED RICE	II	682	22/08/00	16:30	CC		14	PS	14
Martins, J. M. R.	1527	EGG PARASITOIDS OF ANTICARSIA GEMMATALIS (LEPIDOPTERA: NOCTUIDAE) ON SOYBEANS IN BRAZIL.	I	385	22/08/00	16:30	CC		8	PS	8
Martins, L. A.	3974	ACTIVITY OF THE INSECTICIDE/MITICIDE, PYRIDABEN, IN THE CONTROL OF SILVERLEAF WHITEFLY COMPLEX (BEMISIA TABACI - BIOTYPES "A" AND "B") IN SOME MAIN BRAZILIAN CROPS	II	1003	23/08/00	16:30	CC		22	PS	22
Martins, L. H.	2746	MORTALITY OF THE ANTICARSIA GEMMATALIS IN ARTIFICIAL DIET TREATED WITH AQUEOUS EXTRATS OF THE MELIA AZEDARACH	II	693	23/08/00	16:30	CC		14	PS	14
Martins, M.	524	FLIES AS A BIOINDICATOR FOR BIODIVERSITY LOSS IN AGRICULTURAL LANDING USE SYSTEMS	I	133	23/08/00	16:30	CC		3	PS	3
Martins, M.	1780	AGREGGATION, CLUTCH SIZE AND OVIPOSITION BEHAVIOR IN DROSOPHILA PHALERATA	I	448	24/08/00	16:30	CC		9	PS	9
Martins, M. B.	1795	A NEW RECORD AND BREEDING HOST PLANT FOR A SPECIES OF THE D. FLAVOPILOSA GROUP (DROSOPHILIDAE, DROSOPHILA)	I	452	24/08/00	16:30	CC		9	PS	9
Martins, R. D.	250	EFFICIENCY OF THE INSECTICIDE TEMIK 150 (ALDICARB) ON CONTROL OF SHARPSHOOTER VECTORS OF XYLELLA FASTIDIOSA ON CITRUS	I	64	22/08/00	16:30	CC		2	PS	2
Martins, R. L. P.	2998	OCURRENCE OF AEDES ALBOPICTUS IN PORTO VELHO – RONDONIA – BRAZIL	II	756	23/08/00	16:30	CC		15	PS	15
Martins, R. P.	3454	INFLUENCE OF THE PRESENCE OF CARIOCAR BRASILIENSIS (CARIOCARACEAE) ON THE DENSITY OF STINGLESS BEE NESTS (APIDAE: MELIPONINI) IN A SMALL FARM, JANUÁRIA, MG, BRAZIL	II	872	21/08/00	16:30	CC		19	PS	19
Martins, R. P.	1016	COMMUNITY OF INSECTS FROM PAEPALANTHUS BROMELIOIDES: A NEW PHYTOTELMATA PLANT	I	256	23/08/00	16:30	CC		6	PS	6
Martins, R. P.	1973	UTILIZATION OF FLORAL RESOURCES BY MELIPONINEOS (APIDAE:MELIPONINI) IN A FOREST FRAGMENT, BELO HORIZONTE, MG, BRAZIL	I	497	25/08/00	16:30	CC		10	PS	10
Martins, R. P.	1162	BIOLOGY OF ISODONTIA FUSCIPENNIS COMPLEX IN TRAP-NESTS (HYMENOPTERA: SPHECIDAE)	I	293	25/08/00	16:30	CC		6	PS	6
Martins, R. P.	497	COMPOSITION AND RELATIVE ABUNDANCE OF DIPTERAN FAMILIES (EXCLUDING NEMATOCERA AND ACALYPTRATAE) COLLECTED BY MALAISE TRAPS, WITHIN AND OUTSIDE FOREST FRAGMENTS IN TWO DIFFERENT AREAS	I	126	22/08/00	16:30	CC		3	PS	3

Sub-titles: (HB=Hotel Bourbon) - (HM=Hotel Mabu) - (CC=Convention Center) - (Bol=Foz Boulevard) - (PS=Poster Session) - (PL=Plenary Lecturer)

AUTHOR	Nº	TITLE	Book	Page	Date	Time	Local	Room	Session	Symp	New Session
Martins, V. G.	2278	USING PRIMERS DESIGNED FOR AMPLIFICATION OF FLIES'S MITOCHONDRIAL DNA TO AMPLIFY MITOCHONDRIAL DNA FROM TERMITES, WITH PHYLOGENETIC PURPOSE	I	575	23/08/00	16:30	CC		12	PS	12
Martins, V. G.	3488	INVASION OF URBAN BUILDINGS BY THE MOUND BUILDING TERMITE, CORNITERMES CUMULANS (ISOPTERA): REPORT OF TWO CASES OCCURRED IN THE SOUTHEAST OF BRAZIL	II	880	22/08/00	16:30	CC		19	PS	19
Martins, V. J.	2998	OCURRENCE OF AEDES ALBOPICTUS IN PORTO VELHO – RONDONIA – BRAZIL	II	756	23/08/00	16:30	CC		15	PS	15
Martius, C.	395	FACTORS AFFECTING TERMITE DISTRIBUTION AND DIVERSITY IN NATURAL AND MANAGED CENTRAL AMAZONIAN FOREST ECOSYSTEMS	I	100	22/08/00	14:20	HB	C	3	2	3
Martius, C.	525	FACTORS AFFECTING TERMITE DISTRIBUTION AND DIVERSITY IN NATURAL AND MANAGED CENTRAL AMAZONIAN FOREST ECOSYSTEMS	I	133	23/08/00	16:30	CC		3	PS	3
Martius, C.	393	MODELLING THE ROLE OF TERMITES IN THE CARBON CYCLE OF NEOTROPICAL FORESTS	I	100	22/08/00	13:50	HB	C	3	2	3
Marucci, R. C.	3157	OVIPOSITION PATTERNS OF PROCONIINI SHARPSHOOTERS (CICADELLIDAE: CICADELLINAE) IN CITRUS	II	796	23/08/00	16:30	CC		16	PS	16
Marucci, R. C.	3732	TAXONOMIC STATUS AND NOTES ON BIOLOGY OF ACROGONIA FROM CITRUS: ACROGONIA TERMINALIS OR A NEW SPECIES?	II	942	21/08/00	16:30	CC		21	PS	21
Maruyama, W. I.	280	SPATIAL DISTRIBUTION OF ACROGONIA SP., DILOBOPTERUS COSTALIMAI AND ONCOMETOPIA FACIALIS IN BRAZILIAN CITRUS	I	71	23/08/00	16:30	CC		2	PS	2
Marvaldi, A. E.	3623	HIGHER PHYLOGENY OF THE CURCULIONIDAE: EVIDENCE FROM A MOLECULAR AND MORPHOLOGICAL STUDY	II	915	21/08/00	15:20	HB	E	21	2	21
Marwi, M. A.	2951	THE PRESENT OF OPHYRA SPP. (DIPTERA: MUSCIDAE) AS IMPORTANT CLUES IN THE STIMULATION OF POST-MORTEM INTERVAL OF HIGHLY DECOMPOSED BODIES FOUND IN MALASYA	II	745	26/08/00	14:15	Bol	R	15	11	15
Marzorati, G. E.	281	PHYTOPHAGOUS PENTATOMIDS ASSOCIATED WITH DIFFERENT LEGUMINOSAE IN PROVINCE OF BUENOS AIRES, ARGENTINA	I	71	23/08/00	16:30	CC		2	PS	2
Masahito, C. O.	2252	A NOVEL GENE UP-REGULATED DURING RECOVERY FROM COLD-SHOCK IN DROSOPHILA	I	568	22/08/00	16:30	CC		12	PS	12
Masaki, S.	3309	PHOTOPERIOD IN EARLY DEVELOPMENT MODIFIES THE CRITICAL PHOTOPERIOD IN LATE DEVELOPMENT FOR PUPAL DIAPAUSE INDUCTION IN A MOTH	II	836	25/08/00	11:05	HB	K	18	8	18
Masaki, S.	1773	SEASONAL CHANGE IN DAYLENGTH REGULATES INCIDENCE AND INTENSITY OF DIAPAUSE IN A MOTH	I	447	22/08/00	16:30	CC		9	PS	9
Masamdu, R.	2014	PATHOGENS OF TARO BEETLES AND THEIR POTENTIAL USE IN PEST MANAGEMENT IN THE SW PACIFIC	I	508	23/08/00	14:00	HM	P	11	5	11
Mascarenhas, R.	1053	THE SAND-FLEA HISTORY (TUNGA: SIPHONAPTERA)	I	266	23/08/00	16:30	CC		6	PS	6
Mashkey, I. A.	290	HF-ENERGY INFLUENCE ON GRANARY PESTS	I	74	23/08/00	16:30	CC		2	PS	2
Masia, R.	2465	CENTRAL ROLE OF METABOLISM IN ELECTROGENESIS AND EPITHELIAL TRANSPORT IN MALPIGHIAN TUBULES OF THE YELLOW FEVER MOSQUITO AEDES AEGYPTI	II	623	23/08/00	16:30	CC		13	PS	13
Masia, R.	2466	VOLTAGE POLARIZATION OF THE BASOLATERAL MEMBRANE OF PRINCIPAL CELLS IN MALPIGHIAN TUBULES OF THE YELLOW FEVER MOSQUITO AEDES AEGYPTI: ROLE OF THE VACUOLAR H+-ATPASE AT THE APICAL MEMBRANE	II	623	23/08/00	16:30	CC		13	PS	13
Masia, R.	2536	THE MECHANISM OF ACTION OF LEUCOKININ IN MALPIGHIAN TUBULES OF THE YELLOW FEVER MOSQUITO AEDES AEGYPTI: REQUIREMENT OF INTRA- AND EXTRACELLULAR CALCIUM	II	641	25/08/00	16:30	CC		13	PS	13
Masia, R.	2398	TWO ELECTRODE VOLTAGE CLAMP METHODS IN SINGLE PRINCIPAL CELLS OF MALPIGHIAN TUBULES OF AEDES AEGYPTI: VALIDATION OF THE METHOD	II	606	21/08/00	16:30	CC		13	PS	13
Masirov, D.	1342	NOVALURON (RIMON EC-10), A NOVEL IGR FOR CONTROLLING AGRICULTURAL INSECT PESTS	I	339	23/08/00	16:30	CC		7	PS	7
Massad, E.	2173	MODELING THE IMPACT OF GLOBAL WARNING ON VECTOR-BORNE INFECTIONS	I	549	21/08/00	14:05	HB	L	12	2	12
Masters, G. J.	425	INSECTS AS INDICATORS OF SUBTLE, CLIMATE-INDUCED HABITAT FRAGMENTATION	I	108	24/08/00	11:20	HB	C	3	5	3
Masuda, H.	2507	HEME GENERATION AND PROCESSING IN THE MIDGUT LUMEN AND ITS STORAGE IN THE EPITHELIAL CELLS OF THE RHODNIUS PROLIXUS (HEMIPTERA: REDUVIIDAE)	II	633	24/08/00	16:30	CC		13	PS	13
Masui, A.	2726	MODE OF ACTION AND CHARACTARISTICS OF A NOVEL INSECT PEST CONTROL AGENT, CHROMAFENOZIDE	II	688	23/08/00	16:30	CC		14	PS	14
Masui, A.	3961	INSECTICIDAL ACTIVITY OF A NOVEL INSECT PEST CONTROL AGENT, CHROMAFENOZIDE	II	1000	22/08/00	16:30	CC		22	PS	22
Masumoto, M.	3975	RECENT TREND IN INSECT FAUNA DETECTED AT THE PLANT QUARANTINE OF JAPAN	II	1003	23/08/00	16:30	CC		22	PS	22
Masunaga, K.	1054	SPECIATION AND DISPERSAL OF MARINE SHORE DOLICHOPODID FLIES IN EAST ASIA (DIPTERA: DOLICHOPODIDAE, HYDROPHORINAE)	I	266	23/08/00	16:30	CC		6	PS	6
Masuoka, P.	2882	THE INFLUENCE OF DEFORESTATION ON VECTOR-BORNE DISEASES	II	727	22/08/00	10:05	Bol	R	15	3	15
Mateus, M. C.	2747	INTEGRATED CONTROL MANAGEMENT AGAINST THE PEST COMPLEX OF LUCERNE CROPS	II	694	23/08/00	16:30	CC		14	PS	14
Mateus, R. P.	1055	DROSOPHILA FAUNA (DIPTERA, DROSOPHILIDAE) IN THREE XEROPHYTIC AREAS OF SÃO PAULO STATE (BRAZIL)	I	266	23/08/00	16:30	CC		6	PS	6
Mateus, R. P.	1073	OCURRENCE AND FLUCTUATION IN POPULATION SIZE OF A RECENTLY INTRODUCED DROSOPHILIDAE SPECIES IN BRAZIL	I	271	23/08/00	16:30	CC		6	PS	6
Mathiopoulos, K. D.	2279	ODYSSEUS, A NOVEL TRANSPOSON INVOLVED IN THE GENERATION OF CHROMOSOMAL INVERSIONS IN THE MALARIA MOSQUITO ANOPHELES ARABIENSIS	I	575	23/08/00	16:30	CC		12	PS	12
Mathiopoulos, K. D.	3976	A CENTROMERE-SPECIFIC CLONE IN THE MEDFLY, CERATITIS CAPITATA	II	1003	24/08/00	16:30	CC		22	PS	22
Mathiopoulos, K. D.	787	MICROSATELLITE MARKERS OF TWO AGRICULTURAL PESTS, THE MEDFLY, CERATITIS CAPITATA AND THE OLIVE FLY, BACTROCERA OLEAE	I	199	22/08/00	16:30	CC		5	PS	5
Mathiopoulos, K.D.	2358	GENOMIC STRUCTURE AND ECDYSONE REGULATION OF THE PROPHENOLOXIDASE 1 GENE IN THE MALARIA VECTOR ANOPHELES GAMBIAE	II	596	23/08/00	14:20	HB	I	13	5	13
Mathis, W. N.	3663	A PHYLOGENETIC STUDY OF THE TRIBE DRYXINI (DIPTERA: EPHYDRIDAE)	II	925	24/08/00	11:05	HB	E	21	6	21
Matioli, A. L.	1056	SAMPLING AND POPULATION DISTRIBUTION OF MITES FROM STIGMAEIDAE FAMILY IN CITRUS ORCHARDS IN SÃO PAULO STATE	I	266	23/08/00	16:30	CC		6	PS	6
Matioli, A. L.	1057	FOOD PREFERENCE OF AGISTEMUS AFF. BAKERI (ACARI: STIGMAEIDAE)	I	267	23/08/00	16:30	CC		6	PS	6
Matioli, A. L.	58	ACTION OF THIAMETHOXAN ON THE POPULATION DYNAMICS OF THE BROAD MITE Polyphagotarsonemus latus (Banks) ON COTTON AND ITS SELECTIVITY TO PREDATOR MITE Eusetus concordis (Chant).	I	15	25/08/00	16:30	CC		1	PS	1
Matok, H.	737	APHID ENZYMES INVOLVED IN DETOXICATION OF CEREAL ALLELOCHEMICALS	I	186	25/08/00	16:30	CC		4	PS	4
Matok, H.	735	FEEDING BEHAVIOUR OF PEA APHID ON ALFALFA	I	186	23/08/00	16:30	CC		4	PS	4
Matos, L. F.	3343	A NEW ARTIFICIAL DIET REDUCES THE DEVELOPMENTAL TIME OF HYLOBIUS TRANSVERSOVITTATUS BY A FACTOR OF FIVE	II	844	23/08/00	16:30	CC		18	PS	18
Matrangolo, W. J. R.	3232	OCCURRENCE OF SHARPSHOTER IN CITRUS ORCHARDS AFFECTED BY CVC IN NORTH COAST OF BAHIA AND SOUTH OF SERGIPE STATE, BRAZIL	II	816	23/08/00	16:30	CC		17	PS	17
Matsubara, F.	3556	AN INVITATION: MORE FRESH COCOONS FOR A COMPLETELY NEW USE OF SERICIN AND FIBROIN AND SILKWORM PUPAE, AN URGENT NEED FOR A NEW INDUSTRIAL SYSTEM OF SERICULTURE IN THE 21ST CENTURY	II	897	25/08/00	16:30	CC		19	PS	19
Matsuda, K.	706	SUITABILITY OF SEVERAL RUTACEOUS PLANTS FOR A PAPILIONID BUTTERFLY, PAPILIO POLYTES	I	178	24/08/00	16:30	CC		4	PS	4

Sub-titles: (HB=Hotel Bourbon) - (HM=Hotel Mabu) - (CC=Convention Center) - (Bol=Foz Boulevard) - (PS=Poster Session) - (PL=Plenary Lecturer)

AUTHOR	N°	TITLE	Book	Page	Date	Time	Local	Room	Session	Symp	New Session
Matsui, M.	2505	CHARACTERIZATION OF A RECOMBINANT INSECT CHITINASE AND A BACULOVIRUS CHITINASE	II	633	24/08/00	16:30	CC		13	PS	13
Matsuki, M.	1888	INSECT RESISTANCE IN EUCALYPTUS GLOBULUS TO ACUTE AND CHRONIC INSECT DAMAGE IN AUSTRALIA	I	476	26/08/00	14:05	HB	M	10	10	10
Matsumoto, M.	3557	PHOTOPERIODIC CLOCK-ENDOCRINE SWITCH AXIS IN DIAPAUSE REGULATION IN SILKMOTH	II	897	24/08/00	16:30	CC		19	PS	19
Matsumoto, S.	597	MOLECULAR MECHANISM OF SEX PHEROMONE PRODUCTION IN THE SILKWORM, BOMBYX MORI	I	151	23/08/00	10:00	Bol	S	4	4	4
Matsumura, M.	2615	GROWTH STAGE-DEPENDENT RESISTANCE OF RICE PLANT TO THE WHITEBACKED PLANTHOPPER	II	661	21/08/00	16:30	CC		14	PS	14
Matsumura, M.	1058	ASYMMETRIC INTERSPECIFIC INTERACTION ON WING DIMORPHISM BETWEEN RICE PLANTHOPPERS, SOGATELLA FURCIFERA AND NILAPARVATA LUGENS	I	267	23/08/00	16:30	CC		6	PS	6
Matsunaru, M.	3264	RELATIONSHIPS BETWEEN THE LOCATION AND THE RADIATION SENSITIVITY OF RETROTRANSPOSONS IN THE GENOME AND THE INSERTION MECHANISM	II	824	22/08/00	10:20	HB	K	18	2	18
Matsuoka, T.	3313	ECDYSTEROID CONTROL OF WING MORPHOGENESIS DURING METAMORPHOSIS AND PUPAL DEVELOPMENT	II	837	23/08/00	16:30	CC		18	PS	18
Matsumura, Y.	3264	RELATIONSHIPS BETWEEN THE LOCATION AND THE RADIATION SENSITIVITY OF RETROTRANSPOSONS IN THE GENOME AND THE INSERTION MECHANISM	II	824	22/08/00	10:20	HB	K	18	2	18
Matsuyama, S.	694	SEMIOCHEMICALS INDUCING DEFENSIVE BEHAVIOR OF APIS CERANA JAPONICA AGAINST VESPA MANDARINA	I	175	23/08/00	16:30	CC		4	PS	4
Matthaeis, E. De	3785	A PHYLOGENETIC STUDY IN THE CAVE CRICKET GENUS TROGLOPHILUS (ORTHOPTERA, RAPHIDOPHORIDAE): COMBINING ALLOZYMIC AND MITOCHONDRIAL DNA SEQUENCE VARIATION DATA	II	955	23/08/00	16:30	CC		21	PS	21
Matthiessen, J. N.	1059	UTILISATION OF UNIQUE ATTRIBUTES OF LARVAL WHITEFRINGED WEEVIL FOR BIOASSAYING TOXICITY OF PURE AND PLANT-DERIVED FUMIGANT COMPOUNDS	I	267	23/08/00	16:30	CC		6	PS	6
Matthiessen, J. N.	1889	THE CHALLENGES OF SOIL-DWELLING SCARABS AS PESTS OF EUCALYPTS	I	476	26/08/00	14:20	HB	M	10	10	10
Matthiessen, J. N.	2748	MANAGEMENT OF A SOIL INSECT PEST WITH FUMIGANT - A UNIQUE CHALLENGE TO ADOPTION OF IPM	II	694	24/08/00	16:30	CC		14	PS	14
Mathysen, I.	2741	THE BLACK COTTON BEETLE, SYAGRUS RUGIFRONS BALY (CHRYSOMELIDAE: COLEOPTERA): ITS IMPACT ON COTTON PRODUCTION IN SOUTH AFRICA AND PROBLEMS PERTAINING TO INTEGRATED PEST MANAGEMENT	II	692	23/08/00	16:30	CC		14	PS	14
Mattoccia, M.	3116	FLUCTUATING ASYMMETRY, MATING SUCCESS, BODY SIZE AND HETEROZYGOSITY IN MALES OF COENAGRION SCITULUM (ODONATA: COENAGRIONIDAE)	II	786	21/08/00	16:30	CC		16	PS	16
Mattos, M. A. A.	1371	CONTROL OF BEAN LEAFHOPPER EMPOASCA KRAEMERI (HEMIPTERA: CICADELLIDAE) WITH THIAMETHOXAM ON COWPEA	I	346	22/08/00	16:30	CC		7	PS	7
Mattos, M. A. A.	2714	CONTROL OF POTATO LEAFHOPPER EMPOASCA KRAEMERI (HEMIPTERA: CICADELLIDAE) WITH THIAMETHOXAM ON COWPEA	II	685	23/08/00	16:30	CC		14	PS	14
Mattos, M. L. T.	2745	REDUCTION OF CARBOFURAN INSECTICIDE DOSAGE FOR ORYZOPHAGUS ORYZAE LARVAL CONTROLING AND ENVIRONMENTAL IMPACT EVALUATION IN THE FLOODED RICE ECOSYSTEM	II	693	23/08/00	16:30	CC		14	PS	14
Matuo, T.	31	MODEL FOR OPTIMISATION OF THE WORKRATE OF AIRBLAST SPRAYERS ON CONTROL OF BREVIPALPUS PHOENICIS	I	8	22/08/00	16:30	CC		1	PS	1
Matuo, T.	32	MODEL FOR REDUCTION OF THE COSTS AND ENVIRONMENTAL IMPACTS ON THE CONTROL OF BREVIPALPUS PHOENICIS	I	8	22/08/00	16:30	CC		1	PS	1
Matuyama, S.	724	BIOLOGICAL ACTIVITY OF WORKER MANDIBULAR ACIDS IN APIS CERANA AND APIS MELLIFERA	I	183	25/08/00	16:30	CC		4	PS	4
Mau, R. F. L.	3977	ESTABLISHING A SUSTAINABLE MANAGEMENT PROGRAM FOR DIAMONDBACK MOTH	II	1004	23/08/00	16:30	CC		22	PS	22
Mavragani-Tsipidou, P.	787	MICROSATELLITE MARKERS OF TWO AGRICULTURAL PESTS, THE MEDFLY, CERATITIS CAPITATA AND THE OLIVE FLY, BACTROCERA OLEAE	I	199	22/08/00	16:30	CC		5	PS	5
Mavrikakis, P. G.	3978	CERATITIS CAPITATA OVERWINTERING IN MEDITERRANEAN CLIMATE	II	1004	24/08/00	16:30	CC		22	PS	22
May, J. E.	3410	INFLUENCE OF ARGENTINE AND COASTAL BROWN ANT (HYMENOPTERA: FORMICIDAE) INVASIONS ON RICHNESS AND SPECIES COMPOSITION OF ANTS IN GARDENS IN PERTH, AUSTRALIA	II	861	22/08/00	11:05	HM	Q	19	2	19
May, M. L.	3158	MORPHOLOGY AND EVOLUTION OF THE SECONDARY GENITALIA OF LIBELLULOIDEA (ODONATA: ANISOPTERA)	II	797	23/08/00	16:30	CC		16	PS	16
May, M. L.	3800	PHYLOGENY OF ENALLAGMA (ODONATA: COENAGRIONIDAE) AND RELATED GENERA	II	959	24/08/00	16:30	CC		21	PS	21
Maywald, G. F.	762	PEST MANAGEMENT INFORMATION IN AUSTRALIA	I	192	23/08/00	10:35	Bol	T	5	4	5
Maywald, G. F.	782	MINING GEOGRAPHICAL DATA FOR BIOLOGICAL INFORMATION	I	197	25/08/00	10:05	Bol	T	5	6	5
Maywald, G. F.	3990	INTEGRATION OF GLOBAL CHANGE IMPACTS	II	1007	24/08/00	16:30	CC		22	PS	22
Maywald, G. F.	2876	VULNERABILITY OF LIVESTOCK TO ARTHROPOD PARASITES AND VECTOR-BORNE DISEASES UNDER GLOBAL CHANGE	II	726	21/08/00	14:05	Bol	R	15	2	15
Mazalov, Y. P.	290	HF-ENERGY INFLUENCE ON GRANARY PESTS	I	74	23/08/00	16:30	CC		2	PS	2
Mazaud, F.	4040	THE INFORMATION NETWORK ON POST HARVEST OPERATIONS, INPHO AND THE DISSEMINATION OF INFORMATION ON TRADITIONAL AND CURRENT STORED OF AGRICUTURAL PRODUCTS AT THE RURAL LEVEL	II	1020	23/08/00	15:15	HB	J	23	7	23
Mazurkiewicz, M.	3344	INTERCELLULAR CYTOPLASMIC TRANSPORT DURING OOGENESIS OF A MOTH MIDGE, TINEARIA ALTERNATA (DIPTERA: PSYCHODIDAE)	II	844	24/08/00	16:30	CC		18	PS	18
Mazzeo, G.	331	SCALE INSECTS OF CITRUS IN ITALY (HOMOPTERA COCCOIDEA)	I	84	24/08/00	16:30	CC		2	PS	2
Mazzini, M.	2467	CELL DIFFERENTIATION OF THE FOLLICULAR EPITHELIUM IN STICK INSECT OVARIOLES	II	623	23/08/00	16:30	CC		13	PS	13
Mazzini, M.	3037	OVARIAN FOLLICLE DIFFERENTIATION IN INSECT OVARIOLES	II	766	21/08/00	11:30	HB	G	16	1	16
Mazzini, M.	3102	COMPARATIVE SPERMATOLOGY IN PLECOPTERA	II	783	26/08/00	15:45	HB	G	16	9	16
Mazzonetto, F.	2749	RESISTANCE OF BEAN GENOTYPES TO ZABROTES SUBFASCIATUS (COLEOPTERA: BRUCHIDAE)	II	694	23/08/00	16:30	CC		14	PS	14
Mazzonetto, F.	4052	EFFECT OF POWDERS FROM VEGETAL SPECIES ON ZABROTES SUBFASCIATUS (COLEOPTERA: BRUCHIDAE) IN STORED BEAN	II	1023	22/08/00	16:30	CC		23	PS	23
Mazzoni, E.	1299	RELATIONSHIP BETWEEN EXPRESSION, AMPLIFICATION AND METHYLATION OF FE4 GENE IN MYZUS PERSICAE (HOMOPTERA, APHIDIDAE)	I	328	21/08/00	16:30	CC		7	PS	7
Mazzucconi, S. A.	1060	A REVIEW OF THE SOUTH AMERICAN NOTONECTA (PARANECTA), INCLUDING N. INCA NEW SPECIES FROM PERU (HETEROPTERA: NOTONECTIDAE)	I	267	23/08/00	16:30	CC		6	PS	6
Mazzucconi, S. A.	1061	VELIIDAE FROM ARGENTINA (HETEROPTERA): A PRELIMINAR LIST	I	268	23/08/00	16:30	CC		6	PS	6
Mc Coy, C. W.	1579	PARASITISM AND PERSISTENCE IN THE FIELD OF ENTOMOPATHOGENIC NEMATODES AND OTHER NATURAL ENEMIES OF THE LARVAE DIAPREPES ABBREVIATUS (COLEOPTERA: CURCULIONIDAE).	I	398	23/08/00	16:30	CC		8	PS	8
Mc Elfresh, S.	730	PHEROMONES SYSTEM OF LEPTOGLOSSUS ZONATUS (HETEROPTERA:COREIDAE)	I	184	24/08/00	16:30	CC		4	PS	4
McBrien, H. L.	585	IDENTIFICATION OF SEX PHEROMONES OF ECONOMICALLY IMPORTANT STINK BUG PESTS OF AGRICULTURE	I	148	22/08/00	10:35	Bol	S	4	2	4
McCarroll, L.	1311	CHARACTERISATION OF AMPLIFIED ALDEHYDE OXIDASES FROM INSECTICIDE RESISTANT CULEX QUINQUEFASCIATUS	I	331	21/08/00	16:30	CC		7	PS	7
McCarroll, L.	2999	COMPARISON OF VECTORIAL CAPACITY IN INSECTICIDE RESISTANT AND SUSCEPTIBLE CULEX QUINQUEFASCIATUS FROM FILARIASIS ENDEMIC SRI LANKAN FIELD POPULATIONS	II	757	23/08/00	16:30	CC		15	PS	15
McClellan, Q. C.	652	THE SOUTHERN PINE BEETLE INTERNET CONTROL CENTER: AN INTERACTIVE INTEGRATED PEST MANAGEMENT WEB-SITE	I	165	24/08/00	16:30	CC		4	PS	4

Sub-titles: (HB=Hotel Bourbon) - (HM=Hotel Mabu) - (CC=Convention Center) - (Bol=Foz Boulevard) - (PS=Poster Session) - (PL=Plenary Lecturer)

AUTHOR	Nº	TITLE	Book	Page	Date	Time	Local	Room	Session	Symp	New Session
McCombs, S. D.	2219	FRUIT FLY TRANSFORMATION WITH PIGGYBAC: PERSPECTIVES AND CONSIDERATIONS	I	560	25/08/00	14:35	HB	L	12	10	12
McCoy, L. M.	3518	GENETIC MECHANISMS CONTRIBUTING TO DIFFERENCES IN COLONY GROWTH RATES BETWEEN AFRICAN AND EUROPEAN HONEY BEES	II	888	23/08/00	16:30	CC		19	PS	19
McCutcheon, G. S.	350	WHITEFLIES (HOMOPTERA: ALEYRODIDAE) ON SPECIES OF MEDICINAL HERBAL PLANTS	I	89	25/08/00	16:30	CC		2	PS	2
McCutcheon, G. S.	2750	ARTHROPODS ASSOCIATED WITH DOUBLECROPPED SOYBEAN	II	694	23/08/00	16:30	CC		14	PS	14
McDonald, P. T.	1268	BIFENAZATE (D2341), A NOVEL AGENT TO CONTROL SPIDER MITES	I	320	25/08/00	9:35	HM	N	7	9	7
McGeoch, M. A.	378	REPRESENTATION, PREDICTABILITY AND ROBUSTNESS IN ECOLOGY: IMPLICATIONS FOR BIOINDICATION	I	96	21/08/00	10:35	HB	C	3	1	3
McGeoch, M. A.	414	TESTING AN ECOLOGICAL BIOINDICATOR SYSTEM: DUNG BEETLES IN NORTHERN KWAZULU-NATAL, SOUTH AFRICA	I	105	23/08/00	14:35	HB	C	3	4	3
McGeoch, M. A.	419	SUMMARY: SCIENTIFIC APPROACHES TO BIOINDICATION.	I	106	23/08/00	16:05	HB	C	3	4	3
McGeoch, M. A.	3497	A NATIONAL PERSPECTIVE OF FOREST TREE PESTS IN SOUTH AFRICA	II	883	23/08/00	16:30	CC		19	PS	19
McGlynn, T. P.	3407	HUMAN COMMENSALISM AND ECOLOGICAL INVASIONS OF NORTH AMERICAN EXOTIC ANTS	II	860	22/08/00	10:20	HM	Q	19	2	19
McGregor, A.	3929	THE TECHNOLOGY AND ECONOMICS OF FRUIT FLY ERADICATION IN PACIFIC ISLAND COUNTRIES	II	992	26/08/00	11:00	HB	H	22	8	22
McGuire, M. R.	3893	FORMULATION AND APPLICATION OF BIOPESTICIDES	II	983	24/08/00	13:30	HB	J	22	4	22
McGuire, M. R.	264	APPLICATION OF BIODEGRADABLE, SUGAR-STARCH SPHERES TREATED WITH REDUCED-RISK INSECTICIDES FOR MANAGEMENT OF KEY RHAGOLETIS SPECIES	I	67	23/08/00	16:30	CC		2	PS	2
McHugh, J. V.	3640	THE INFLUENCE OF DATA BASED ON BEHAVIOR AND THE MORPHOLOGY OF VARIOUS DEVELOPMENTAL STAGES IN A PHYLOGENETIC ANALYSIS OF EROTYLIDAE (COLEOPTERA)	II	919	22/08/00	14:50	HB	E	21	4	21
McInnis, D. O.	3880	GENETIC CONTROL OF FRUIT FLY PESTS: FUTURE FEATS OR FANTASIES	II	979	22/08/00	10:20	HB	H	22	2	22
McIntosh, , R. L.	677	HINOTERMES MARGINALIS OLFACTORY RESPONSES BY MONOCHAMUS CLAMATOR, MONOCHAMUS SCUTELLATUS AND MONOCHAMUS OBTUSUS (COLEOPTERA: CERAMBYCIDAE) TO BARK BEETLE PHEROMONES	I	171	23/08/00	16:30	CC		4	PS	4
McIntosh, R.	1853	MECHANISMS OF RESISTANCE IN TREES TO SHOOT INSECTS	I	467	24/08/00	10:20	HB	M	10	5	10
McKenna, D. D.	1062	IMPLICATIONS OF DEPRESSARIA (LEPIDOPTERA: OECOPHORIDAE) AND HOST-PLANT PHYLOGENIES FOR DEPRESSARIA SPP. DISTRIBUTION, HOST-USAGE, ECOLOGY, AND SPECIATION	I	268	23/08/00	16:30	CC		6	PS	6
McKenzie, J. A.	1258	GENETIC PRINCIPLES AND THE EVOLUTION OF INSECTICIDE RESISTANCE	I	318	24/08/00	13:35	HM	N	7	8	7
Mckenzie, L.	2280	IDENTIFICATION OF TEPHRITID FRUIT FLIES USING rRNA GENES	I	575	23/08/00	16:30	CC		12	PS	12
McLean, H.	2461	A HIGH-AFFINITY OCTOPAMINE/TYRAMINE TRANSPORTER CLONED FROM THE INSECT CENTRAL NERVOUS SYSTEM	II	622	23/08/00	16:30	CC		13	PS	13
McLean, S.	637	SELECTION OF TROPICAL STEM BORERS FOR RESISTANCE TO CRYIAB IN MAIZE	I	161	21/08/00	16:30	CC		4	PS	4
McLean, S.	638	BIOCHEMICAL BASIS FOR STORAGE PEST RESISTANCE IN MAIZE.	I	161	21/08/00	16:30	CC		4	PS	4
McMahon, C.	2438	RESPONSES OF THE TROPICAL BONT TICK AMBLYOMMA VARIEGATUM TO ITS AGGREGATION-ATTACHMENT-PHEROMONE AND TO HOST ODOUR ON A SERVOSPHERE	II	616	22/08/00	16:30	CC		13	PS	13
McMillin, J. D.	1859	DEPLOYMENT OF TREE RESISTANCE TO INSECTS IN SHORT- ROTATION BIOMASS PLANTATIONS	I	469	24/08/00	14:05	HB	M	10	6	10
McMillin, J. D.	1942	IMPACTS OF DOUGLAS-FIR BEETLE ON FOREST OVERSTORY AND UNDERSTORY CONDITIONS OF THE GREATER YELLOWSTONE AREA	I	489	23/08/00	16:30	CC		10	PS	10
McMillin, J. D.	1943	USDA FOREST SERVICE FOREST HEALTH PROTECTION INTERNATIONAL PARTNERSHIPS AND ACTIVITIES	I	490	23/08/00	16:30	CC		10	PS	10
McNabb, S.	2523	THE USE OF DROSOPHILA TO STUDY THE CONTROL PATHWAYS FOR EXOGENOUS AND ENDOGENOUS COMPONENTS OF THE ECDYSIS RHYTHM	II	637	25/08/00	16:30	CC		13	PS	13
McNabb, S.	3273	THE USE OF DROSOPHILA TO STUDY THE CONTROL PATHWAYS FOR EXOGENOUS AND ENDOGENOUS COMPONENTS OF THE ECDYSIS RHYTHM	II	827	23/08/00	14:50	HB	K	18	3	18
McNamara, N.	1257	THE UPTAKE OF BOTANICAL INSECTICIDES BY FARMERS: A CASE STUDY OF TOBACCO BASED PRODUCTS IN NIGERIA	I	317	24/08/00	11:20	HM	N	7	7	7
McPheron, B. A.	2281	THE MEDITERRANEAN FRUIT FLY IN THE US: POPULATION STRUCTURE INFERRED FROM MITOCHONDRIAL DNA AND MICROSATELLITE ANALYSES	I	576	23/08/00	16:30	CC		12	PS	12
McPherson, R. M.	2568	IPM SYSTEMS FOR SOYBEAN IN THE SOUTHERN USA: SUCCESSES AND CHALLENGES	II	649	22/08/00	15:20	HB	B	14	4	14
Meats, A.	2337	TRACKING AUSTRALIAN FRUIT FLIES USING MICROSATELLITES	I	590	25/08/00	16:30	CC		12	PS	12
Meats, A. W.	88	USE OF A DATABASE AND GEOGRAPHIC INFORMATION SYSTEM TO MONITOR A FRUIT FLY ERADICATION PROGRAM	I	23	21/08/00	14:35	HB	A	2	2	2
Mechaber, W. L.	669	IDENTIFICATION OF HOSTPLANT VOLATILES ATTRACTIVE TO THE SPHINX MOTH, MANDUCA SEXTA	I	169	22/08/00	16:30	CC		4	PS	4
Mechi, M. R.	3460	RELATIVE ABUNDANCE AND EXPLOITATION OF AVAILABLE RESOURCES BY APID BEES (HYMENOPTERA: APOIDEA) IN AN URBANIZED AREA	II	873	21/08/00	16:30	CC		19	PS	19
Mecke, R.	1944	NEW RECORDS OF COLEOPTERA AND HYMENOPTERA FROM ARAUCARIA ANGUSTIFOLIA TREES IN THE SOUTH OF BRAZIL	I	490	23/08/00	16:30	CC		10	PS	10
Mecke, R.	3159	THE WEEVIL GENUS ARAUCARIUS (CURCULIONIDAE, COSSONINAE) - NEW INVESTIGATION OF AN UNUSUAL TIBIAL STRUCTURE	II	797	24/08/00	16:30	CC		16	PS	16
Medal, J.	2064	SAFETY OF GRATIANA BOLIVIANA AS A BIOCONTROL AGENT OF TROPICAL SODA APPLE (SOLANUM VIARUM): IS EGGPLANT A SUITABLE HOST?	I	521	22/08/00	16:30	CC		11	PS	11
Medal, J. C.	1580	CLASSICAL BIOLOGICAL CONTROL OF SOLANUM VIARUM (SOLANACEAE) IN THE USA	I	398	23/08/00	16:30	CC		8	PS	8
Medeiros , A. C. S.	1961	INSECTS ASSOCIATED WITH SEEDS OF THREE NATIVE SPECIES OF BRAZILIAN ATLANTIC FOREST	I	494	24/08/00	16:30	CC		10	PS	10
Medeiros, A. H.	521	OCCURENCE OF LEAF-CUTTING ANTS IN DIFFERENT REGIONS OF RIO GRANDE DO SUL STATE	I	132	23/08/00	16:30	CC		3	PS	3
Medeiros, A. C. S.	1963	SEED PREDATION BY CTENOCOLUM CROTONAE (COLEOPTERA:BRUCHIDAE) IN LONCHOCARPUS MUEHLBERGIANUS (LEGUMINOSAE)	I	495	24/08/00	16:30	CC		10	PS	10
Medeiros, F. A. S. B.	2670	MELON RESPONSE TO SILVERLEAF WHITEFLY INJURY	II	674	22/08/00	16:30	CC		14	PS	14
Medeiros, L.	1781	LIVING ON A HAIRY SURFACE: MOVEMENT AND FEEDING BEHAVIOR OF GRATIANA SPADICEA (COL.:CHRYSOMELIDAE: CASSIDINAE) ON ITS HOST PLANT SOLANUM SISYMBRIIFOLIUM (SOLANACEAE)	I	449	23/08/00	16:30	CC		9	PS	9
Medeiros, M. A.	1581	CONTROL OF THE SOUTH AMERICAN TOMATO PINWORM IN GLASSHOUSE WITH T. PRETIOSUM: BIOLOGICAL AND ECONOMICAL EFFICIENCY	I	399	23/08/00	16:30	CC		8	PS	8
Medeiros, M. A.	2751	DIAMONDBACK MOTH POPULATION DYNAMICS AND PARASITOID SURVEY IN THE FEDERAL DISTRICT, BRAZIL	II	695	24/08/00	16:30	CC		14	PS	14
Medeiros, M. A.	2647	USE OF INSECTICIDES FOR CONTROLLING THE BRAZILIAN TOMATO PINWORM AND THE DIAMONDBACK MOTH IN THE FEDERAL DISTRICT, BRAZIL: A CASE STUDY	II	669	22/08/00	16:30	CC		14	PS	14
Medeiros, M. O.	1063	INFLUENCE OF WATER BALANCE ON THE POPULATION DYNAMICS OF THE BURROWING BUG ATARSOCORIS BRACHIARIAE (HEMIPTERA: CYDNIDAE)	I	268	23/08/00	16:30	CC		6	PS	6
Medeiros, M. O.	1064	INFLUENCE OF PRECIPITATION VOLUME AND SOIL TEMPERATURE ON THE POPULATION DYNAMICS OF THE BURROWING BUG ATARSOCORIS BRACHIARIAE (HEMIPTERA: CYDNIDAE)	I	268	23/08/00	16:30	CC		6	PS	6
Medeiros, M. O.	3345	LIFE HISTORY OF THE BURROWING BUG, ATARSOCORIS BRACHIARIAE (HEMIPTERA: CYDNIDAE) ON BRACHIARIA DECUMBENS PLANTS	II	845	25/08/00	16:30	CC		18	PS	18
Medeiros, M. O.	3367	METAMORPHOSIS IN THE BURROWING BUG, ATARSOCORIS BRACHIARIAE (HEMIPTERA: CYDNIDAE)	II	850	25/08/00	16:30	CC		18	PS	18

Sub-titles: (HB=Hotel Bourbon) - (HM=Hotel Mabu) - (CC=Convention Center) - (Bol=Foz Boulevard) - (PS=Poster Session) - (PL=Plenary Lecturer)

AUTHOR	Nº	TITLE	Book	Page	Date	Time	Local	Room	Session	Symp	New Session
Medeiros, M. O.	3160	MORPHOLOGICAL ASPECTS OF THE EGG, 1ST AND 5TH NYMPHAL INSTARS OF THE BURROWING BUG, ATARSOCORIS BRACHIARIAE (HEMIPTERA: CYDNIDAE)	II	797	22/08/00	16:30	CC		16	PS	16
Medeiros, R. B.	3211	IDENTIFICATION OF A PLANT VIRUS RECEPTOR IN THE INSECT VECTOR CELLS	II	811	22/08/00	13:35	Bol	U	17	2	17
Medeiros, S. S. A.	1582	BIOLOGICAL ASPECTS OF PODISUS NIGRISPINUS (HETEROPTERA: PENTATOMIDAE) BEING AS PREY SPODOPTERA FRUGIPERDA (LEPIDOPTERA: NOCTUIDAE)	I	399	23/08/00	16:30	CC		8	PS	8
Medina, A. I.	477	AQUATIC INSECT BIODIVERSITY IN STREAMS OF DIFFERENT BASINS AT A REGIONAL SCALE	I	121	21/08/00	16:30	CC		3	PS	3
Medina, V.	3213	BIOLOGY OF CRINIVIRUSES AND WHITEFLY-TRANSMISSION	II	811	22/08/00	14:30	Bol	U	17	2	17
Medina, Z. J.	2801	INTEGRATED BIOLOGICAL CONTROL OF WHITE FLIES (BEMISIA TABACI) IN OAXACA, MEXICO	II	707	24/08/00	16:30	CC		14	PS	14
Meersschaut, D. Van Den	567	BEETLE DIVERSITY AND FOREST CHARACTERISTICS IN FLANDERS (BELGIUM)	I	143	25/08/00	16:30	CC		3	PS	3
Mehrnejad, M. R.	282	THE COMMON PISTACHIO PSYLLA, THE MAJOR PISTACHIO PEST IN IRAN	I	72	24/08/00	16:30	CC		2	PS	2
Mehrnejad, M. R.	1583	THE COCCINELLID BEETLE, OENOPIA CONGLOBATA, AN IMPORTANT PREDATOR OF THE COMMON PISTACHIO PSYLLA	I	399	23/08/00	16:30	CC		8	PS	8
Meien, O. F. von	2002	FUNDAMENTAL ISSUES THAT LIMIT SCALE UP OF FUNGAL BIOPESTICIDES USING SOLID STATE FERMENTATION PROCESSES	I	505	22/08/00	10:50	HM	P	11	3	11
Meignin, C.	2211	ZAM, A RETROVIRUS FROM DROSOPHILA MELANOGASTER	I	558	24/08/00	15:35	HB	L	12	8	12
Meijerink, J.	2870	OLFACTORY RECEPTORS OF THE MALARIA MOSQUITO ARE SENSITIVE TO HUMAN SWEAT COMPONENTS	II	724	21/08/00	10:20	Bol	R	15	1	15
Meijerink, J.	644	POSSIBLE ROLE OF AMMONIA IN HOST-SEEKING BEHAVIOR OF BLOOD-FEEDING INSECTS	I	163	25/08/00	11:35	Bol	R	4	9	15
Meijerman, L.	788	COMPUTER-ASSISTED TOOLS FOR THE SPECIES RECOGNITION OF ECONOMICALLY IMPORTANT INSECTS AND MITES	I	199	22/08/00	16:30	CC		5	PS	5
Meikle, W. G.	4037	MODELLING AS A TOOL FOR INTEGRATED PEST MANAGEMENT IN THE RURAL MAIZE STORE ECOSYSTEM	II	1019	23/08/00	13:45	HB	J	23	7	23
Meikle, W. G.	4047	SIMPLE EVALUATION PROCEDURES AS IPM TOOLS FOR STORED MAIZE IN WEST AFRICA	II	1022	24/08/00	10:45	HB	J	23	8	23
Meikle, W. G.	4018	ANALYSING THE IMPACT OF TERETRIUS NIGRESCENS ON PROSTEPHANUS TRUNCATUS IN MAIZE STORES IN WEST AFRICA	II	1015	22/08/00	10:30	HB	J	23	3	23
Meiners, T.	695	SEX AND CRIME IN A BEETLE: FEMALE CHOICE AND DEADLY MALE - MALE AGGRESSION IN MALACHIUS BIPUSTULATUS	I	176	24/08/00	16:30	CC		4	PS	4
Meiners, T.	1472	THE ROLE OF INDUCED PLANT VOLATILES FOR EGG PARASITOIDS AND THEIR POTENTIAL FOR SEMIOCHEMICAL CONTROL	I	371	26/08/00	10:35	HM	O	8	8	8
Meiners, T.	4129	CHEMICAL SIGNALLING BETWEEN HOST PLANT AND EGG PARASITOID OF A GALERUCINE LEAF BEETLE	II	1043	25/08/00	14:20	HM	P	24	2	24
Meiners, T.	696	THE ROLE OF INDUCED PLANT VOLATILES FOR EGG PARASITOIDS AND THEIR POTENTIAL FOR SEMIOCHEMICAL CONTROL	I	176					4		4
Meiners, T.	697	CHEMICAL SIGNALLING BETWEEN HOST PLANT AND EGG PARASITOID OF A GALERUCINE LEAF BEETLE	I	176					4		4
Meinke, L. J.	160	INSECTICIDE RESISTANCE IN THE WESTERN CORN ROOTWORM: IMPLICATIONS TO CURRENT AND FUTURE MANAGEMENT STRATEGIES	I	41	26/08/00	14:35	HB	A	2	11	2
Meirelles, R. M.	3161	ULTRASTRUCTURAL STUDIES ON THE SALIVARY GLANDS OF RHODNIUS DOMESTICUS, R. PROLIXUS AND TRIATOMA INFESTANS (HEMIPTERA: REDUVIIDAE)	II	797	23/08/00	16:30	CC		16	PS	16
Meisch, M.	2937	CURRENT AND FUTURE APPLICATION TACHNOLOGY FOR MOSQUITO CONTROL	II	741	25/08/00	15:30	Bol	R	15	10	15
Meisch, M. V.	2752	PROCEDURES FOR ADULTICIDE EFFICACY TRIALS	II	695	23/08/00	16:30	CC		14	PS	14
Meiswinkel, R.	2316	SPECIES DIAGNOSTIC DIFFERENCES IN RIBOSOMAL DNA INTERNAL TRANSCRIBED SPACER 2 FROM SEVEN CRYPTIC SPECIES OF THE CULICOIDES IMICOLA COMPLEX (DIPTERA: CERATOPOGONIDAE)	I	584	25/08/00	16:30	CC		12	PS	12
Meiswinkel, R.	2315	FROM SEVEN CRYPTIC SPECIES OF THE CULICOIDES IMICOLA COMPLEX (DIPTERA: CERATOPOGONIDAE)	I	584	24/08/00	16:30	CC		12	PS	12
Meixner, M. D.	2281	THE MEDITERRANEAN FRUIT FLY IN THE US: POPULATION STRUCTURE INFERRED FROM MITOCHONDRIAL DNA AND MICROSATELLITE ANALYSES	I	576	23/08/00	16:30	CC		12	PS	12
Mejdalani, G.	3801	WING VENATION IN THE LEAFHOPPER SUBFAMILY CICADELLINAE (HEMIPTERA: AUCHENORRHYNCHA: CICADELLIDAE).	II	959	23/08/00	16:30	CC		21	PS	21
Mejdalani, G.	3848	A NEW GENUS OF CICADELLINI (HEMIPTERA: CICADELLIDAE) FROM SOUTHEASTERN BRAZIL.	II	971	25/08/00	16:30	CC		21	PS	21
Melamed, S.	3230	HYTOPLASMA-BEARING LEAFHOPPERS/PLANTHOPPERS, SUSPECTED TO BE VECTORS, IN VINEYARDS IN THE GOLAN HEIGHTS, ISRAEL	II	815	23/08/00	16:30	CC		17	PS	17
Melia, R. F.	2678	THERMAL IMAGING FOR THE DETECTION OF SUBTERRANEAN TERMITES AND DAMAGE	II	676	22/08/00	16:30	CC		14	PS	14
Mello, L. J.	3442	MORTALITY OF THE MITE VARROA JACOBSONI IN AFRICANIZED BEES COLONIES	II	869	24/08/00	11:20	HM	Q	19	5	19
Mellor, P.	2316	SPECIES DIAGNOSTIC DIFFERENCES IN RIBOSOMAL DNA INTERNAL TRANSCRIBED SPACER 2 FROM SEVEN CRYPTIC SPECIES OF THE CULICOIDES IMICOLA COMPLEX (DIPTERA: CERATOPOGONIDAE)	I	584	25/08/00	16:30	CC		12	PS	12
Mellor, P.	2315	FROM SEVEN CRYPTIC SPECIES OF THE CULICOIDES IMICOLA COMPLEX (DIPTERA: CERATOPOGONIDAE)	I	584	24/08/00	16:30	CC		12	PS	12
Mel'nikov, A. I.	2267	INCOMPLETE DOMINANCE OF SOME MORPHOLOGICAL CHARACTERS IN HYBRIDS OF DROSOPHILA VIRILIS GROUP	I	572	22/08/00	16:30	CC		12	PS	12
Melo, A. L.	1065	LIFE CYCLE OF MARTAREGA URUGUAYENSIS (HETEROPTERA: NOTONECTIDAE) UNDER LABORATORY CONDITIONS	I	269	23/08/00	16:30	CC		6	PS	6
Melo, A. L.	568	AQUATIC HETEROPTERA (GERROMORPHA & NEPOMORPHA) FROM RETIRO DAS PEDRAS, A LOCALITY NEARBY BELO HORIZONTE, MINAS GERAIS, BRAZIL	I	144	25/08/00	16:30	CC		3	PS	3
Melo, A. L.	1017	A POSSIBLE CASE OF MIMICRY BETWEEN AN INSECT AND A TADPOLE	I	257	23/08/00	16:30	CC		6	PS	6
Melo, A. L.	1293	EFFECTS OF IVERMECTIN ON THE FAT BODY MORPHOLOGY OF CULEX QUINQUEFASCIATUS LARVAE	I	326	21/08/00	16:30	CC		7	PS	7
Melo, A. L. de	2631	EFFECTS OF IVERMECTIN ON CARRION-BREEDING FLIES	II	665	21/08/00	16:30	CC		14	PS	14
Melo, C. A.	1307	SUSCEPTIBILITY TO CARTAP AND ABAMECTIN IN DIAMONDBACK MOTH STRAINS FROM BRAZIL	I	330	21/08/00	16:30	CC		7	PS	7
Melo, E. P.	308	MACROFAUNA OF THE SOIL IN DIFFERENT TILLAGE SYSTEMS, IN OXYSOL OF PARANÁ, BRAZIL	I	78	24/08/00	16:30	CC		2	PS	2
Melo, F. A.	3185	CHARACTERIZATION OF SPODOPTERA SPECIES (LEPIDOPTERA: NOCTUIDAE) OF SOUTHERN BRAZIL	II	803	22/08/00	16:30	CC		16	PS	16
Melo, F. H.	853	ENDOPHYTES, TANNINS, AND HERBIVORES: THE INTERFACE IN A WOODY SHRUB	I	216	24/08/00	14:30	HB	D	6	6	6
Melo, F. R.	2063	EFFECTS IN VITRO AND IN VIVO OF SOYBEAN KUNITZ TRYPSIN INHIBITORS AGAINST THE BOOL WEEVIL ANTHONOMUS GRANDIS	I	520	22/08/00	16:30	CC		11	PS	11
Melo, G. C.	3110	INCIDENCE AND MORPHOLOGIC ASPECTS OF LONOMIA OBLIQUA (LEPIDOPTERA: SATURNIIDAE).	II	785	21/08/00	16:30	CC		16	PS	16
Melo, M. A. V.	2096	EFFECT OF SUNLIGHT ON THE RESIDUAL ACTIVITY OF A TABLET FORMULATION BASED ON BACILLUS THURINGIENSIS ISRAELENSIS AGAINST AEDES AEGYPTI LARVAE	I	529	23/08/00	16:30	CC		11	PS	11
Melo, M. A. V.	2227	RAPD MARKERS FOR GENETIC POPULATIONS STUDIES IN AEDES	I	562	21/08/00	16:30	CC		12	PS	12
Melo, M. A. V.	2117	SELECTION OF CULEX QUINQUEFASCIATUS POPULATION RESISTANT TO BACILLUS SPHAERICUS STRAIN 2362	I	534	24/08/00	16:30	CC		11	PS	11
Melo, M. C.	3744	INMATURE STAGES OF ZELUS LONGIPES (HETEROPTERA, REDUVIIDAE)	II	945	22/08/00	16:30	CC		21	PS	21

Sub-titles: (HB=Hotel Bourbon) - (HM=Hotel Mabu) - (CC=Convention Center) - (Bol=Foz Boulevard) - (PS=Poster Session) - (PL=Plenary Lecturer)

AUTHOR	Nº	TITLE	Book	Page	Date	Time	Local	Room	Session	Symp	New Session
Melo, S. M.	2152	CLONING AND HETEROLOGOUS EXPRESSION OF A BACILLUS THURINGIENSIS PROTEIN TOXIC AGAINST THE FALL ARMYWORM	I	543	25/08/00	16:30	CC		11	PS	11
Mencarelli, C.	3098	THE GIANT SPERM AXONEME OF THE GALL-MIDGE FLY ASPHONDYLIA RUEBSAAMENI KERTESZ: FINE STRUCTURE AND DEVELOPMENT	II	782	26/08/00	13:45	HB	G	16	9	16
Mendel, Z.	3983	GIS, GEOSTATISTICS AND MEDFLY: ECOLOGY AND CONTROL	II	1005	24/08/00	16:30	CC		22	PS	22
Mendes , M. C.	3317	ACARICIDE ACTION OF ROPE TOBACCO (NICOTINA TABACUM) OVER LARVAE OF BOOPHILUS MICROPLUS UNDER LABORATORY CONDITIONS	II	838	21/08/00	16:30	CC		18	PS	18
Mendes, B. P.	547	THE SPIDER FAUNA FROM SUGAR CANE CROP, SÃO PAULO STATE, BRAZIL.	I	138	24/08/00	16:30	CC		3	PS	3
Mendes, H. R.	853	ENDOPHYTES, TANNINS, AND HERBIVORES: THE INTERFACE IN A WOODY SHRUB	I	216	24/08/00	14:30	HB	D	6	6	6
Mendes, J. E. P.	1945	IMPACT OF DEFOLIATION BY COSTALIMAITA FERRUGINEA (COLEOPTERA: CHRYSOMELIDAE) IN EUCALYPTUS GRANDIS HILL EX MAIDEN	I	490	23/08/00	16:30	CC		10	PS	10
Mendes, N. L.	265	A GASOLINE-DRIVEN SUCTION APPARATUS FOR SAMPLING BLISSUS ANTILLUS (HEMIPTERA: LYGAEIDAE) AND OTHER ARTHROPODS IN PASTURES	I	67	24/08/00	16:30	CC		2	PS	2
Mendes, S. C.	170	AGRONOMIC EFFICIENCY OF INSECTICIDES AT DIFFERENT RATES TO THE CONTROL OF APHIS GOSSYPII IN COTTON CROP	I	44	21/08/00	16:30	CC		2	PS	2
Mendonça Jr., M. de S.	1584	A LABORATORY SELECTION EXPERIMENT: EVOLUTION OF DROSOPHILA MELANOGASTER UNDER THE ATTACK OF THE PUPAL PARASITOID PACHYCREPOIDEUS VINDEMIAE	I	399	23/08/00	16:30	CC		8	PS	8
Mendonça Júnior, M. S.	1066	A NEW HYPOTHESIS FOR INSECT GALL-MAKER SPECIES RICHNESS: RESOURCE SYNCHRONISATION AND THE EFFECTS OF FIRE	I	269	24/08/00	16:30	CC		6	PS	6
Mendonça, N. T. de	2753	EVALUATION OF THE EFFICIENCY OF THE FARM CHEMICAL FASTANE 1 P (ALPHACYPERMETHRIN) TO CONTROL THE ANTS FROM THE GENUS ACROMYRMEX (HYMENOPTERA: FORMICIDAE)	II	695	23/08/00	16:30	CC		14	PS	14
Mendonça, N. T. de	2754	A DOSE RECOMENDATION AND AN EVALUATION OF THE EFFICIENCY OF THE FARM CHEMICAL FASTANE 1P (ALPHACIPERMETHRIN) TO CONTROL ATTA LAEVIGATA, ATTA SEXDENS RUBROPILOSA AND ATTA BISPHAERICA (HYMENOPTERA: FORMICIDAE)	II	695	23/08/00	16:30	CC		14	PS	14
Mendonça, R. S. de	283	A DOSE RECOMENDATION AND AN EVALUATION OF THE EFFICIENCY OF THE FARM CHEMICAL CONFIDOR (IMIDACLOPRID) TO CONTROL MYZUS PERSICAE (HOMOPTERA: APHIDIDAE) IN THE POTATO CROP SOLANUM TUBEROSUM	I	72	23/08/00	16:30	CC		2	PS	2
Mendonça, R. S. de	284	CHEMICAL CONTROL OF THIPS TABACI (THYSANOPTERA: THRIPIDAE) WITH INSECTICIDE CONFIDOR (IMIDACLOPRID), IN POTATO CROP, SOLANUM TUBEROSUM	I	72	23/08/00	16:30	CC		2	PS	2
Mendonça, R. S. de	347	CHEMICAL CONTROL OF "WHITE FLY", BEMISIA ARGENTIFOLII (HEMIPTERA: ALEYRODIDAE) WITH CALYPSO 480 SC (THIACLOPRID), CONFIDOR 700 GRDA (IMIDACLOPRID) E CONFIDOR 200SC (IMIDACLOPRID) IN PAPRIKA CROP, CAPSICUM ANNUUM	I	88	25/08/00	16:30	CC		2	PS	2
Mendonça, R. S. de	348	CHEMICAL CONTROL OF "WHITE FLY", BEMISIA ARGENTIFOLII (HEMIPTERA: ALEYRODIDAE) WITH CALYPSO 480 SC (THIACLOPRID), CONFIDOR 700 GRDA (IMIDACLOPRID0) E CONFIDOR 200SC (IMIDACLOPRID) IN EGG PLANT CROP, SOLANUM MELONGENA	I	88	25/08/00	16:30	CC		2	PS	2
Mendonça, R. S. de	2753	EVALUATION OF THE EFFICIENCY OF THE FARM CHEMICAL FASTANE 1 P (ALPHACYPERMETHRIN) TO CONTROL THE ANTS FROM THE GENUS ACROMYRMEX (HYMENOPTERA: FORMICIDAE)	II	695	23/08/00	16:30	CC		14	PS	14
Mendonça, R. S. de	2754	A DOSE RECOMENDATION AND AN EVALUATION OF THE EFFICIENCY OF THE FARM CHEMICAL FASTANE 1P (ALPHACIPERMETHRIN) TO CONTROL ATTA LAEVIGATA, ATTA SEXDENS RUBROPILOSA AND ATTA BISPHAERICA (HYMENOPTERA: FORMICIDAE)	II	695	23/08/00	16:30	CC		14	PS	14
Mendonça, R. S. de	656	CHEMICAL CONTROL OF THE "LEAF MINER", LEUCOPTERA COFFEELLA (LEPIDOPTERA: LYONETIIDAE), WITH FURY 400 CE AND MARSHAL 400 SC IN COFFEE CROP, COFFEA ARABICA	I	166	22/08/00	16:30	CC		4	PS	4
Meneguim, A. M.	3231	DIVERSITY OF SHARPSHOOTERS IN COFFEE PLANTATIONS IN PARANÁ STATE, BRAZIL	II	816	23/08/00	16:30	CC		17	PS	17
Menezes Jr., A. O.	2097	GENERA OF ENCYRTIDAE (HYMENOPTERA: CHALCIDOIDEA) PARASITOIDS OF MEALYBUGS (HEMIPTERA: PSEUDOCOCCIDAE) IN NEOTROPICAL REGION	I	529	23/08/00	16:30	CC		11	PS	11
Menezes, D.	268	EFFICIENCY OF METHODS FOR SAMPLING THRIPS ON ONION	I	68	23/08/00	16:30	CC		2	PS	2
Menezes, E. B	4057	DO THE PEOPLE KNOW ABOUT SUBTERRANEAN TERMITES?	II	1024	25/08/00	9:35	HB	J	23	10	23
Menezes, E. B.	360	FIRST EVIDENCE OF COPTOTERMES HAVILANDI IN CAMPOS DOS GOYTACAZES (RJ), BRAZIL	I	91	25/08/00	16:30	CC		2	PS	2
Menezes, E. B.	1946	EFFICIENCY OF GRANULATED SYSTEMIC INSECTICIDES TO ELIMINATE THE COPTOTERMES HAVILANDI COLONIES ATTACKING ROOTS OF TREES	I	490	23/08/00	16:30	CC		10	PS	10
Menezes, E. B.	3400	FIFTEEN YEARS OF EXPERIENCE ON GEOGRAFICAL DISTRIBUTION, BEHAVIOR AND CONTROL OF COPTOTERMES HAVILANDI IN BRAZIL	II	858	21/08/00	15:00	HM	Q	19	1	19
Menezes, E. B.	3477	DAMAGES CAUSED BY THE NASUTITERMES SPP. (ISOPTERA : TERMITIDAE) IN ERIOTHECA CRENULATICALYX (BOMBACACEAE) AT THE UNIVERSIDADE FEDERAL DA PARAÍBA, JOÃO PESSOA (PB), BRAZIL	II	878	22/08/00	16:30	CC		19	PS	19
Menezes, E. B.	4089	OCCURRENCE OF RHINOTERMES MARGINALIS(ISOPTERA: RHINOTERMITIDAE) IN URBAN AREAS OF RIO DE JANEIRO CITY	II	1032	24/08/00	16:30	CC		23	PS	23
Menezes, E. B.	4113	CONTROL OF NASUTITERMES SP. IN A HISTORICAL PATRIMONY IN THE CONTRYSIDE OF RIO DE JANEIRO	II	1038	24/08/00	16:30	CC		23	PS	23
Menezes, E. B.	4114	CONTROL OF NASUTITERMES SP. ATTACKING A STORE OF FABRICS IN THE COUNTRYSIDE OF RIO DE JANEIRO STATE	II	1039	25/08/00	16:30	CC		23	PS	23
Menezes, E. B.	875	CHARACTERIZATION OF THE POPULATIONS OF FRUIT FLIES (DIPTERA: TEPHRITIDAE) COLLECTED IN SEROPEDICA CITY (RJ), BRAZIL BY THE FAUNISTIC ANALYSIS	I	221	21/08/00	16:30	CC		6	PS	6
Menezes, E. B.	876	PHANUROPSIS SEMIFLAVIVENTRIS (HYMENOPTERA, SCELIONIDAE), AN EGG PARASITOID OF THE STINK BUG ANTITHEUCUS SEPULCRALIS (HETEROPTERA, PENTATOMIDAE) IN SEROPEDICA CITY (RJ), BRAZIL	I	221	21/08/00	16:30	CC		6	PS	6
Menezes, E. B.	3466	FORAGING BEHAVIOR OF THE SUBTERRANEAN TERMITE COPTOTERMES HAVILANDI (ISOPTERA: RHINOTERMITIDAE) IN RESIDENTIAL AREAS	II	875	21/08/00	16:30	CC		19	PS	19
Menezes, E. B.	3468	WOOD-CONSUMPTION RATE BY THE SUBTERRANEAN TERMITE COPTOTERMES HAVILANDI (ISOPTERA: RHINOTERMITIDAE) IN RESIDENTIAL AREAS	II	875	21/08/00	16:30	CC		19	PS	19
Menezes, E. B.	3467	SELECTION OF DYES FOR MARKING THE SUBTERRANEAN TERMITE COPTOTERMES HAVILANDI (ISOPTERA: RHINOTERMITIDAE) IN LABORATORY	II	875	21/08/00	16:30	CC		19	PS	19
Menezes, E. B.	3533	INFESTATION OF TERMITES IN EUCALYPTUS SP. AT THE "UNIVERSIDADE FEDERAL RURAL DO RIO DE JANEIRO"	II	891	25/08/00	16:30	CC		19	PS	19
Menezes, E. B.	3359	BIOLOGY OF URBANUS ACAWOIOS (LEPIDOPTERA, HESPERIIDAE) IN LABORATORY	II	848	23/08/00	16:30	CC		18	PS	18
Menezes, E. B.	3455	PRELIMINARY SURVEY AND SPECIES COMPOSITION OF TERMITES IN SOME SITES OF THE CAMPUS OF THE "UNIVERSIDADE FEDERAL RURAL DO RIO DE JANEIRO", IN SEROPEDICA (RJ), BRAZIL	II	872	21/08/00	16:30	CC		19	PS	19
Menezes, E. B.	3465	ERADICATION OF THE COPTOTERMES HAVILANDI COLONIES BY CURATIVE AND PREVENTIVE TREATMENT OF INFESTED RESIDENTIAL BUILDINGS IN URBAN AREAS IN THE CITIES OF NITEROI AND RIO DE JANEIRO (RJ), BRAZIL	II	875	22/08/00	16:30	CC		19	PS	19
Menezes, E. B.	3504	ADAPTATION OF THE SUBTERRANEAN TERMITE COPTOTERMES HAVILANDI (ISOPTERA: RHINOTERMITIDAE) TO THE INTERIOR OF BRAZIL	II	884	22/08/00	16:30	CC		19	PS	19
Menezes, E. B.	3479	MAINTENANCE OF SECONDARY NEST OF COPTOTERMES HAVILANDI IN LABORATORY	II	878	22/08/00	16:30	CC		19	PS	19

Sub-titles: (HB=Hotel Bourbon) - (HM=Hotel Mabu) - (CC=Convention Center) - (Bol=Foz Boulevard) - (PS=Poster Session) - (PL=Plenary Lecturer)

AUTHOR	Nº	TITLE	Book	Page	Date	Time	Local	Room	Session	Symp	New Session
Menn, J. J.	3888	CURRENT STATUS OF BIOPESTICIDES	II	981	23/08/00	9:30	HB	H	22	4	22
Mensah, R. K	2755	HABITAT DIVERSITY: EFFECT ON POPULATION DENSITIES OF PREDATORY INSECTS OF HELICOVERPA SPP. IN COTTON IN AUSTRALIA	II	696	23/08/00	16:30	CC		14	PS	14
Mensah, R. K	3979	IPM PROGRAM IN COTTON IN AUSTRALIA BASED ON BENEFICIAL INSECTS, STRIP-CROPPING AND PROVISION OF SUPPLEMENTARY FOOD	II	1004	24/08/00	16:30	CC		22	PS	22
Meola, R. W.	4090	CYTOTOXICITY OF LUFENURON IN UNHATCHED LARVAE OF THE CAT FLEA CTENOCEPHALIDES FELIS	II	1033	23/08/00	16:30	CC		23	PS	23
Meola, S. M.	3045	ULTRASTRUCTURAL ANALYSIS OF NEUROSECRETORY CELLS IN THE ANTENNAE OF THE MOSQUITO, CULEX SALINARIUS (DIPTERA: CULICIDAE)	II	768	22/08/00	10:05	HB	G	16	2	16
Meola, S. M.	4090	CYTOTOXICITY OF LUFENURON IN UNHATCHED LARVAE OF THE CAT FLEA CTENOCEPHALIDES FELIS	II	1033	23/08/00	16:30	CC		23	PS	23
Meola, S. M.	3250	TESTIS ECDYSIOTROPIN, AN INSECT GONADOTROPIN THAT INDUCES SYNTHESIS OF ECDYSTEROID	II	821	21/08/00	9:50	HB	K	18	1	18
Mercadier, G.	2160	SCREENING FUNGAL PATHOGENS OF INSECTS FOR AMENABILITY TO LIQUID CULTURE SPORE PRODUCTION	I	545	25/08/00	16:30	CC		11	PS	11
Mercer, D. R.	1585	EFFECTS OF LARVAL DENSITY AND PREDATION BY TOXORHYNCHITES AMBOINENSIS (DIPTERA; CULICIDAE) UPON AEDES POLYNESIENSIS PRODUCTION	I	400	23/08/00	16:30	CC		8	PS	8
Mercer, D. R.	3000	BITING PATTERNS AND DEVELOPMENTAL SUBSTRATES FOR CULICOIDES PARAENSIS (DIPTERA; CERATOPOGONIDAE), THE VECTOR OF OROPOUCHE VIRUS, IN IQUITOS, PERU	II	757	24/08/00	16:30	CC		15	PS	15
Mercer, R.	50	INTERSPECIFIC PHYSIOLOGICAL DIFFERENTIATION IN MARINE AND TERRESTRIAL HALOZETES SPECIES (ACARI, ORIBATIDA)	I	13	23/08/00	16:30	CC		1	PS	1
Meredith, J.	2380	NEUROPEPTIDE CONTROL OF INSECT HINDGUT REABSORPTION: RECENT MOLECULAR ADVANCES	II	601	25/08/00	11:05	HB	I	13	8	13
Merelo Lobo, A. R.	2959	ANOPHELES GAMBIAE MIDGUT MICROVILLI: EFFECTS OF INDUCED IMMUNITY ON LONGEVITY, FERTILITY AND TRANSMISSION OF MALARIA	II	747	21/08/00	16:30	CC		15	PS	15
Merfield, C. N.	855	INTERACTIONS BETWEEN PREDATOR SPECIES, THEIR PREY AND THE HOST PLANT	I	216	25/08/00	10:05	HB	D	6	7	6
Merlevede, F.	1434	PRODUCTION OF PREDATORY BUGS ON ARTIFICIAL AND FACTITIOUS FOODS AND THEIR USE IN GREENHOUSE PEST MANAGEMENT	I	362	21/08/00	15:35	HM	O	8	2	8
Mermudes, J. R. M.	3162	COMPARATIVE MORPHOLOGY, TAXONOMIC STUDIES AND TRIBAL REASSIGNMENT OF THE NEOTROPICAL GENERA OF CLEOMENINI (COLEOPTERA, CERAMBYCIDAE)	II	798	24/08/00	16:30	CC		16	PS	21
Mermudes, J. R. M.	3163	MORPHOLOGICAL COMPARATIVE STUDY OF THE PTYCHODERES ELONGATUS AND TRIBOTROPIS PRASINATUS (COLEOPTERA, ANTHRIBIDAE)	II	798	24/08/00	16:30	CC		16	PS	21
Mermudes, J. R. M.	3802	REVISION AND TRANSFER TO HETEROPSININ OF THE GENUS EUPEMPELUS BATES (COLEOPTERA, CERAMBYCIDAE)	II	960	24/08/00	16:30	CC		21	PS	21
Merritt, R. W.	2947	THE ROLE OF AQUATIC INSECTS IN FORENSIC INVESTIGATIONS	II	744	26/08/00	11:35	Bol	R	15	11	15
Merwe, M. van der	233	OVO-LARVICIDAL EFFECTS OF LUFENURON TO POTATO TUBER MOTH, PHTHORIMAEA OPERCULELLA (ZELLER) (LEPIDOPTERA: GELECHIIDAE)	I	59	22/08/00	16:30	CC		2	PS	2
Mesa, A.	2282	A PARTHENOGENETIC NEW SPECIES OF THE GRYLLACRIDID GENUS APOTETAMENUS	I	576	23/08/00	16:30	CC		12	PS	12
Mesa, A.	2283	A X-AUTOSOME TANDEM FUSION IN AN UNDESCRIBED SPECIES OF THE FAMILY PODOSCIRTIDAE	I	576	23/08/00	16:30	CC		12	PS	12
Mesa, A.	2284	DOES AN X-AUTOSOME CENTRIC FUSION IN ACRIDOIDEA CONDEMN THE SPECIES TO EXTINTION?	I	576	23/08/00	16:30	CC		12	PS	12
Mesa, A.	2285	NON MENDELIAN BEHAVIOR IN MALE MEIOSIS ASYNAPTICAL MULTIPLE SEX CHROMOSOMES IN CRICKETS	I	577	25/08/00	16:30	CC		12	PS	12
Mesa, A.	3164	A FRESH AND SIMPLIFIED VIEW ON CRICKET PHALLIC STRUCTURES	II	798	24/08/00	16:30	CC		16	PS	16
Mesa, A.	3766	PHALLIC STRUCTURE, BIOACUSTIC AND CHROMOSOMES OF THE CRICKET UROGRYLLUS TOLEDOPIZAI	II	951	21/08/00	16:30	CC		21	PS	21
Mesa, A.	3803	A NEW SPECIES OF THE GENUS HYGRONEMOBIUS	II	960	21/08/00	16:30	CC		21	PS	21
Mesa, A.	3804	A NEW SPECIES OF THE NEMOBIINAE CRICKET ZUCCHIELLA	II	960	21/08/00	16:30	CC		21	PS	21
Mesa, A.	3867	BEHAVIOUR, BIOACUSTIC, PHALLIC SCLERITES AND CYTOGENETIC IN SOME SPECIES OF THE GENUS ENDECOUS (ORTHOPTERA, PHALANGOPSIDAE)	II	976	22/08/00	16:30	CC		21	PS	21
Mesa, A.	3767	MORPHOLOGY, BIOACUSTIC AND CYTOGENETIC IN 4 SPECIES OF ANUROGRYLLUS (ORTHOPTERA, GRYLLIDAE).	II	951	22/08/00	16:30	CC		21	PS	21
Mesa, A.	557	WHY DOES SPECIES RICHNESS INCREASE WITH FRAGMENT SIZE? PASSIVE SAMPLING IN ATLANTIC FOREST CRICKETS	I	141	25/08/00	16:30	CC		3	PS	3
Mescher, M. C.	2189	A DELETERIOUS GENETIC ELEMENT PROMOTES MULTIPLE-QUEEN ASSOCIATIONS IN THE FIRE ANT SOLENOPSIS INVICTA	I	553	22/08/00	16:15	HB	L	12	4	12
Meshkova, V.L.	1070	RADE AND DISAPPEARING INSECT SPECIES (COLEOPTERA) IN THE NORTH-EAST OF UKRAINE	I	270	23/08/00	16:30	CC		6	PS	6
Mesquita, A. L. M.	2098	INTERACTION OF THE ENTOMOPATHOGENIC FUNGUS, PAECILOMYCES FUMOSOROSEUS (DEUTEROMYCOTINA: HYPHOMYCETES) WITH THE PARASITOID, APHELINUS ASYCHIS (HYMENOPTERA: APHELINIDAE) AND THEIR COMPETITION FOR AN APHID HOST	I	529	23/08/00	16:30	CC		11	PS	11
Mesquita, A. L. M.	2633	STRATATEGIC MANAGEMENT FOR THE CONTROL OF SOURSOP PESTS IN NORTHEAST BRAZIL	II	665	22/08/00	16:30	CC		14	PS	14
Mesquita, A. L. M.	905	SURVEY AND IDENTIFICATION OF FRUIT FLY SPECIES IN THE REGION OF BAIXO JAGUARIBE, STATE OF CEARÁ, BRAZIL	I	229	21/08/00	16:30	CC		6	PS	6
Message, D.	3441	HONEY BEE DISEASES AND VARROA INFESTATIONS IN BRAZIL	II	869	24/08/00	11:05	HM	Q	19	5	19
Messenger, M. T.	1067	AGONISTIC BEHAVIOR BETWEEN COLONIES OF THE FORMOSAN SUBTERRANEAN TERMITE, COPTOTERMES FORMOSANUS (ISOPTERA: RHINOTERMITIDAE), FROM LOUIS ARMSTRONG PARK, NEW ORLEANS, LOUISIANA	I	269	23/08/00	16:30	CC		6	PS	6
Messenger, M. T.	285	THE SIBERT TECHNOLOGY DIGITAL MICROPROBE (DMP) AND ITS USES IN DETECTING TERMITE GALLERIES, CAVITIES, AND DECAYED WOOD IN TREES, STRUCTURAL LUMBER, AND TRANSMISSION POLES	I	72	23/08/00	16:30	CC		2	PS	2
Messing, R.	1661	FRUIT FLY BIOLOGICAL CONTROL IN LATIN AMERICA: MINIMIZING THE RISKS POSED BY TEPHRITIDAE IN MEXICO AND CENTRAL AMERICA	I	419	25/08/00	16:30	CC		8	PS	8
Metsugi, K.	1695	INDUCTION OF FEMALE-EGG OVIPOSITION BY HIGH ILLUMINATION IN A PARASITOID, HAPLOGONATOPUS ATRATUS (HYMENOPTERA: DRYINIDAE)	I	427	25/08/00	16:30	CC		8	PS	8
Mexia, A.	1499	A FIRST APPROACH ON THE POTENTIAL ROLE OF DICYPHUS CERASTII WAGNER (HEMIPTERA: MIRIDAE), AS NATURAL CONTROL AGENT IN PORTUGUESE GREENHOUSES	I	378	21/08/00	16:30	CC		8	PS	8
Mexia, A.	1500	THE ROLE OF CHRYSOPIDS AS NATURAL CONTROL AGENTS IN PORTUGUESE GREENHOUSES	I	378	21/08/00	16:30	CC		8	PS	8
Mexia, A.	2756	IPM STRATEGIES ON GREENHOUSE VEGETABLES: CONSTRAINTS TO A GENERAL ADOPTION	II	696	23/08/00	16:30	CC		14	PS	14
Mexia, A.	3065	INSECT WINGS AND MICRO HELICOPTER DESIGN	II	773	23/08/00	16:05	HB	G	16	5	16
Mexia, A.	286	COMPARATIVE STUDY OF BUMBLEBEES AND HONEYBEES EFFICIENCY IN GREENHOUSE MUSKMELON CROPS	I	73	23/08/00	16:30	CC		2	PS	2
Mexia, A.	287	POLLINATION OF GREENHOUSE TOMATO CROP BY BUMBLEBEES	I	73	23/08/00	16:30	CC		2	PS	2
Mexia, A.	247	DIGLYPHUS SP. COMPLEX IN OESTE REGION OF PORTUGAL AND ITS ROLE AS NATURAL CONTROL AGENTS IN GREENHOUSE VEGETABLES	I	63	22/08/00	16:30	CC		2	PS	2

Sub-titles: (HB=Hotel Bourbon) - (HM=Hotel Mabu) - (CC=Convention Center) - (Bol=Foz Boulevard) - (PS=Poster Session) - (PL=Plenary Lecturer)

AUTHOR	Nº	TITLE	Book	Page	Date	Time	Local	Room	Session	Symp	New Session
Mexia, A.	1586	FIRST APPROACH ON THE POTENTIAL ROLE OF SEVERAL SPECIES (NEUROPTERA: CHHRYSOPIDAE), AS NATURAL CONTROL AGENT IN PORTUGUESE GREENHOUSES	I	400	23/08/00	16:30	CC		8	PS	8
Mexia, A.	1757	DIAPAUSE TO FACILITATE THE REARING OF HELICOVERPA ARMIGERA (HBN.) (LEPIDOPTERA, NOCTUIDAE)	I	443	21/08/00	16:30	CC		9	PS	9
Mexia, A.	2060	NOCTUIDAE PARASITOID COMPLEX IN GREENHOUSE VEGETABLE CROPS IN OESTE REGION (PORTUGAL)	I	520	22/08/00	16:30	CC		11	PS	11
Mexia, A.	2757	IPM PROGRAMMES FOR PROTECTED VEGETABLE CROPS (IN OESTE REGION OF PORTUGAL)	II	696	23/08/00	16:30	CC		14	PS	14
Mexia, A.	1619	FIRST APPROACH ON THE POTENTIAL ROLE OF DICYPHUS CERASTII WAGNER (HEMIPTERA: MIRIDAE), AS NATURAL CONTROL AGENT IN PORTUGUESE GREENHOUSES	I	408	25/08/00	16:30	CC		8	PS	8
Mexia, A.	167	FORAGING ACTIVITY OF BUMBLEBEES IN GREENHOUSE MUSKMELON CROP	I	43	21/08/00	16:30	CC		2	PS	2
Mexia, A.	169	INFLUENCE OF CROPPING SEASON IN FORAGING ACTIVITY OF BUMBLEBEE IN GREENHOUSE TOMATO CROP	I	43	21/08/00	16:30	CC		2	PS	2
Mexia, A.	333	BUMBLEBEE FORAGING ACTIVITY AT GREENHOUSE TOMATO CROP WITH DIFFERENT POLLINATOR DENSITY	I	84	25/08/00	16:30	CC		2	PS	2
Mexia, A.	2129	WHITEFLIES AND THEIR PARASITOIDS' STATEMENTS IN HORTICULTURAL PROTECTED CROPS IN PORTUGAL	I	537	24/08/00	16:30	CC		11	PS	11
Mexia, A.	3956	A BIOTECNICAL METHOD FOR THE CONTROL OF THE OLIVE FLY IN ORGANIC ORCHARDS	II	998	22/08/00	16:30	CC		22	PS	22
Mexia, A. M.	60	FIELD EVALUATION OF SPIDER MITES (ACARI: TETRANYCHIDAE) POPULATION ON CORN AT BAIXO ALENTEJO (PORTUGAL)	I	15	24/08/00	16:30	CC		1	PS	1
Mey, W.	449	THE CADDISFLIES (TRICHOPTERA) OF LARGE RIVERS IN NAMIBIA: UNIFORMITY OR DIFFERENT FAUNAS?	I	114	26/08/00	11:05	HB	C	3	9	3
Meyer, J. H.	2722	CALCIUM SILICATE APPLICATION ENHANCES RESISTANCE OF SUGARCANE TO THE STALK BORER ELDANA SACCHARINA	II	687	23/08/00	16:30	CC		14	PS	14
Meyer, M. De	448	DISTRIBUTION PATTERNS AND HOST PLANT RELATIONSHIPS WITHIN THE GENUS CERATITIS MACLEAY (DIPTERA: TEPHRITIDAE) IN AFRICA	I	114	26/08/00	10:50	HB	C	3	9	3
Meyer, M. De	3805	REVISION OF THE SUBGENUS CERATITIS (PTERANDRUS) BEZZI (DIPTERA: TEPHRITIDAE)	II	960	24/08/00	16:30	CC		21	PS	21
Meyer, S. K.	1251	PINK BOLLWORM RESISTANCE TO BT COTTON	I	316	23/08/00	15:05	HM	N	7	6	7
Meyerdirk, D. E.	1587	BIOLOGICAL CONTROL OF THE PINK HIBISCUS MEALYBUG, MACONELLICOCCUS HIRSUTUS (GREEN), IN THE CARIBBEAN	I	400	23/08/00	16:30	CC		8	PS	8
Mezzomo, J. A.	906	SURVEY OF FRUIT FLIES (DIPTERA: TEPHRITIDAE) IN FOUR CITIES IN PARAÍBA	I	229	21/08/00	16:30	CC		6	PS	6
Mezzomo, J. A.	2151	LARVAL PARASITOIDS AND PATHOGENS OF SPODOPTERA FRUGIPERDA (LEPIDOPTERA: NOCTUIDAE) IN FOUR CITIES IN PARAÍBA	I	542	25/08/00	16:30	CC		11	PS	11
Mezzomo, J. A.	1582	BIOLOGICAL ASPECTS OF PODISUS NIGRISPINUS (HETEROPTERA: PENTATOMIDAE) BEING AS PREY SPODOPTERA FRUGIPERDA (LEPIDOPTERA: NOCTUIDAE)	I	399	23/08/00	16:30	CC		8	PS	8
Miah, M. I.	468	BIODIVERSITY OF THE PARASITIC HYMENOPTERA IN A COASTAL MANGROVE FOREST OF BANGLADESH	I	119	21/08/00	16:30	CC		3	PS	3
Miah, M. I.	3806	THE PHYLOGENY AND TAXONOMY OF THE PARASITIC WASPS SUBFAMILY CAMPOPLEGINAE (HYMENOPTERA, ICHNEUMONIDAE)	II	961	24/08/00	16:30	CC		21	PS	21
Miao, W.	3029	THE PROGRESS AND TENDENCY OF THE CHEMICAL MEASURES ON CONTROLLING THE HYGIENIC PESTS IN CHINA	II	764	25/08/00	16:30	CC		15	PS	15
Miao, Y.S.	3048	DEVELOPMENTAL REGULATION AND FUNCTIONS FOR FLRFAMIDE PEPTIDES IN MANDUCA SEXTA	II	769	22/08/00	11:35	HB	G	16	2	16
Michael Locke	XV	Insects for experiments on basic biology	I	LXIII	25/08/00	8:00	HM			PL	
Michalik, J.	2099	GENETIC CHARACTERIZATION OF BACULOVIRUS SsMNPV, A PATHOGEN OF STILPNOTIA SALICIS (LYMANTRIIDAE) ISOLATED IN POLAND	I	529	23/08/00	16:30	CC		11	PS	11
Michaud, J. P.	2591	MANAGEMENT STRATEGIES FOR BROWN CITRUS APHID AND CITRUS TRISTEZA VIRUS	II	655	24/08/00	15:20	HB	B	14	7	14
Michetti, M. H.	1135	USE OF NATURAL EXTRACTS OF BASIL, DILL AND FENNEL LIKE ALTERNATIVE MEASURE OF CONTROL OF MACROSIPHOM EUPHORBIAE (HEMIPTERA: APHIDIDAE)	I	286	24/08/00	16:30	CC		6	PS	6
Micó, E.	3671	HOPLIINI OF THE IBERIAN PENINSULA SCARABAEOIDEA, MELOLONTHIDAE): A BIOGEOGRAPHICAL AND TAXONOMIC STUDY	II	927	24/08/00	14:35	HB	E	21	7	21
Midtgaard, F.	1364	RESISTANCE IN NORWAY SPRUCE AGAINST THE GREEN SPRUCE APHID	I	344	23/08/00	16:30	CC		7	PS	7
Mielke, O. H. H.	3107	MORPHOLOGY AND BIOLOGY OF THE IMMATURE STAGES OF CITHERONIA (CITHERONIA) BRISSOTII BRISSOTII (LEPIDOPTERA, SATURNIIDADE, CERATOCAMPINAE)	II	784	21/08/00	16:30	CC		16	PS	16
Mielke, O. H. H.	3126	LIFE HISTORY AND MORPHOLOGY OF THE IMMATURE STAGES OF THE HAIRSTREAK BUTTERFLY "THECLA" CISSUSA (LEPIDOPTERA, LYCAENIDAE, THECLINAE)	II	789	22/08/00	16:30	CC		16	PS	16
Mienaltowski, M.	2917	ENGINEERING BLOOD MEAL-ACTIVATED SYSTEMIC IMMUNITY USING FAT BODY-SPECIFIC GENES IN THE MOSQUITO VECTOR	II	736	24/08/00	15:05	Bol	R	15	8	15
Mihalache, G.	1847	A NEW VIRAL PRODUCT "Inf-Ld" USED IN THE CONTROL OF POPULATIONS DENSITY OF LYMANTRIA DISPAR L. AND EUPROCTIS CHRYSORRHOEA	I	466	23/08/00	15:35	HB	M	10	4	10
Mihalkó, Z.	1219	UNUSUAL NEST SUBSTRATE OF AN AUGOCHLORINE BEE WITH DESCRIPTION OF NEST STRUCTURE AND POLLEN RESOURCES	I	307	25/08/00	16:30	CC		6	PS	6
Mike Hassell	XIV	Insect parasitoid interactions	I	LXII	25/08/00	8:00	HB			PL	
Miklas, N.	582	MATE RECOGNITION IN NEZARA VIRIDULA (HETEROPTERA, PENTATOMIDAE): A MATTER OF SONGS AND PHEROMONES	I	147	22/08/00	9:35	Bol	S	4	2	4
Milanes, J.	3222	PESTICIDE EVALUATION TO CONTROL VECTORS INSECTS OF TOBACCO VIRUS DISEASES	II	813	22/08/00	16:30	CC		17	PS	17
Milanez, J. M.	288	DAMAGE EVALUATION OF HELICOVERPA ZEA ON THREE CORN HYBRIDS IN DIFFERENT PLANTING TIMES	I	73	23/08/00	16:30	CC		2	PS	2
Milanez, J. M.	1588	ARTIFICIAL DIET FOR DIABROTICA SPECIOSA (COLEOPTERA; CHRYSOMELIDAE) REARING	I	400	24/08/00	16:30	CC		8	PS	8
Milanez, J. M.	2652	PESTICIDE EVALUATION TO CONTROL GYROPSYLLA SPEGAZZINIANA (HEMIPTERA, PSYLLIDAE) IN PARAGUAY-TEA ORCHARD	II	670	22/08/00	16:30	CC		14	PS	14
Milanez, J. M.	2653	INSECTICIDE EVALUATION TO CONTROL AGROTIS IPSILON (LEPIDOPTERA, NOCTUIDAE) IN TOBACCO	II	670	21/08/00	16:30	CC		14	PS	14
Milanez, J. M.	3222	PESTICIDE EVALUATION TO CONTROL VECTORS INSECTS OF TOBACCO VIRUS DISEASES	II	813	22/08/00	16:30	CC		17	PS	17
Milanez, J. M.	24	FLUCTUATION OF BREVIPALPUS PHOENICIS (ACARI, TENUIPALPIDAE) IN CITRIC ORCHARD IN CHAPECÓ, SC	I	6	21/08/00	16:30	CC		1	PS	1
Milano, P.	1502	AGENIASPIS CITRICOLA: INTRODUCTION, LABORATORY REARING AND ADAPTATION IN BRAZIL	I	379	21/08/00	16:30	CC		8	PS	8
Milano, S.	3399	TERMITE PESTS AND THEIR CONTROL IN URBAN BRAZIL	II	858	21/08/00	14:45	HM	Q	19	I	19
Miles, M.	129	LANDSCAPE LEVEL CULTURAL CONTROL: FUTURE PROSPECTS AND LIMITATIONS	I	33	24/08/00	11:30	HB	A	2	7	2
Miles, M.	751	SPATIAL ANALYSIS OF HELIOTHIS DISTRIBUTION AND ABUNDANCE FOR MEASURING THE EFFECTS OF MOTH MOVEMENT AT THE REGIONAL SCALE	I	190	21/08/00	14:10	Bol	T	5	I	5
Milhomem, M. S.	4166	THE SCARABAEINAE FAUNA (COLEOPTERA: SCARABAEDAE) OF THE CERRADO OF BRASÍLIA, DF, BRAZIL	II	1052	21/08/00	16:30	CC		Erratum	PS	6

Sub-titles: (HB=Hotel Bourbon) - (HM=Hotel Mabu) - (CC=Convention Center) - (Bol=Foz Boulevard) - (PS=Poster Session) - (PL=Plenary Lecturer)

AUTHOR	Nº	TITLE	Book	Page	Date	Time	Local	Room	Session	Symp	New Session
Millar, J.	730	PHEROMONES SYSTEM OF LEPTOGLOSSUS ZONATUS (HETEROPTERA:COREIDAE)	I	184	24/08/00	16:30	CC		4	PS	4
Millar, J. G.	585	IDENTIFICATION OF SEX PHEROMONES OF ECONOMICALLY IMPORTANT STINK BUG PESTS OF AGRICULTURE	I	148	22/08/00	10:35	Bol	S	4	2	4
Millar, J. G.	619	OVIPOSITION ATTRACTANTS AND OVIPOSITION STIMULANTS FOR Culex MOSQUITOES	I	157	25/08/00	9:35	Bol	S	4	7	4
Millar, J. G.	1890	BIOLOGICAL CONTROL OF COLEOPTERAN PESTS OF EUCALYPTUS IN CALIFORNIA	I	476	26/08/00	14:35	HB	M	10	10	10
Millar, J. G.	3874	MATING DISRUPTION OF CAROB MOTH IN DATES.	II	978	21/08/00	14:00	HB	H	22	1	22
Millar, J. G.	1891	DIFFERENTIAL PARASITISM BY AN EGG PARASITOID, AVETIANELLA LONGOI, OF TWO PHORACANTHA SPP. ATTACKING EUCALYPTUS	I	477	26/08/00	14:50	HB	M	10	10	10
Milléo, J.	3807	A REVISION OF THE GENUS TIPHYSA MULSANT AND TRANSFERENCE TO BRACHIACANTHADINI (COLEOPTERA, COCCINELLIDAE).	II	961	24/08/00	16:30	CC		21	PS	21
Miller III, D. G.	845	AN INQUILINE APHID, TAMALIA INQUILINUS N. SP., CO-OCCUPYING GALLS OF THE COMMUNAL APHID TAMALIA COWENI (HOMOPTERA: APHIDIDAE)	I	214	23/08/00	16:00	HB	D	6	5	6
Miller, D. R.	289	DO INVERSIONS INCREASE SPRAY DRIFT	I	73	23/08/00	16:30	CC		2	PS	2
Miller, E.	1447	DEVELOPMENT AND IMPLEMENTATION OF AN AUTOMATED SYSTEM FOR MASS REARING PINK BOLLWORM (PECTINOPHORA GOSSYPIELLA)	I	365	22/08/00	15:20	HM	O	8	4	8
Miller, J.	2105	DESTRUCTION OF BACTERIA IN THE DIGESTIVE TRACT OF THE MAGGOT OF THE GREEN BOTTLE FLY, PHAENICIA SERICATA	I	531	23/08/00	16:30	CC		11	PS	11
Miller, J.	4093	LOUSE COMB VERSUS HAND EXAMINATION FOR THE DIAGNOSIS OF HEAD LOUSE INFESTATIONS	II	1033	25/08/00	16:30	CC		23	PS	23
Miller, J. Y.	457	PATTERNS OF BIODIVERSITY IN THE NEOTROPICAL CASTNIIDAE (LEPIDOPTERA)	I	116	26/08/00	14:50	HB	C	3	10	3
Miller, L. D.	455	EUPTYCHIINE SATYRID BUTTERFLIES: BIODIVERSITY, NOMENCLATURAL FRUSTRATION AND FUTURE PROMISE	I	115	26/08/00	14:20	HB	C	3	10	3
Miller, L. R.	3808	ASPECTS OF MALPIGHIAN TUBULES, POSITION, ATTACHMENT AND COILING, AS TAXONOMIC CHARACTERS IN ISOPTERA	II	961	24/08/00	16:30	CC		21	PS	21
Miller, L. R.	3809	THE SIGNIFICANCE OF THE ANOJUGAL LOBE AND "RADIAL SECTOR" IN ISOPTERAN WING VENATION	II	961	24/08/00	16:30	CC		21	PS	21
Miller, P. F.	2784	FIELD STUDY TO COMPARE AN INTEGRATED FLEA CONTROL TREATMENT OF CAPSTAR AND PROGRAM TO ADVANTAGE USED ALONE AGAINST THE CAT FLEA (SIPHONAPTERA: PULICIDAE)	II	703	24/08/00	16:30	CC		14	PS	14
Miller, S.	570	INSECT HERBIVORES AS PREDICTORS OF PLANT PHYLOGENY: EXAMPLES FROM NEW GUINEA FICUS	I	144	25/08/00	16:30	CC		3	PS	3
Miller, S. E.	445	CHALLENGES AND OPPORTUNITIES IN UNDERSTANDING AND UTILIZING AFRICAN INSECT DIVERSITY	I	113	26/08/00	9:35	HB	C	3	9	3
Miller, S. E.	3576	STUDYING HOST AND MICROHABITAT USE BY ARTHROPODS IN TROPICAL RAIN FOREST CANOPIES: ISSUES & PERSPECTIVES	II	902	24/08/00	9:35	Bol	U	20	2	20
Miller, T. A.	4159	INSECT PHYSIOLOGY ONLINE	II	1050	21/08/00	16:30	CC		Erratum	PS	5
Mills, D.	3262	RECENT PROGRESS IN GENOMIC MAPPING IN BOMBYX MORI: WHERE SHOULD WE GO FROM HERE?	II	824	22/08/00	9:35	HB	K	18	2	18
Mills, K. A.	4032	THE USE OF RESEARCH RESULTS IN CONJUNCTION WITH PRACTICAL EXPERTISE TO OVERCOME THE PROBLEM OF PHOSPHINE RESISTANCE IN STORED PRODUCT INSECT PESTS.	II	1018	23/08/00	10:30	HB	J	23	6	23
Mills, K.A.	4027	INTRODUCTION TO SESSION 23, SYMPOSIUM 6, FUMIGATION MODIFIED ATMOSPHERES FOR URBAN USE AND STORED PRODUCT PROTECTION	II	1017	23/08/00	9:30	HB	J	23	6	23
Mills, N. J.	822	HYPERPARASITISM AND ECTOPARASITISM: THE IMPACT OF OMNIVOROUS INTERACTIONS ON POPULATION MANAGEMENT	I	208	22/08/00	15:05	HB	D	6	4	6
Mills, N. J.	857	FACTORS INFLUENCING TOP-DOWN CONTROL OF INSECT POPULATIONS	I	217	25/08/00	10:50	HB	D	6	7	6
Mills, N. J.	1469	THE RELATIONSHIP BETWEEN EGG LOAD AND FECUNDITY AMONG TRICHOGRAMMA PARASITOIDS	I	371	26/08/00	9:50	HM	O	8	8	8
Mills, N. J.	2551	THE ROLE OF NATURAL ENEMIES AND HABITAT MODIFICATION IN CODLING MOTH MANAGEMENT PROGRAMS	II	645	21/08/00	15:35	HB	B	14	2	14
Mills, N. J.	2758	THE ROLE OF NATURAL ENEMIES AND HABITAT MODIFICATION IN CODLING MOTH MANAGEMENT PROGRAMS	II	696	23/08/00	16:30	CC		14	PS	14
Milner, R. J.	2000	POTENTIAL FOR FUNGAL BIOPESTICIDES IN TROPICAL AGRICULTURE: THE AUSTRALIAN EXPERIENCE	I	505	22/08/00	9:50	HM	P	11	3	11
Milner, R. J.	2003	CURRENT STATUS ON MICROBIAL CONTROL OF TERMITES IN AUSTRALIA	I	505	22/08/00	13:35	HM	P	11	4	11
Milner, R. J.	2033	COMPARISON OF THE PATHOGENICITY OF THREE ISOLATES OF METARHIZIUM FOR WINGLESS GRASSHOPPER: EEFECT OF DOSE AND TEMPERATURE	I	513	21/08/00	16:30	CC		11	PS	11
Milner, R. J.	2011	THE DEVELOPMENT OF METARHIZIUM-BASED BIOPESTICIDES FOR USE AGAINST SUGARECANE WHITEGRUBS IN AUSTALIA	I	507	23/08/00	11:05	HM	P	11	5	11
Milner, R. J.	1020	USE OF THE FUNGUS METARHIZIUM ANISOPLIAE TO CONTROL LOCUSTS IN AUSTRALIA	I	257	23/08/00	16:30	CC		6	PS	6
Milner, R. J.	2100	RESPONSE OF COPTOTERMES FORMOSANUS SHIRAKI TO ISOLATES OF METARHIZIUM ANISOPLIAE IN THE UNITED STATES: VIRULENCE AND REPELLENCY	I	530	23/08/00	16:30	CC		11	PS	11
Milner, R. J.	2156	PHYLOGENY OF PAECILOMYCES SPECIES REVEALED BY ANALYSIS OF RIBOSOMAL RNA ITS SEQUENCES	I	544	25/08/00	16:30	CC		11	PS	11
Milner, R. J.	2157	PHYLOGENY OF PAECILOMYCES SPECIES REVEALED BY ANALYSIS OF RIBOSOMAL RNA ITS SEQUENCES	I	544	25/08/00	16:30	CC		11	PS	11
Min, K. J.	2468	FLIGHT INDUCED LIPID MOBILIZATION AND ENHANCED REPRODUCTION IN MELANOPLUS SANGUINIPES	II	623	23/08/00	16:30	CC		13	PS	13
Min, K. J.	1030	MIGRATORY SPECIES, INDIVIDUAL VARIATION IN MIGRATORY TENDENCY: CORRELATIONS WITH RESOURCE STORAGE AND MOBILIZATION	I	260	23/08/00	16:30	CC		6	PS	6
Mineo, G.	1068	ON SOME BEHAVIOURAL DECISIONS FOR POSTEMBRYONIC DEVELOPMENT AND FOR RESOURCE COMPETITION OBSERVED IN EULOPHID ECTOPARASITES (HYMENOPTERA: CHALCIDOIDEA)	I	269	23/08/00	16:30	CC		6	PS	6
Mineo, G.	2759	CONTROL OF CITRUS LEAF MINER BY IPM TECNIQUES AT YOUNG LEMON PLANTING IN SICILY	II	697	25/08/00	16:30	CC		14	PS	14
Minervino, E.	1331	INFLUENCE OF INSECTICIDES ON THE SPIDERS COMMUNITY IN A SOY CULTIVATION (BUENOS AIRES, ARGENTINA)	I	336	22/08/00	16:30	CC		7	PS	7
Minnaar, L. C.	2741	THE BLACK COTTON BEETLE, SYAGRUS RUGIFRONS BALY (CHRYSOMELIDAE: COLEOPTERA): ITS IMPACT ON COTTON PRODUCTION IN SOUTH AFRICA AND PROBLEMS PERTAINING TO INTEGRATED PEST MANAGEMENT	II	692	23/08/00	16:30	CC		14	PS	14
Mintzas, A.	2262	HEAT SHOCK RESPONSE IN THE MEDITERRANEAN FRUIT FLY: GENES, PROMOTERS AND THERMOTOLERANCE	I	571	22/08/00	16:30	CC		12	PS	12
Mintzas, A.	787	MICROSATELLITE MARKERS OF TWO AGRICULTURAL PESTS, THE MEDFLY, CERATITIS CAPITATA AND THE OLIVE FLY, BACTROCERA OLEAE	I	199	22/08/00	16:30	CC		5	PS	5
Minucci, A.	192	EFFECT OF DIFFERENT SEED TREATMENTS ON APHID APHIS GOSSYPII CONTROL VEGETATIVE DEVELOPMENT AND YIELD OF COTTON CROP	I	49	22/08/00	16:30	CC		2	PS	2
Minucci, A.	193	EFFECT OF DIFFERENT SEED TREATMENTS ON THRIPS FRANKLINIELLA SCHULTZII CONTROL, VEGETATIVE DEVELOPMENT AND YIELD OF COTTON CROP	I	49	22/08/00	16:30	CC		2	PS	2
Miramontes, O.	2175	SELF-ORGANIZED TOLERANCE TO STRESS IN TERMITES	I	549	21/08/00	15:05	HB	L	12	2	12
Miranda- Esquivel, D. R.	489	HISTORICAL BIOGEOGRAPHY OF THE SOUTH AMERICAN RHYTIRRHININI (COLEOPTERA: CURCULIONIDAE)	I	124	22/08/00	16:30	CC		3	PS	3

Sub-titles: (HB=Hotel Bourbon) - (HM=Hotel Mabu) - (CC=Convention Center) - (Bol=Foz Boulevard) - (PS=Poster Session) - (PL=Plenary Lecturer)

AUTHOR	Nº	TITLE	Book	Page	Date	Time	Local	Room	Session	Symp	New Session
Miranda, M. T. M.	2061	ANTIMICROBIAL PEPTIDES FROM THE CATTLE TICK BOOPHILUS MICROPLUS	I	520	22/08/00	16:30	CC		11	PS	11
Miranda, A.	2061	ANTIMICROBIAL PEPTIDES FROM THE CATTLE TICK BOOPHILUS MICROPLUS	I	520	22/08/00	16:30	CC		11	PS	11
Miranda, E.	1589	MASSPRODUCTION OF THE EGG PARASITOID, TELENOMUS PODISI, ON THE PENTATOMID, EUSCHISTUS HEROS, FOR BIOLOGICAL CONTROL OF PENTATOMID PESTS ON SOYBEAN IN BOLIVIA	I	401	22/08/00	16:30	CC		8	PS	8
Miranda, I. P.de A.	901	THREE NEW SPECIES OF COLEOPTERA (CURCULIONIDAE: DERELOMINI) POLLINATORS OF CAIAUÉ Elaeis oleifera (KUNTH) CORTÉS AND OF THE F1 HYBRID (E. guineensis X E. oleifera) IN THE STATE OF AMAZONAS	I	228	21/08/00	16:30	CC		6	PS	6
Miranda, J. E.	715	AZADIRACTA INDICA AND BOUGAINVILLEA SPECTABILIS EXTRACTS TO CONTROL VELVETBEAN CATERPILLAR	I	181	24/08/00	16:30	CC		4	PS	4
Miranda, J. E.	1365	INSECTICIDE PROPERTIES OF ETHANOLIC EXTRACT ISOLATED FROM SEEDS OF PIPER TUBERCULATUM SEEDS (PIPERACEAE) ON DIATRAEA SACCHARALIS (LEPIDOPTERA: PYRALI DAE)	I	344	25/08/00	16:30	CC		7	PS	7
Miranda, J. E.	3519	EFFECTS OF METHOPRENE ON SILKWORM, BOMBYX MORI (LEPIDOPTERA: BOMBYCIDAE)	II	888	24/08/00	16:30	CC		19	PS	19
Miranda, J. E.	3520	EFFECTS OF PYRIPROXYFEN ON THE LARVAL DEVELOPMENT, THE COCOON AND SILK PRODUCTION OF BOMBYX MORI (LEPIDOPTERA: BOMBYCIDAE)	II	888	24/08/00	16:30	CC		19	PS	19
Miranda, J. E.	3521	EFFECTS OF TOPICAL APPLICATION OF FENOXYCARB AT DIFFERENT DOSES ON SILKWORM, BOMBYX MORI (LEPIDOPTERA: BOMBYCIDAE)	II	888	23/08/00	16:30	CC		19	PS	19
Miranda, J. E.	3522	MORPHOLOGICAL DESCRIPTION OF THE CATERPILLAR OF BOMBYX MORI (LEPIDOPTERA: BOMBYCIDAE) WITH THE USE OF SCANNING ELECTRONIC MICROSCOPY	II	889	23/08/00	16:30	CC		19	PS	19
Miranda, J. E.	1687	EFFECT OF DIATRAEA SACCHARALIS TREATED EGGS ON CRISOPIDS LARVAE	I	425	25/08/00	16:30	CC		8	PS	8
Miranda, J.E.	3166	EXTERN ANATOMY DESCRIPTION OF ANTICARSIA GEMMATALIS (LEPIDOPTERA: NOCTUIDAE) THROUGH THE SCANNING ELECTRONIC MICROSCOPY	II	799	21/08/00	16:30	CC		16	PS	16
Miranda, J.E.	703	SUSCEPTIBILITY TESTS OF 4,5-DIIDROPIPERLONGUMININA ISOLATED FROM PIPER TUBERCULATUM SEEDS ON VELVETBEAN CATERPILLAR	I	178	24/08/00	16:30	CC		4	PS	4
Miranda, J.E.	3111	EFFECT OF TWO PLANT EXTRACTS ON CERAEOCHRYSA CINCTA AND C. CUBANA (NEUROPTERA: CHRYSOPIDAE)	II	785	21/08/00	16:30	CC		16	PS	16
Miranda, J.E.	3550	ANTIBIOTIC OLAQUINDOX AS ADDICTIVE IN THE FEEDING OF BOMBYX MORI (LEPIDOPTERA: BOMBYCIDAE)	II	896	25/08/00	16:30	CC		19	PS	19
Miranda, J.E.	3551	FEEDING OF BOMBYX MORI WITH ARTIFICIAL DIET AND ITS EFFECT ON THE LARVAL DEVELOPMENT AND THE SILK PRODUCTION	II	896	25/08/00	16:30	CC		19	PS	19
Miranda, M. A.	698	MASS TRAPPING EXPERIENCE OF CERATITIS CAPITATA(DIPTERA: TEPHRITIDAE) WITH SYNTHETIC FEMALE FOOD ATTRACTANTS IN A CITRUS ORCHARD (MALLORCA, SPAIN)	I	176	24/08/00	16:30	CC		4	PS	4
Miranda, M. A.	3103	PRACTICAL APPLICATION OF A CLASSIFICATION FUNCTION TO DETERMINE WING MORPHOLOGY DIFFERENCES BETWEEN WILD AND STERILE MALES OF CERATITIS CAPITATA (DIPTERA: TEPHRITIDAE).	II	783	21/08/00	16:30	CC		16	PS	16
Miranda, M. L. de	3144	DESCRIPTION OF FINAL LARVAL INSTAR AND PUPA OF CURINUS COERULEUS (COLEOPTERA, COCCINELLIDAE, CHILOCORINAE), A PREDATOR OF ALEUROTHRIXUS SP. (HEMIPTERA, ALEYRODIDAE) AND NOTES ON THE ASSOCIATED BIOCOENOSIS	II	793	23/08/00	16:30	CC		16	PS	16
Miranda, M. P.	3232	OCCURRENCE OF SHARPSHOTER IN CITRUS ORCHARDS AFFECTED BY CVC IN NORTH COAST OF BAHIA AND SOUTH OF SERGIPE STATE, BRAZIL	II	816	23/08/00	16:30	CC		17	PS	17
Miranda, M.A.	880	SPACE-SEASONAL DISTRIBUTION OF CERATITIS CAPITATA (DIPTERA: TEPHRITIDAE) IN A MASS TRAPPING EXPERIENCE IN A CITRUS ORCHARD IN MALLORCA (SPAIN)	I	222	21/08/00	16:30	CC		6	PS	6
Miranda-Esquivel, D. R.	526	A COMPARISON BETWEEN RECONCILIATED TREES, DISPERSE-VICARIANCE AND PARALOGY FREE BIOGEOGRAPHIC SCHEMES	I	133	23/08/00	16:30	CC		3	PS	3
Miranda-Esquivel, D. R.	527	A CLADISTIC ANALYSIS OF NEOTROPICAL, ETHIOPIC AND AUSTRALIAN SUBGENERA OF THE GENUS SIMULIUM (DIPTERA:SIMULIIDAE)	I	133	23/08/00	16:30	CC		3	PS	3
Miranda-Esquivel, D. R.	528	NEOTROPIC BIOGEOGRAPHY: A PERSPECTIVE FROM SIMULIIDAE TAXA	I	134	23/08/00	16:30	CC		3	PS	3
Miranda-Esquivel, D. R.	3825	TAXONOMIC DISTINCTNESS, ENDEMICITY, AND COMPLEMENTARITY: NEW CLUES TO DEFINE PRIORITIES FOR CONSERVATION IN SOUTHERN SOUTH AMERICA	II	965	24/08/00	16:30	CC		21	PS	21
Miretzki, M.	4066	SMALL WILD MAMMALS SIPHONAPTERA FROM ITAPEVI COUNTY, STATE OF SÃO PAULO, BRAZIL	II	1027	21/08/00	16:30	CC		23	PS	23
Miretzki, M.	1902	RELATIONSHIP BETWEEN TICKS AND SMALL WILD MAMMALS IN A DISTURBED ATLANTIC FOREST FRAGMENT IN ITAPEVI COUNTY, STATE OF SÃO PAULO, BRAZIL	I	479	21/08/00	16:30	CC		10	PS	10
Miserendino, M. L.	1069	LENGTH-MASS RELATIONSHIPS FOR AQUATIC INSECTS IN FRESHWATER ENVIRONMENTS OF PATAGONIA (ARGENTINA).	I	270	23/08/00	16:30	CC		6	PS	6
Miserendino, M. L.	1198	EFFECT OF HABITAT TYPE ON AQUATIC INSECTS IN FOUR STREAMS OF PATAGONIA (ARGENTINA)	I	302	25/08/00	16:30	CC		6	PS	6
Mishchenko, A. A.	290	HF-ENERGY INFLUENCE ON GRANARY PESTS	I	74	23/08/00	16:30	CC		2	PS	2
Mishchenko, A.A.	1070	RADE AND DISAPPEARING INSECT SPECIES (COLEOPTERA) IN THE NORTH-EAST OF UKRAINE	I	270	23/08/00	16:30	CC		6	PS	6
Mishima, A.	1083	OCCURRENCE PATTERNS OF SPODOPTERA LITURA (LEPIDOPTERA: NOCTUIDAE) IN SOUTHERN JAPAN AND SOUTH-EASTERN ASIA	I	273	23/08/00	16:30	CC		6	PS	6
Missa, O.	3581	SPECIES RICHNESS AND COMPOSITION OF WEEVILS (CURCULIONIDAE) IN THE CANOPY OF A LOWLAND TROPICAL RAIN FOREST IN PAPUA NEW GUINEA	II	904	24/08/00	13:30	Bol	U	20	2	20
Missirlis, F.	2469	OXYGEN RADICAL METABOLISM IN DROSOPHILA MELANOGASTER	II	624	23/08/00	16:30	CC		13	PS	13
Mita, K.	3266	BOMBYX EST DATABASE, SILKBASE, FOR GENOME ANALYSIS OF BOMBYX MORI	II	825	22/08/00	11:05	HB	K	18	2	18
Mita, K.	3267	GENOMICS OF REPRODUCTION AND DIAPAUSE IN BOMBYX MORI	II	825	22/08/00	11:35	HB	K	18	2	18
Mita, K.	3530	CHANGE OF GENE EXPRESSION PATTERN CAUSEDBY COMPOUND EYE METAMORPHOSIS OF BOMBYX MORI	II	891	24/08/00	16:30	CC		19	PS	19
Mita, K.	2295	A HOMOLOGUE OF THE DROSOPHILA MELANOGASTER SEX- DETERMINING GENE DOUBLESEX IS TRANSCRIBED INTO SEX-SPECIFIC ISOFORMES IN THE SILKWORM, BOMBYX MORI	I	579	24/08/00	16:30	CC		12	PS	12
Mita, K.	2324	SEX-SPECIFIC ALTERNATIVE SPLICING OF THE LEPIDOPTERAN HOMOLOGS OF THE DROSOPHILA MELANOGASTER SEX DETERMINING GENE DOUBLESEX	I	586	25/08/00	16:30	CC		12	PS	12
Mita, K.	3510	STRUCTURAL ANALYSIS OF THE Z CHROMOSOME IN BOMBYX MORI BY USING THE BAC LIBRARY	II	886	23/08/00	16:30	CC		19	PS	19
Mita, K.	3262	RECENT PROGRESS IN GENOMIC MAPPING IN BOMBYX MORI: WHERE SHOULD WE GO FROM HERE?	II	824	22/08/00	9:35	HB	K	18	2	18
Mita, K.	2305	CHARACTERIZATION OF GENOMIC GENE ENCODING KYNURENINE 3-MONOOXYGENASE IN THE SILKWORM BOMBYX MORI	I	582	24/08/00	16:30	CC		12	PS	12
Mita, K.	3312	MOLECULAR BIOLOGY OF INSECT CLOCKS FOR PHOTOPERIODISM	II	836	25/08/00	14:00	HB	K	18	8	18
Mitamura, T.	3565	ADHESIVE STRENGTH OF THE GLUE SUBSTANCES IN THE COLLETERIAL GLANDS OF THE JAPANESE WILD SILKMOTHS	II	899	22/08/00	16:30	CC		19	PS	19
Mitchell, A.	3695	MOLECULAR PHYLOGENY OF NOCTUOIDEA: THE NOCTUIDAE REDEFINED	II	933	26/08/00	10:35	HB	E	21	9	21
Mitchell, D. A.	2002	FUNDAMENTAL ISSUES THAT LIMIT SCALE UP OF FUNGAL BIOPESTICIDES USING SOLID STATE FERMENTATION PROCESSES	I	505	22/08/00	10:50	HM	P	11	3	11
Mitchell, D.A.	2001	IS SOLID STATE FERMENTATION THE BEST OPTION TO PRODUCE FUNGAL BIOPESTICIDES	I	505	22/08/00	10:20	HM	P	11	3	11
Mitchell, J. D.	3392	TERMITES AS PESTS IN SOUTHERN AFRICA	II	856	21/08/00	11:20	HM	Q	19	1	19
Mitchell, P. L.	2604	HETEROPTERANS TRANSMITTING PLANT DISEASES	II	658	26/08/00	10:05	HB	B	14	9	14

Sub-titles: (HB=Hotel Bourbon) - (HM=Hotel Mabu) - (CC=Convention Center) - (Bol=Foz Boulevard) - (PS=Poster Session) - (PL=Plenary Lecturer)

AUTHOR	Nº	TITLE	Book	Page	Date	Time	Local	Room	Session	Symp	New Session
Mitrofanov, V. G.	2267	INCOMPLETE DOMINANCE OF SOME MORPHOLOGICAL CHARACTERS IN HYBRIDS OF DROSOPHILA VIRILIS GROUP	I	572	22/08/00	16:30	CC		12	PS	12
Mitrophanov, V. B.	1445	DEVELOPMENT AND ORGANIZATION OF MANUFACTURE VIRUS PREPARATION VIRIN - •••	I	365	22/08/00	14:50	HM	O	8	4	8
Mitsuhashi, W.	3346	DETECTION OF WOLBACHIA IN A LINE WITH FEMALE-BIASED SEX RATIO OF A BUTTERFLY, HYPOLIMNAS BOLINA	II	845	23/08/00	16:30	CC		18	PS	18
Mitsuhashi, W.	2145	WOLBACHIA ARE DISTRIBUTED THROUGHOUT SOMATIC AND GENITAL ORGANS OF A MULBERRY LEAFHOPPER, HISHIMONOIDES SELLATIFORMIS	I	541	25/08/00	16:30	CC		11	PS	11
Mitsuhata, M.	2498	MASKING OF CIRCADIAN ACTIVITY RHYTHM IN BUMBLE BEES: A NOVEL ADAPTATION MECHANISM TO HIGH-LATITUDE CONDITION	II	631	24/08/00	16:30	CC		13	PS	13
Mitter, C.	3695	MOLECULAR PHYLOGENY OF NOCTUOIDEA: THE NOCTUIDAE REDEFINED	II	933	26/08/00	10:35	HB	E	21	9	21
Mitter, C.	3687	MOLECULAR EVIDENCE FOR THE BASAL RADIATION OF THE LEPIDOPTERA	II	931	25/08/00	15:35	HB	E	21	8	21
Miura, K.	2101	DETECTION OF WOLBACHIA FROM ORIUS SPP. IN JAPAN	I	530	23/08/00	16:30	CC		11	PS	11
Miura, I.	3096	PHYLOGENETIC RELATIONSHIP ON SPERM ULTRASTRUCTURE OF THE STAG BEETLES (COLEOPTERA-LUCANIDAE)	II	781	26/08/00	11:40	HB	G	16	9	16
Miura, T.	2184	GENE EXPRESSION AND CASTE POLYMORPHISM IN TERMITES	I	551	22/08/00	14:15	HB	L	12	4	12
Miyai, S.	3226	COMPARISON OF RIBOSOMAL DNA BY PCR-RFLP ANALYSIS AMONG LOCAL CLONES OF FOXGLOBE APHID, AULACORTHUM SOLANI, WHICH SHOW DIFFERENT TRANSMISSION EFFICIENCY OF SOYBEAN DWARF LUTEOVIRUS	II	814	22/08/00	16:30	CC		17	PS	17
Miyamoto, K.	2332	OCCURRENCE OF TWO DELTA-ENDOTOXIN GENES, THE CRY9DA AND A NOVEL ALLIED GENE, IN JAPANESE BACILLUS THURINGIENSIS ENVIRONMENTAL ISOLATES THAT PRODUCE SPHERICAL PARASPORAL INCLUSIONS WITH LEPIDOPTERA-SPECIFIC TOXICITY	I	588	25/08/00	16:30	CC		12	PS	12
Miyanaga, R.	3653	WHY DO MALE AND FEMLAE PSEUDOXENOS IWATAI (STYLOPIDAE) EXTRUDE AT DEFINITE POSISTIONS ON THE HOST METASOMA?	II	922	23/08/00	15:35	HB	E	21	5	21
Miyanoto, Y.	291	INSECT PESTS ON MACADAMIANUT TREES IN COLONIA SAN JUAN DE YAPACANI, SANTA CRUZ DISTRICT, BOLIVIA	I	74	23/08/00	16:30	CC		2	PS	2
Miyata, H.	1879	IMPACT OF FOREST UTILIZATION ON THE ASSEMBLAGE OF LONGICORN BEETLES (COLEOPTERA: CERAMBYCIDAE) IN THE WARM-TEMPERATE FORESTS OF JAPAN	I	474	25/08/00	16:05	HB	M	10	8	10
Miyata, S.	2439	HARDINESS TO LOW OR HIGH TEMPERATURE AND DRYING-OUT IN A WATER STRIDER, AQUARIUS PALUDUM AND A SUBSPECIES, A. P. AMAMIENSIS	II	616	22/08/00	16:30	CC		13	PS	13
Miyata, T.	1282	MANAGEMENT OF ACARICIDE RESISTANCE IN JAPAN	I	324	25/08/00	15:35	HM	N	7	10	7
Miyata, T.	1393	MECHANISMS OF RESISTANCE TO THE INSECTICIDE METHIDATHION IN AMBLYSEIUS WOMERSLEYI (ACARI: PHYTOSEIIDAE)	I	351	22/08/00	16:30	CC		7	PS	7
Miyazawa, M.	3523	MASS-PRODUCTION OF PORCINE INTERLEUKIN-2 IN BOMBYX MORI	II	889	24/08/00	16:30	CC		19	PS	19
Miyoshi, A. R.	3803	A NEW SPECIES OF THE GENUS HYGRONEMOBIUS	II	960	21/08/00	16:30	CC		21	PS	21
Mizell III, R. F.	3205	PHYSIOLOGICAL ADAPTATIONS OF LEAFHOPPERS THAT FEED ON XYLEM FLUID: EXPLORING NUTRIENT LIMITATIONS AS A COMPONENT OF INTEGRATED CROP MANAGEMENT	II	809	21/08/00	14:35	Bol	U	17	1	17
Mizell III, R. F.	3219	NUTRITION AND DEVELOPMENT OF THE GLASSY-WINGED SHARPSHOOTER EXAMINED BY TRADITIONAL AND NOVEL NUTRITIONAL INDICES	II	813	21/08/00	16:30	CC		17	PS	17
Mizell III, R. F.	3725	A PREDICTIVE MODEL TO ENHANCE SAFEGUARDING CAPABILITIES AGAINST WEEVILS BASED ON ECOLOGY, BEHAVIOR AND PHYLOGENY	II	940	21/08/00	16:30	CC		21	PS	21
Mizell, R.	1019	FLIGHT PATTERNS OF AN ASIAN AMBROSIA BEETLE, XYLOSANDRUS CRASSIUSCULUS, IN TREE NURSERIES IN GEORGIA AND NORTH FLORIDA, USA	I	257	23/08/00	16:30	CC		6	PS	6
Mizell, R. F.	292	NEW TRAPPING METHOD FOR PENTATOMIDAE, COREIDAE AND OTHER HETEROPTERA	I	74	23/08/00	16:30	CC		2	PS	2
Mizutani, N.	588	A PHEROMONE COMPONENT OF THE BEAN BUG, RIPTORTUS CLAVATUS, ATTRACTS AN EGG PARASITOID, OOENCYRTUS NEZARAE	I	149	22/08/00	11:05	Bol	S	4	2	4
Moar, W. J.	1239	EXPRESSION OF BACILLUS THURINGIENSIS CRY2A PROTEINS IN PLANT CHLOROPLASTS: INCREASING TOXICITY TO SUSCEPTIBLE AND BACILLUS THURINGIENSIS RESISTANT INSECTS	I	313	22/08/00	15:05	HM	N	7	4	7
Mocelin, G.	1293	EFFECTS OF IVERMECTIN ON THE FAT BODY MORPHOLOGY OF CULEX QUINQUEFASCIATUS LARVAE	I	326	21/08/00	16:30	CC		7	PS	7
Mochida, O.	291	INSECT PESTS ON MACADAMIANUT TREES IN COLONIA SAN JUAN DE YAPACANI, SANTA CRUZ DISTRICT, BOLIVIA	I	74	23/08/00	16:30	CC		2	PS	2
Mochida, O.	1589	MASSPRODUCTION OF THE EGG PARASITOID, TELENOMUS PODISI, ON THE PENTATOMID, EUSCHISTUS HEROS, FOR BIOLOGICAL CONTROL OF PENTATOMID PESTS ON SOYBEAN IN BOLIVIA	I	401	22/08/00	16:30	CC		8	PS	8
Mochida, O.	182	ATTEMPTS TO MANAGE ANTICARSIA GEMMATALIS (LEPIDOPTERA, NOCTUIDAE) ON SOYBEAN IN COLONIA OKINAWA, SANTA CRUZ DISTRICT, BOLIVIA WITH BACULOVIRUS ANTICARSIA COMMERCIALIZED IN BRASIL	I	47	21/08/00	16:30	CC		2	PS	2
Mochida, O.	293	YIELD LOSS ASSESSMENT OF UPLAND RICE DUE TO INSECT PESTS IN CENTRAL KALIMANTAN, BORNEO, INDONESIA IN WET SEASON 1997/98	I	74	24/08/00	16:30	CC		2	PS	2
Moe, S. J.	789	NON-PARAMETRIC MODELLING AND EXPERIMENTAL TESTING OF BLOWFLY POPULATION DYNAMICS	I	199	22/08/00	16:30	CC		5	PS	5
Mohamed, Y.	2825	SURVEY OF PRACTICES AND PERCEPTIONS OF SMALL HOLDER FARMERS RELATING TO PEST MANAGEMENT ON VEGETABLE CROPS IN EASTERN AFRICA	II	713	23/08/00	16:30	CC		14	PS	14
Mohan, M.	3980	MAPPING, TAGGING, MARKER-ASSISTED SELECTION AND MAP-BASED GENE CLONING OF GALL MIDGE RESISTANCE GENES IN RICE	II	1004	24/08/00	16:30	CC		22	PS	22
Mohan, S.	4054	NATURAL PRODUCT REPELLANTS OR ATTRACTANTS: PART OF A SOLUTION TO CONTROL STORED-PRODUCT INSECTS	II	1024	24/08/00	14:15	HB	J	23	9	23
Mohankumar, S.	2760	INTEGRATION OF PLANT RESISTANCE WITH INSECTICIDES FOR THE MANAGEMENT OF COTTON LEAFHOPPER, AMRASCA DEVASTANS [DISTANT]	II	697	23/08/00	16:30	CC		14	PS	14
Mohankumar, S.	1366	RELATIVE TOXICITY OF INSECTICIDES TO COTTON LEAFHOPPER POPULATIONS FROM VARIED ENVIRONMENTS	I	345	25/08/00	16:30	CC		7	PS	7
Mohankumar, S.	2286	MARKER-ASSISTED SELECTION AS A STRATEGY FOR SELECTING INSECT RESISTANT BREEDING LINES WITH IMPROVED EFFICIENCY	I	577	24/08/00	16:30	CC		12	PS	12
Mohankumar, S.	2287	MOLECULAR CHARACTERIZATION OF RICE BROWN PLANTHOPPER POPULATION	I	577	24/08/00	16:30	CC		12	PS	12
Mohankumar, S.	3886	MOLECULAR CHARACTERIZATION OF RICE BROWN PLANTHOPPER POPULATION	II	981	22/08/00	15:05	HB	H	22	3	22
Mohon, M.	3885	MOLECULAR MARKERS IN RICE FOR ENHANCING RICE GALL MIDGE RESISTANCE	II	981	22/08/00	14:35	HB	H	22	3	22
Mohri, H.	3094	ULTRASTRUCTURE OF DIMORPHIC SPERMATOZOA AND THEIR FERTILIZATION IN CICADIDAE (HEMIPTERA)	II	781	26/08/00	10:50	HB	G	16	9	16
Mohri, H.	3095	ULTRASTRUCTURES AND MOVEMENTS IN THE SPERMATOZOON OF STAG BEETLES	II	781	26/08/00	11:15	HB	G	16	9	16
Mohri, H.	3096	PHYLOGENETIC RELATIONSHIP ON SPERM ULTRASTRUCTURE OF THE STAG BEETLES (COLEOPTERA-LUCANIDAE)	II	781	26/08/00	11:40	HB	G	16	9	16
Moino Jr, A.	2004	MICROBIAL CONTROL OF TERMITES IN BRAZIL	I	506	22/08/00	14:05	HM	P	11	4	11
Moino Jr., A.	2112	COMPATIBILITY OF ENTOMOPATOGENIC FUNGI WITH NEONICOTINOIDS INSECTICIDES	I	533	23/08/00	16:30	CC		11	PS	11
Moita, L.F.	2353	THIOESTER CONTAINING PROTEINS IN INNATE IMMUNITY OF MOSQUITO ANOPHELES GAMBIAE	II	594	23/08/00	10:45	HB	I	13	4	13
Mojena, P. A.	1590	BIOLOGICAL CONTROL OF THE NANTUCKET PINE TIP MOTH (RHYACIONIA FRUSTRANA), A PEST OF THE GENUS PINUS	I	401	23/08/00	16:30	CC		8	PS	8
Mola, L. M.	2307	COMPARATIVE CYTOGENETICS IN ARGENTINE SPECIES OF PENTATOMINAE (PENTATOMIDAE, HETEROPTERA)	I	582	24/08/00	16:30	CC		12	PS	12

Sub-titles: (HB=Hotel Bourbon) - (HM=Hotel Mabu) - (CC=Convention Center) - (Bol=Foz Boulevard) - (PS=Poster Session) - (PL=Plenary Lecturer)

AUTHOR	Nº	TITLE	Book	Page	Date	Time	Local	Room	Session	Symp	New Session
Mola, L. M.	2309	CYTOGENETIC HETEROGENEITY IN COMMON ARGENTINE HAPLOGINE SPIDERS	I	583	24/08/00	16:30	CC		12	PS	12
Molaei, G.	2288	ISOLATION, CLONING, AND CHARACTERIZATION OF G PROTEIN-COUPLED RECEPTOR GENES, FROM THE AFRICAN MIGRATORY LOCUST, LOCUSTA MIGRATORIA	I	577	23/08/00	16:30	CC		12	PS	12
Moldenke, A. F.	2035	THE BENEFICIAL NEMATODE, HETERORHABDITIS MARELATUS : ITS PROMISE IN BIOCONTROL OF PESTS IN NURSERY AND FIELD CROPS	I	513	21/08/00	16:30	CC		11	PS	11
Moldenke, A. R.	52	THE UNIQUE INSECT BIODIVERSITY OF THE KLAMATH/SISKIYOU MOUNTAIN REGION IN NW USA; CHALLENGES FOR INVENTORY AND CONSERVATION	I	13	24/08/00	16:30	CC		1	PS	3
Moldenke, A. R.	1951	MANAGEMENT OF HEADWATER FOREST STREAMS: ISSUES OF INSECT DIVERSITY AND BIOMASS PRODUCTION FOR VERTEBRATE PREDATORS	I	492	23/08/00	16:30	CC		10	PS	10
Moleas, T.	3592	IMPORTANCE OF SOME PLANTS OF THE MEDITERRANEAN FLORA IN THE BIOLOGY OF FRANKLINIELLA OCCIDENTALIS (THYSANOPTERA THRIPIDAE)	II	906	21/08/00	16:30	CC		20	PS	20
Moleas, T.	1486	PREDATION OF DOCIOSTAURUS MAROCCANUS BY ZOOPHAGOUS DIPTERA AND COLEOPTERA (SOUTHERN ITALY)	I	375	21/08/00	16:30	CC		8	PS	8
Moleas, T.	1776	BIOETHOLOGY OF PHYLLOCNISTIS CITRELLA IN APULIA (SOUTH ITALY)	I	447	23/08/00	16:30	CC		9	PS	9
Molina, R. M. S.	3234	MIGRATION AS A STRATEGY FOR SURVIVAL OF DALBULUS MAIDIS (HEMIPTERA: CICADELLIDAE) DURING CORN OVERSEASON IN CENTRAL BRAZIL	II	816	23/08/00	16:30	CC		17	PS	17
Molina, S. I.	1071	DIVERSITY AND FUNCTIONAL STRUCTURE OF INSECT COMMUNITIES UNDER GRAZING AND EXCLUSION REGIMES IN A MONTANE ARGENTINE GRASSLAND	I	270	23/08/00	16:30	CC		6	PS	6
Molina, S. I.	565	ESTIMATING INSECT DIVERSITY IN CENTRAL ARGENTINA: A COMPARISON AMONG TAXA AND HABITATS	I	143	25/08/00	16:30	CC		3	PS	3
Molino-Olmedo, F.	4091	DATA ON INSECTS IMPLICATED IN THE DESTRUCTION OF WORKS OF ART IN SPAIN	II	1033	23/08/00	16:30	CC		23	PS	23
Molnár, T.	1779	EDGE EFFECT ON GROUND BEETLES	I	448	23/08/00	16:30	CC		9	PS	9
Molyneux, D. H.	2884	THE INFLUENCE OF WAR AND CONFLICT ON VECTOR-BORNE DISEASES	II	728	22/08/00	11:05	Bol	R	15	3	15
Mornol, M. T.	2828	EFFECTS OF INFECTION BY THE PARASITIC NEMATODE THRIPINEMA FUSCUM ON FRANKLINIELLA FUSCA POPULATION DYNAMICS AND TOSPOVIRUS EPIDEMIOLOGY IN PEANUT	II	714	25/08/00	16:30	CC		14	PS	14
Monard, A.	868	THE MALAGASY MIGRATORY LOCUST IN MADAGASCAR	I	219	26/08/00	9:50	HB	D	6	9	6
Moulden, N.	2498	MASKING OF CIRCADIAN ACTIVITY RHYTHM IN BUMBLE BEES: A NOVEL ADAPTATION MECHANISM TO HIGH-LATITUDE CONDITION	II	631	24/08/00	16:30	CC		13	PS	13
Monje, J. C.	1544	SURVEY FOR NATIVE TRICHOGRAMMATID SPECIES IN KENYA	I	389	22/08/00	16:30	CC		8	PS	8
Monné, M. A.	3811	A NEW NEOTROPICAL GENUS OF THE TRIBE TRACHYDERINI (COLEOPTERA, CERAMBYCIDAE)	II	962	24/08/00	16:30	CC		21	PS	21
Monné, M. L.	3810	REVISION OF THE GENUS CERALOCYNA (COLEOPTERA, CERAMBYCIDAE)	II	962	24/08/00	16:30	CC		21	PS	21
Monné, M. L.	3811	A NEW NEOTROPICAL GENUS OF THE TRIBE TRACHYDERINI (COLEOPTERA, CERAMBYCIDAE)	II	962	24/08/00	16:30	CC		21	PS	21
Monnerat, R.	299	BIONOMY OF THE BOLL WEVILL REARED ON ARTIFICIAL DIET	I	76	24/08/00	16:30	CC		2	PS	2
Monnerat, R. G.	2102	A CULTURE COLLECTION OF BACILLUS THURINGIENSIS AND BACILLUS SPHAERICUS PATHOGENIC TO INSECTS	I	530	23/08/00	16:30	CC		11	PS	11
Monnerat, R. G.	2103	PATHOGENICITY OF NEW ISOLATES OF BACILLUS THURINGIENSIS AGAINST LEPIDOPTERAN AND DIPTERAN PESTS	I	530	23/08/00	16:30	CC		11	PS	11
Monnerat, R. G.	2132	CARACTERIZATION OF NEW STRAINS OF BACILLUS THURINGIENSIS TOXIC AGAINST BOLL WEVILL, ANTHONOMUS GRANDIS	I	538	24/08/00	16:30	CC		11	PS	11
Monnerat, R. G.	2152	CLONING AND HETEROLOGOUS EXPRESSION OF A BACILLUS THURINGIENSIS PROTEIN TOXIC AGAINST THE FALL ARMYWORM	I	543	25/08/00	16:30	CC		11	PS	11
Monnerat, R. G.	2119	CHARACTERIZATION OF THE PROTEOLYTIC ACTIVITY OF ANTHONOMUS GRANDIS AND ISOLATION OF CDNAS ENCODING SERINE AND CYSTEINE PROTEASES	I	534	24/08/00	16:30	CC		11	PS	11
Monnerat, R. G.	2063	EFFECTS IN VITRO AND IN VIVO OF SOYBEAN KUNITZ TRYPSIN INHIBITORS AGAINST THE BOOL WEEVIL ANTHONOMUS GRANDIS	I	520	22/08/00	16:30	CC		11	PS	11
Montagna, M. A.	2761	SPATIAL DISTRIBUTION OF SILVERLEAF WHITEFLY IN MELON	II	697	23/08/00	16:30	CC		14	PS	14
Montagna, M. A.	2743	EVALUATION OF INDOXACARB FOR LEPIDOPTEROUS PESTS CONTROL ON VEGETABLES	II	693	22/08/00	16:30	CC		14	PS	14
Montalvo, J. M.	1916	NATURAL RESISTANCE OF TEN CUBAN FOREST SPECIES AGAINST TERMITE ATTACK	I	483	22/08/00	16:30	CC		10	PS	10
Monte, C. A.	717	FEMALE SEX PHEROMONE OF CASTNIA LICUS (LEPIDOPTERA:CASTNIIDEA): IDENTIFICATION AND FIELD APPLICATION	I	181	24/08/00	16:30	CC		4	PS	4
Monteiro Junior, A. F.	1139	A SURVEY OF THE ENTOMO-WILDLIFE ASSOCIATED THE GUAVA ORCHARDS (PSIDIUM GUAYAVA) CULTUVAR OGAWA 2, WITH THE UTILIZATION OF LURING TRAP MODEL C-47 AND THE (BINOMIAL) 'PRESENCE-ABSENCE' SAMPLING METHOD, IN THE STATE OF RIO DE JANEIRO, BRAZIL	I	287	23/08/00	16:30	CC		6	PS	6
Monteiro Junior, A. F.	1140	THE OCCURENCE AND BIOLOGICAL ASPECTS OF THE JUMPING PLANT LICE (HOMOPTERA:PSYLIDAE) ON GUAVA PLANTS (PSIDIUM GUAYAVA) AND 'SOMBREIRO' TREES (VICTORIA FAIRCHILDIANA) IN THE STATE OF RIO DE JANEIRO, BRAZIL	I	287	23/08/00	16:30	CC		6	PS	6
Monteiro, R. F.	1096	TRI-TROPHIC INTERACTIONS AMONG SPECIES ON MIKANIA GLOMERATA (ASTERACEAE) GALLS ON SOUTHEASTERN BRAZIL: A SPECIES RICH SYSTEM	I	276	24/08/00	16:30	CC		6	PS	6
Monteiro, R. F.	1591	DIVERSITY AND COMMUNITY STRUCTURE OF PARASITOIDS ASSOCIATED WITH ENTOMOGENOUS GALLS IN BRAZIL	I	401	23/08/00	16:30	CC		8	PS	8
Monteiro, R. C.	2762	FIRST RECORD OF NEOHYDATOTHRIPS SAMAYUNKUR (THYSANOPTERA:THRIPIDAE) IN BRAZIL	II	697	23/08/00	16:30	CC		14	PS	14
Montes, P.	1834	AN IPM APPROACH TO PREVENT THE ACCIDENTAL IMPORTATION OF SUBCORTICAL INSECTS FROM CHILE TO THE UNIDET STATES	I	462	22/08/00	14:35	HB	M	10	3	10
Montes, P.	373	EFFECTIVENESS OF METHYL BROMIDE ALTERNATIVES AGAINST POTENTIAL PESTS TO BE IMPORTED TO THE UNITED STATES FROM CHILE	I	94	25/08/00	16:30	CC		2	PS	2
Montes, P.	2856	AN IPM APPROACH TO PREVENTION OF POTENTIAL PESTS THAT MIGHT BE IMPORTED TO THE UNITED STATES ON CHILEAN LOGS: PART I, EFFECTIVENESS OF METHYL BROMIDE ALTERNATIVES	II	721	24/08/00	16:30	CC		14	PS	14
Montesdeoca, M.	209	EVALUATION OF THE EFFICACY ON AN AGGREGATION PHEROMONE AS A MEANS OF CAPTURE AND PROTECTION AGAINST COSMOPOLITES SORDIDUS GERMAR (COLEOPTERA: CURCULIONIDAE) IN THE CANARY ISLANDS	I	53	22/08/00	16:30	CC		2	PS	2
Moore, A.	747	DEVELOPMENT OF AN OPTICAL FLYING INSECT DETECTION AND IDENTIFICATION SYSTEM (OFIDIS)	I	189	21/08/00	11:15	Bol	T	5	1	5
Moore, C.	687	THE EFFECTS OF HOST PLANT ODOURS ON THE CALLING BEHAVIOUR, EGG MATURATION AND MATING SUCCESS OF THE COTTON BOLLWORM, HELICOVERPA ARMIGERA (HÜBNER) (LEPIDOPTERA: NOCTUIDAE)	I	174	23/08/00	16:30	CC		4	PS	4
Moore, R. C.	1268	BIFENAZATE (D2341), A NOVEL AGENT TO CONTROL SPIDER MITES	I	320	25/08/00	9:35	HM	N	7	9	7
Moore, S. D.	1461	AUGMENTATION OF PARASITOIDS FOR CONTROL OF CITRUS PESTS IN SOUTHERNFRICA	I	369	22/08/00	10:35	HM	O	8	3	8
Moore, S. D.	2589	NON-TARGET EFFECTS OF PESTICIDES ON BENEFICIAL INSECTS	II	654	24/08/00	14:50	HB	B	14	7	14
Moore, S. L.	2289	SEX-BIASED PARASITISM IN INSECTS	I	578	23/08/00	16:30	CC		12	PS	12
Moores, G. D.	1231	ROLE OF ESTERASES IN RESISTANCE TO PYRETHROIDS IN LEPIDOPTERA	I	311	21/08/00	15:35	HM	N	7	2	7
Moores, G. D.	1332	METABOLIC RESISTANCE TO PYRETHROIDS IN AUSTRALIAN HELICOVERPA SPECIES	I	336	22/08/00	16:30	CC		7	PS	7

Sub-titles: (HB=Hotel Bourbon) - (HM=Hotel Mabu) - (CC=Convention Center) - (Bol=Foz Boulevard) - (PS=Poster Session) - (PL=Plenary Lecturer)

AUTHOR	Nº	TITLE	Book	Page	Date	Time	Local	Room	Session	Symp	New Session
Moores, G. D.	1228	MOLECULAR STUDIES OF INSECT ACETYLCHOLINESTERASE: IS THERE NEW LIFE IN AN OLD TARGET?	I	310	21/08/00	14:05	HM	N	7	2	7
Mora, J.	3006	THE IMPORTANCE OF DEVELOPING NOVEL STRATEGIES FOR PESTICIDE USE IN CONTROLLING VECTOR-BORNE DISEASES	II	758	24/08/00	16:30	CC		15	PS	15
Mora, R.	3394	TERMITE DAMAGE TO BUILDINGS IN THE PROVINCE OF CORDOBA	II	857	21/08/00	11:50	HM	Q	19	1	19
Moraes, C. M. De	1072	GEOGRAPHIC DISTRIBUTION OF CUPUAÇU FRUIT BORER CONOTRACHELUS HUMEROPICTUS ON CUPUAÇU IN THE STATE OF AMAZONAS, BRAZIL	I	270	23/08/00	16:30	CC		6	PS	6
Moraes, C. M. De	1454	FINDING HOSTS IN A COMPLEX ENVIRONMENT: THE ROLE OF PLANT COMMUNICATION	I	367	23/08/00	14:35	HM	O	8	6	8
Moraes, C. M. De	1782	OVIPOSITION BEHAVIOR OF CONOTRACHELUS HUMEROPICTUS (COLEOPTERA: CURCULIONIDAE)	I	449	25/08/00	16:30	CC		9	PS	9
Moraes, E. M.	1073	OCURRENCE AND FLUCTUATION IN POPULATION SIZE OF A RECENTLY INTRODUCED DROSOPHILIDAE SPECIES IN BRAZIL	I	271	23/08/00	16:30	CC		6	PS	6
Moraes, G. J.	2740	RESISTANCE OF STRAWBERRIES TO TETRANYCHUS URTICAE (ACARI: TETRANYCHIDAE)	II	692	23/08/00	16:30	CC		14	PS	14
Moraes, G. J.	15	DAMAGE CHARACTERIZATION OF OLIGONYCHUS YOTHERSI (ACARI: TETRANICHIDAE) TO ERVA-MATE (ILEX PARAGUARIENSIS) (AQUIFOLIACEAE)	I	4	21/08/00	16:30	CC		1	PS	7
Moraes, G. J. de	2104	ANOTHER CASE OF INSECT AND TARSONEMID MITE (ACARI: TARSONEMIDAE) ASSOCIATION.	I	531	23/08/00	16:30	CC		11	PS	11
Moraes, G. J. de	2109	EFFECT OF A FORMULATION OF BACILUS THURINGIENSIS VAR. KURSTAKI ON THE IMMATURE STAGES, LONGEVITY AND FEEDING PREFERENCE OF PODISUS NIGRISPINUS	I	532	23/08/00	16:30	CC		11	PS	11
Moraes, G. J. de	30	SPACIAL AND TEMPORAL DISTRIBUTION OF CALACARUS HEVEAE ON RUBBER TREES IN BRAZIL	I	8	22/08/00	16:30	CC		1	PS	1
Moraes, J. C.	218	DETERMINATION OF INJURY AND DAMAGE OF THE MEALYBUG DYSMICOCCUS BREVIPES (HEMIPTERA: PSEUDOCOCCIDAE) IN PINEAPPLE	I	56	22/08/00	16:30	CC		2	PS	2
Moraes, J. C.	2614	EFFECT OF NITROGEN FERTILIZATION ON THE RESISTANCE OF CORN PLANTS TO THE ATTACK OF FALL ARMYWORM (LEPIDOPTERA: NOCTUIDAE)	II	660	21/08/00	16:30	CC		14	PS	14
Moraes, R. C. B.	2763	DETERMINATION OF THE OPTIMAL AND UPPER THRESHOLD OF TEMPERATURE FOR THE DEVELOPMENT OF SELENASPIDUS ARTICULATUS IN CITRUS	II	698	23/08/00	16:30	CC		14	PS	14
Moraes, R. H. P.	1592	OCCURRENCE OF BACULOVIRUS AND HEXAMERMIS SP. (NEMATODA, MERMITHIDAE) IN LONOMIA OBLIQUA (LEPIDOPTERA, SATURNIIDAE)	I	401	23/08/00	16:30	CC		8	PS	8
Morais, A. A.	1593	A SURVEY OF LACEWINGS (NEUROPTERA: CHRYSOPIDAE), IN COFFEE AGROECOSSYSTEM, IN LAVRAS, MG, BRAZIL	I	402	23/08/00	16:30	CC		8	PS	8
Morais, A. B. B.	1947	PRELIMINARY INVENTORY OF ARBOREAL INSECTS IN SANTA MARIA, RS, BRAZIL	I	491	23/08/00	16:30	CC		10	PS	10
Morais, H. C.	505	COMPARISON OF CARYOCAR BRASILIENSE CATERPILLAR FAUNA IN TWO CERRADO AREAS OF THE DISTRITO FEDERAL, BRAZIL	I	128	22/08/00	16:30	CC		3	PS	3
Morais, H. C.	891	HERBIVORES ASSOCIATED WITH THE REPRODUCTIVE PARTS OF OURATEA HEXASPERMA IN CENTRAL BRAZIL	I	225	21/08/00	16:30	CC		6	PS	6
Morais, H. C.	1074	CATERPILLARS ASSOCIATED WITH THE REPRODUCTIVE STRUCTURES OF PLANTS IN THE CERRADO	I	271	23/08/00	16:30	CC		6	PS	6
Morais, H. C.	1075	EFFECTS OF A PREDATORY ANT ON FLORAL VISITORS	I	271	23/08/00	16:30	CC		6	PS	6
Morais, H. C.	950	RICHNESS AND ABUNDANCE OF LEPIDOPTERAN CATERPILLARS ASSOCIATED WITH CERRADO PLANTS	I	240	22/08/00	16:30	CC		6	PS	6
Morais, H. C.	1878	RICHNESS AND ABUNDANCE OF CATERPILLARS ON CONGENERIC PLANTS IN CERRADO AREAS OF THE DISTRITO FEDERAL	I	473	25/08/00	15:35	HB	M	10	8	10
Morales, A. C.	2290	STUDY OF HYBRID ZONE AMONG DROSOPHILA SERIDO AND DROSOPHILA SP D, SPECIES OF THE CLUSTER BUZZATII	I	578	23/08/00	16:30	CC		12	PS	12
Morales, F.	100	HOST PLANT RESISTANCE TO BEMISIA TABACI AND OTHER WHITEFLY SPECIES, AND ASSOCIATED VIRUSES	I	26	22/08/00	13:35	HB	A	2	4	2
Morales, F. J.	1649	BEMISIA TABACI BIOTYPE B (HEMIPTERA: ALEYRODIDAE) AND ITS PARASITOIDS: GUADELOUPE ISLAND AS A REPRESENTATIVE SITE OF THE CARIBBEAN	I	416	24/08/00	16:30	CC		8	PS	8
Morales, L.	4151	ENHANCEMENT OF ANTICARSIA GEMMATALIS (LEPIDOPTERA: NOCTUIDAE) BACULOVIRUS ACTIVITY BY OPTICAL BRIGHTENERS	II	1048	21/08/00	16:30	CC		Erratum	PS	11
Morawicki, P.	3021	MONITORING OF HEMATOPHAGOUS VECTORS IN THE AREA OF INFLUENCE OF THE YACYRETA DAM	II	762	22/08/00	16:30	CC		15	PS	15
Morawicki, P.	562	DISTRIBUTION OF SOME SWALLOWTAIL BUTTERFLIES OF POSADAS, MISIONES, ARGENTINA	I	142	25/08/00	16:30	CC		3	PS	3
Morcos, A.	1269	THIAMETHOXAM: NEW INNOVATIVE APPLICATION OPPORTUNITIES FOR A SYSTEMIC PRODUCT	I	320	25/08/00	10:05	HM	N	7	9	7
Morcos, A.	341	THIAMETHOXAM USED AS SEED TREATMENT (CRUISER/ADAGE®), OR AS SOIL APPLICATION (ACTARA/PLATINUM®)	I	86	25/08/00	16:30	CC		2	PS	2
Mordocco, A.	2001	IS SOLID STATE FERMENTATION THE BEST OPTION TO PRODUCE FUNGAL BIOPESTICIDES	I	505	22/08/00	10:20	HM	P	11	3	11
Mordue, A. J.	2874	SEMIOCHEMICAL STRATEGIES IN MOSQUITOES AND MIDGES	II	725	21/08/00	11:20	Bol	R	15	1	15
Moré, M.	321	EGG DEVELOPMENT IN DIATRAEA SACCHARALIS (LEPIDOPTERA: PYRALIDAE) UNDER DIFFERENT TEMPERATURE REGIMES	I	81	24/08/00	16:30	CC		2	PS	2
Moreira, A. A.	3524	INTERNAL ARCHITECTURE OF ATTA BISPHAERICA NESTS (HYMENOPTERA: FORMICIDAE)	II	889	24/08/00	16:30	CC		19	PS	19
Moreira, A. A.	3525	RESPONSE OF ATTA BISPHAERICA (HYMENOPTERA, FORMICIDAE) TO METHANOLIC EXTRACTS OF SUGAR CANE AND ANDROPOGON GRASS	II	889	24/08/00	16:30	CC		19	PS	19
Moreira, D.	187	BIOLOGY OF THE GUAJAVA WEEVIL, CONOTRACHELUS PSIDII (COLEOPTERA: CURCULIONIDAE), REARED UNDER LABORATORY CONDITIONS	I	48	21/08/00	16:30	CC		2	PS	2
Moreira, E.	4058	NEW TOOLS IN MOSQUITO CONTROL MANAGEMENT	II	1025	25/08/00	10:25	HB	J	23	10	23
Moreira, G. R. P.	990	MORPHOLOGICAL CHARACTERIZATION OF TWO PASSIFLORA SUBEROSA FORMS AND INFLUENCE ON HOST PLANT SELECTION BY HELICONIUS ERATO	I	250	22/08/00	16:30	CC		6	PS	6
Moreira, G. R. P.	1031	BEHAVIORAL AND ECOLOGICAL FEATURES OF HOST PLANT SELECTION AND INFLUENCE ON LOCAL SPECIALIZATIONS BY HELICONIUS ERATO	I	260	23/08/00	16:30	CC		6	PS	6
Moreira, G. R. P.	1791	SEASONAL VARIATION AND EFFECTS OF LARVAL FEEDING RESOURCES ON HELICONIUS ERATO (LEPIDOPTERA: NYMPHALIDAE) ADULT BODY SIZE	I	451	24/08/00	16:30	CC		9	PS	9
Moreira, G. R. P.	1781	LIVING ON A HAIRY SURFACE: MOVEMENT AND FEEDING BEHAVIOR OF GRATIANA SPADICEA (COL.:CHRYSOMELIDAE: CASSIDINAE) ON ITS HOST PLANT SOLANUM SISYMBRIIFOLIUM (SOLANACEAE)	I	449	23/08/00	16:30	CC		9	PS	9
Moreira, J. O. T.	294	EFFICIENCY OF SOME CHEMICALS TO CONTROL WHITE FLY, BEMISIA ARGENTIFOLII IN PUMPKIN CUCURBITA MOSCHATA, IN SAN FRANCISCO VALLEY – BRAZIL	I	75	24/08/00	16:30	CC		2	PS	2
Moreira, J. O. T.	699	LUFENURON EFFICIENCY EVALUATION TO CONTROL THE MITE ACERIA GUERRERONIS THAT CAUSES NECROSIS IN THE COCONUT PALM	I	177	25/08/00	16:30	CC		4	PS	4
Moreira, J. O. T.	700	DIAFENTIURON EFFICIENCY EVALUATION TO CONTROL THE MITE ACERIA GUERRERONIS THAT CAUSES NECROSIS IN THE COCONUT PALM	I	177	25/08/00	16:30	CC		4	PS	4
Moreira, J. O. T.	701	ABAMECTIN EFFICIENCY EVALUATION TO CONTROL THE MITE ACERIA GUERRERONIS THAT CAUSES NECROSIS IN THE COCONUT PALM	I	177	25/08/00	16:30	CC		4	PS	4
Moreira, J. O. T.	1594	BIOLOGY, THERMAL REQUIREMENTS AND PARASITIZATION OF TRICHOGRAMMA PRETIOSUM STRAINS ON HELICOVERPA ZEA EGGS	I	402	23/08/00	16:30	CC		8	PS	8
Moreira, L. A.	3001	TOWARD INTERRUPTING MALARIA TRANSMISSION BY GENETIC MANIPULATION OF THE MOSQUITO VECTOR	II	757	23/08/00	16:30	CC		15	PS	15

Sub-titles: (HB=Hotel Bourbon) - (HM=Hotel Mabu) - (CC=Convention Center) - (Bol=Foz Boulevard) - (PS=Poster Session) - (PL=Plenary Lecturer)

AUTHOR	Nº	TITLE	Book	Page	Date	Time	Local	Room	Session	Symp	New Session
Moreira, M.	1166	POPULATION BEHAVIOUR CHANGES OF THE PROCESSIONARY MOTH (THAUMETOPOEA PITYOCAMPA) IN PORTUGAL	I	294	25/08/00	16:30	CC		6	PS	6
Moreira, M. A. B.	1076	OCCURRENCE OF WEED PLANTS AS ALTERNATIVE HOSTS OF SILVERLEAF WHITEFLY (BEMISIA ARGENTIFOLII) (HEMIPTERA: ALEYRODIDAE), IN THE STATE OF RIO GRANDE DO NORTE, BRAZIL	I	271	23/08/00	16:30	CC		6	PS	6
Moreira, M. A. B.	1595	EVALUATION OF THE PARASITISM OF TELENOMUS PODISI ON PIEZODORUS GUILDINII (HETEROPTERA:PENTATOMIDAE) EGGS, IN SOYBEAN CROP IN RORAIMA, BRAZIL	I	402	24/08/00	16:30	CC		8	PS	8
Moreira, M. A. B.	2764	OCCURRENCE OF GRASSHOPPER SCHISTOCERCA PALLENS, (ORTHOPTERA:ACRIDIDAE) IN RORAIMA, BRAZIL	II	698	25/08/00	16:30	CC		14	PS	14
Moreira, M. D.	1045	EFFECTS OF TRICHOMES AND CRISTALIFEROUS IDIOBLASTS DENSITIES, CONCENTRATIONS OF MINERALS AND WEATHER ON THE BEMISIA ARGENTIFOLII IN TOMATO	I	264	23/08/00	16:30	CC		6	PS	6
Moreira, W. A.	1294	EFFECT OF CHEMICAL CONTROL OF BEMISIA ARGENTIFOLII (HEMIPTERA: ALEYRODIDAE) ON THE INCIDENCE OF BEAN GOLDEN MOSAIC VIRUS IN COMMON BEANS AND ITS YIELD	I	327	21/08/00	16:30	CC		7	PS	7
Moreira, W. A.	2626	INTEGRATED MANAGEMENT OF THE APHID, APHIS GOSSYPII, IN INDIAN CHERRY TREE, IN IRRIGATED AREAS OF THE SÃO FRANCISCO VALLEY	II	663	22/08/00	16:30	CC		14	PS	14
Moreira-Ferro, C. K.	2927	STRUCTURE AND EXPRESSION OF THE LARVAL AND ADULT HEXAMERIN GENES, MDH1.1 AND MDH2.1, IN MUSCA DOMESTICA	II	739	25/08/00	11:20	Bol	R	15	9	15
Morella, S. La	1631	TEN YEARS OF STUDIES ON PARASITOIDS OF THE PEAR PSYLLA, CACOPSYLLA PYRI, IN SICILY (RHYNCHOTA PSYLLOIDEA)	I	411	24/08/00	16:30	CC		8	PS	8
Morelli, E.	3724	THE MORPHOLOGY OF THE IMMATURE STAGE OF PHORACANTHA RECURVA (COLEOPTERA: CERAMBYCIDAE) AND A KEY TO LARVAE OF THE SPECIES OF PHORACANTHA IN URUGUAY	II	940	21/08/00	16:30	CC		21	PS	21
Moreno, C. E.	415	INDICATOR GROUPS FOR BIODIVERSITY ASSESSMENT: RESULTS AND PERSPECTIVES OF A STRATEGY.	I	105	23/08/00	14:50	HB	C	3	4	3
Moreno, J. C.	4077	PARSIMONY ANALYSIS OF ENDEMICITY AND ITS APPLICATION TO DETECT HIGH ENDEMISM AREAS USING COMBINED DATA FROM INSECTS, VERTEBRATES, AND PLANTS, FROM THE IBERIAN PENINSULA	II	1029	21/08/00	16:30	CC		23	PS	23
Moreno, P. R.	3347	EFFECT OF INSECT GROWTH REGULATOR BUPROFEZIN ON GREEN LEAFHOPPER (EMPOASCA KRAEMERI ROSS & MOORE, 1957) (HEMIPTERA, CICADELLIDAE) NYMPHS AND ADULTS UNDER LABORATORY CONDITIONS	II	845	23/08/00	16:30	CC		18	PS	18
Moreno, P. R.	3348	EFFECT OF BUPROFEZIN ON GREEN LEAFHOPPER (EMPOASCA KRAEMERI ROSS & MOORE, 1957) (HEMIPTERA, CICADELLIDAE) FECUNDITY UNDER LABORATORY CONDITIONS	II	845	23/08/00	16:30	CC		18	PS	18
Moreno, T.	3394	TERMITE DAMAGE TO BUILDINGS IN THE PROVINCE OF CORDOBA	II	857	21/08/00	11:50	HM	Q	19	1	19
Moreno-Murillo, B.	702	VOLATILE BIOACTIVE CONSTITUENTS FROM THE FLOWERS OF TAGETES ZYPAQUIRENSIS (ASTERACEAE)	I	177	24/08/00	16:30	CC		4	PS	4
Moretti, A.	987	APHIDS: NOT ONLY A PEST INSECT	I	249	22/08/00	16:30	CC		6	PS	6
Moretti, G.	1939	APPLICATION OF A GEOGRAPHICAL INFORMATION SYSTEM TO THE STUDY OF SIREX NOCTILIO (HYMENOPTERA-SIRICIDAE) IN CALAMUCHITA VALLEY, CÓRDOBA, ARGENTINA	I	489	23/08/00	16:30	CC		10	PS	10
Moretto, G.	3442	MORTALITY OF THE MITE VARROA JACOBSONI IN AFRICANIZED BEES COLONIES	II	869	24/08/00	11:20	HM	Q	19	5	19
Moretzsohn, M. C.	2272	BEMISIA TABACI POPULATIONS IN BRAZIL: GENETIC DIVERSITY REVEALED BY RAPD MARKERS	I	573	23/08/00	16:30	CC		12	PS	12
Morgan, A. L.	3542	A PILOT TEST FOR AREA WIDE MANAGEMENT OF THE FORMOSAN SUBTERRANEAN TERMITE IN THE FRENCH QUARTER, NEW ORLEANS, LOUISIANA	II	894	24/08/00	16:30	CC		19	PS	19
Morgan, D	152	INDIVIDUAL-BASED MODELS: VIRTUAL INSECTS?	I	39	26/08/00	9:35	HB	A	2	10	2
Morgan, D.	153	MODELLING THE SPATIAL DYNAMICS OF INSECT-TRANSMITTED PLANT VIRUSES	I	39	26/08/00	10:05	HB	A	2	10	2
Morgan, D.	3970	A HIGHLY INTEGRATED MONITORING SYSTEM TO SUPPORT ON-TIME, ON-LINE DECISION-MAKING IN AGRICULTURE	II	1002	24/08/00	16:30	CC		22	PS	22
Morgan, J. C.	351	MOLECULAR CHARACTERISATION AND QUANTITATION OF THE AMPLIFIED CARBOXYLESTERASE GENE ASSOCIATED WITH ORGANOPHOSPHORUS INSECTICIDE RESISTANCE IN THE BROWN PLANTHOPPER, NILAPARVATA LUGENS	I	89	25/08/00	16:30	CC		2	PS	2
Morgan, M. S.	3	HOST IMMUNE RESPONSE TO SARCOPTES SCABIEI AND INDUCED IMMUNITY	I	1	24/08/00	14:35	HB	F	1	1	1
Mori, H.	3503	CHEMICAL STRUCTURE AND PROPERTIES OF SILK PROTEINS PRODUCED BY THE SILKWORMS REARED UNDER ARTIFICIAL DIET/ASEPTIC CONDITIONS	II	884	23/08/00	16:30	CC		19	PS	19
Mori, H.	2221	BACULOVIRUS-MEDIATED GENE TARGETING IN THE SILKWORM	I	561	25/08/00	15:35	HB	L	12	10	12
Mori, H.	2076	MOLECULAR CHARACTERIZATION OF BOMBYX MORI CYTOPLASMIC POLYHEDROSIS VIRUS SEGMENT	I	524	22/08/00	16:30	CC		11	PS	11
Mori, N.	2580	ORGANOPHOSPHATE RESISTANCE IN GRAPE LEAFHOPPERS AND IPM STRATEGIES	II	652	24/08/00	10:05	HB	B	14	6	14
Mori, T.	291	INSECT PESTS ON MACADAMIANUT TREES IN COLONIA SAN JUAN DE YAPACANI, SANTA CRUZ DISTRICT, BOLIVIA	I	74	23/08/00	16:30	CC		2	PS	2
Morimyo, M.	3266	BOMBYX EST DATABASE, SILKBASE, FOR GENOME ANALYSIS OF BOMBYX MORI	II	825	22/08/00	11:05	HB	K	18	2	18
Morin, J-P.	682	CONTROL OF SCAPANES AUSTRALIS A MAJOR PEST OF COCONUT USING SEMIOCHEMICALS	I	172	23/08/00	16:30	CC		4	PS	4
Morin, J-P.	716	EFFECT OF ORYCTES RHINOCEROS PHEROMONE (ETHYL 4-METHYLOCTANOATE) DIFFUSION RATE ON THE SIZE OF PEST CATCHES	I	181	24/08/00	16:30	CC		4	PS	4
Morita, A.	2291	DIAPAUSE HORMONE AND PHEROMONE BIOSYNTHESIS ACTIVATING NEUROPEPTIDE (DH-PBAN) GENE EXPRESSION IN THE EMBRYO OF THE SILKWORM, BOMBYX MORI	I	578	23/08/00	16:30	CC		12	PS	12
Morita, K.	1344	CONTROL OF DIAMONDBACK MOTH (PLUTELLA XYLOSTELLA) BY SPINOSAD AND ITS INFLUENCE ON PARASITIC WASPS	I	339	23/08/00	16:30	CC		7	PS	7
Moriyama, E. N.	2250	MITOCHONDRIAL DNA SEQUENCES OF TRIATOMINAE (HEMIPTERA: REDUVIIDAE): PHYLOGENETIC RELATIONSHIPS	I	568	22/08/00	16:30	CC		12	PS	12
Morón, M. A.	79	TAXONOMY AND BIOLOGY OF THE SCARABAEIDAE	I	21	21/08/00	9:50	HB	A	2	1	2
Moros, O. I.	1077	POPULATIONS OF NECROPHAGOUS COLEOPTERA AS BIOLOGICAL INDICATORS OF PHYSIOGRAPHIC SUB-REGIONS IN THE TACHIRA'S MOUNTAIN PASS	I	272	23/08/00	16:30	CC		6	PS	6
Morozov, P.S.	577	THE MOLECULAR BIOLOGY OF DROSOPHILA ODORANT RECEPTORS	I	146	21/08/00	10:45	Bol	S	4	1	4
Morrill, W. L.	801	IMPACT OF CULTURAL PRACTICES ON POPULATIONS OF THE WHEAT STEM SAWFLY (HYMENOPTERA: CEPHIDAE) AND ITS ASSOCIATED PARASITOIDS	I	203	21/08/00	10:35	HB	D	6	1	6
Morrill, W. L.	799	ASPECTS OF THE ECOLOGY OF THE WHEAT STEM SAWFLY (HYMENOPTERA: CEPHIDAE) IN NORTH AMERICA	I	202	21/08/00	10:05	HB	D	6	1	6
Morris, R. A.	779	A SOFTWARE ENGINEERING PERSPECTIVE ON DEVELOPING ELECTRONIC FIELD GUIDES: LESSONS FOR BIOINFORMATICS	I	197	24/08/00	15:00	Bol	T	5	5	5
Morris, R. A.	791	DEVELOPING ELECTRONIC FIELD GUIDES: FIRST RESULTS USING COSTA RICAN BUTTERFLIES AND MASSACHUSETTS AQUATIC MACROINVERTEBRATES	I	200	23/08/00	16:30	CC		5	PS	5
Morrison, A. C.	2903	SPATIAL AND TEMPORAL HETEROGENEITY IN DENGUE VIRUS TRANSMISSION AND AEDES AEGYPTI POPULATION DENSITIES IN IQUITOS, PERU	II	733	23/08/00	14:35	Bol	R	15	6	15
Morrison, L. W.	1596	CLASSICAL BIOLOGICAL CONTROL OF IMPORTED FIRE ANTS BY PARASITOID FLIES.	I	402	23/08/00	16:30	CC		8	PS	8

Sub-titles: (HB=Hotel Bourbon) - (HM=Hotel Mabu) - (CC=Convention Center) - (Bol=Foz Boulevard) - (PS=Poster Session) - (PL=Plenary Lecturer)

AUTHOR	Nº	TITLE	Book	Page	Date	Time	Local	Room	Session	Symp	New Session
Morse, J. G.	883	OVIPOSITION OF HOMALODISCA SPP. (HEMIPTERA: CICADELLIDAE: CICADELLINAE) AND ASSOCIATED EGG PARASITISM ON CITRUS: SPATIAL DISTRIBUTION	I	223	21/08/00	16:30	CC		6	PS	6
Morse, S.	1257	THE UPTAKE OF BOTANICAL INSECTICIDES BY FARMERS: A CASE STUDY OF TOBACCO BASED PRODUCTS IN NIGERIA	I	317	24/08/00	11:20	HM	N	7	7	7
Mortimer, S. R.	426	INSECTS AS INDICATORS OF THE RESTORATION OF AGRICULTURAL LAND	I	108	24/08/00	11:35	HB	C	3	5	3
Morton, R.	3989	RESPONSE OF TRANSGENIC PEAS CONTAINING A SEED SPECIFIC ALPHA-AMYLASE INHIBITOR GENE TO HEAT AND WATER STRESSES	II	1007	24/08/00	16:30	CC		22	PS	22
Morton, T.	1597	HOST SELECTION CUES OF A POTENTIAL BIOLOGICAL CONTROL AGENT FOR THE LILY LEAF BEETLE, LILIOCERIS LILII	I	403	23/08/00	16:30	CC		8	PS	8
Moscardi, F.	2567	ROLE OF NATURAL ENEMIES IN DEVELOPING IPM STRATEGIES	II	649	22/08/00	15:05	HB	B	14	4	14
Moscardi, F.	2576	ECOLOGY OF ENTOMOPATHOGENS	II	651	23/08/00	14:30	HB	B	14	5	14
Moscardi, F.	3891	VIRUSES – PROSPECTS IN CROP PROTECTION	II	982	23/08/00	11:15	HB	H	22	4	22
Moscardi, F.	4151	ENHANCEMENT OF ANTICARSIA GEMMATALIS (LEPIDOPTERA: NOCTUIDAE) BACULOVIRUS ACTIVITY BY OPTICAL BRIGHTENERS	II	1048	21/08/00	16:30	CC		Erratum	PS	11
Moscatello, S.	886	IMPROVEMENT OF HONEY-BEE POLLINATION IN ACTINIDIA DELICIOSA	I	224	21/08/00	16:30	CC		6	PS	6
Mosco, M. C.	3722	AN APPROACH TO EVOLUTIVE TAXONOMY OF THE APHID GENUS ANURAPHIS (RHYNCHOTA APHIDIDAE)	II	940	21/08/00	16:30	CC		21	PS	21
Moslim, R.	84	MANAGEMENT OF RHINOCEROS BEETLES IN MALAYSIA	I	22	21/08/00	11:05	HB	A	2	1	2
Mota S., D.	1384	RELATION DOSE-LETHALITY OF THREE PESTICIDES ON VARROA JACOBSONI (GAMASIDA: VARROIDAE) AND APIS MELLIFERA (HYMENOPTERA: APIDAE): COMPARISON OF TWO ADMINISTRATION METHODS	I	349	24/08/00	16:30	CC		7	PS	7
Mota, V. C.	3489	ANT ASSEMBLAGES (FORMICIDAE) IN THE PARQUE ESTADUAL XIXOVÁ-JAPUI, SÃO VICENTE-PRAIA GRANDE, SÃO PAULO	II	881	25/08/00	16:30	CC		19	PS	19
Motta, C. S.	401	SPHINGIDAE OF THE BRAZILIAN AMAZON	I	102	22/08/00	16:05	HB	C	3	2	3
Motta, P. C.	529	CICADA DIVERSITY IN BRASÍLIA, BRAZIL	I	134	24/08/00	16:30	CC		3	PS	3
Motta, P. C.	3812	PHYLOGENETIC RELATIONSHIPS OF BRAZILIAN METHONA BUTTERFLY BASED ON LARVAE	II	962	25/08/00	16:30	CC		21	PS	21
Motte-Florac, E.	4144	MEDICINAL INSECTS	II	1047	21/08/00	16:30	CC		24	PS	24
Moubayed, J.	2986	AN ANNOTATED CHECKLIST OF THE CHIRONOMIDAE (DIPTERA) OF EGYPT	II	753	22/08/00	16:30	CC		15	PS	15
Mouchès, C.	2210	TRANSPOSABLE ELEMENTS IN CULICINES MOSQUITO GENOMES : CLASSICAL AND ODD STRUCTURES, HIGH COPY NUMBER AND ROLE IN POPULATION POLYMORPHISM	I	558	24/08/00	15:15	HB	L	12	8	12
Mouchès, C.	2247	RAPID GENOME SHUFFLING BY TRANSPOSABLE ELEMENTS: WHAT CAN WE LEARN FROM CULEX PIPIENS MOSQUITOES?	I	567	21/08/00	16:30	CC		12	PS	12
Mougabure Cueto, G.	4099	SYNERGIZED PYRETHROIDS FOR THE CONTROL OF PERMETHRIN RESISTANT HEAD LICE PEDICULUS CAPITIS (PHTHIRAPETRA, PEDICULIDAE)	II	1035	21/08/00	16:30	CC		23	PS	23
Mougabure Cueto, G.	4100	REVERSION OF PERMETHRIN RESISTANCE BY INSECTICIDE SYNERGISTS IN THE HEADLICE PEDICULUS CAPITIS (PHTHIRAPTERA, PEDICULIDAE).	II	1035	21/08/00	16:30	CC		23	PS	23
Mougabure Cueto, G. A.	4092	OVICIDAL EFFECT AND EMBRYO RESISTANCE TO INSECTICIDES IN PEDICULUS CAPITIS (PHTHIRAPTERA, PEDICULIDAE)	II	1033	23/08/00	16:30	CC		23	PS	23
Moulton, J. K.	1367	PRO-ACTIVE MANAGEMENT OF BEET ARMYWORM (SPODOPTERA EXIGUA) RESISTANCE TO THE IGRS, TEBUFENOZIDE AND METHOXYFENOZIDE	I	345	24/08/00	16:30	CC		7	PS	7
Mound, L.	2762	FIRST RECORD OF NEOHYDATOTHRIPS SAMAYUNKUR (THYSANOPTERA:THRIPIDAE) IN BRAZIL	II	697	23/08/00	16:30	CC		14	PS	14
Moura, E.	225	EFFECT OF THE INSECT GROWTH REGULATOR DIFLUBENZURON ON REPRODUCTION OF EUSCHISTUS HEROS (FABR.) (HETEROPTERA: PENTATOMIDAE)	I	57	22/08/00	16:30	CC		2	PS	2
Moura, J. I. L.	610	MASS TRAPPING OF RHYNCHOPHORUS PALMARUM USING PHEROMONE IN COCONUT PLANTATION, IN BRAZIL	I	154	24/08/00	10:05	Bol	S	4	6	4
Moura, M. O.	1078	BATFLIES OF THE FISHBAT NOCTILIO LEPORINUS (MAMMALIA: CHIROPTERA): EFFECTS OF HOST SEX, SIZE, DEVELOPMENTAL STAGE AND SEASON	I	272	23/08/00	16:30	CC		6	PS	6
Moura, M. O.	3139	COMPARATIVE MORPHOLOGY OF IMMATURE STAGES OF NOCTILIOSTREBLA AITKENI AND PARADYSCHIRIA FUSCA (DIPTERA: STREBLIDAE)	II	792	22/08/00	16:30	CC		16	PS	16
Moutinho, P.	3432	LEAF-CUTTING ANT (ATTA SEXDENS) EFFECTS ON SOIL, ROOT DISTRIBUTION AND TREE GROWTH IN A SECONDARY FOREST OF EASTERN AMAZONIA	II	866	23/08/00	11:20	HM	Q	19	4	19
Moya Borja, G. E.	2470	INFLUENCE OF DIFFERENT AGES OF FISH PUTREFATION ON THE POST EMBRIONIC DEVELOPMENT OF LUCÍLIA CUPRINA (DIPTERA:CALLIPHORIDAE) UNDER LABORATORY CONDITIONS	II	624	23/08/00	16:30	CC		13	PS	13
Moya Borja, G. E.	3002	INFLUENCE OF A DIET BASE OF FISH MEAT IN DIFFERENT PUTRAFATION STAGES ON THE POST-EMBRYONIC DEVELOPMENT OF LUCILIA CUPRINA (DIPTERA:CALLIPHORIDAE) UNDER LABORATORY CONDITIONS	II	757	24/08/00	16:30	CC		15	PS	15
Moya Borja, G. E.	2966	CORRESPONDENCE BETWEEN THE WEIGHT OF THE LARVAE OF 3RD STATED AND THE ADULTS' SEX OF DERMATOBIA HOMINIS (DIPTERA: CUTEREBRIDAE)	II	748	21/08/00	16:30	CC		15	PS	15
Moya Borja, G. E.	2965	CORRELATION BETWEEN THE WEIGHT OF THE THIRD INSTAR LARVAE AND THE SEX OF ADULTS OF DERMATOBIA HOMINIS (LINNAEUS, JR) (DIPTERA: CUTEREBRIDAE)	II	748	21/08/00	16:30	CC		15	PS	15
Moya Borja, G. E.	2967	SEASONAL FLUCTUATION OF DERMATOBIA HOMINIS (DIPTERA: CUTEREBRIDAE) ON HIDES OF BUTCHERED BOVINES AT THE SLAUGHTERHOUSE OF PIRAI COUNTY, RIO DE JANEIRO, BRAZIL	II	749	21/08/00	16:30	CC		15	PS	15
Moya Borja, G. E.	2968	STUDIES OF THE EFFECT OF CLIMATIC FACTORS ON SEASONAL FLUCTUATION OF DERMATOBIA HOMINIS (DIPTERA: CUTEREBRIDAE) ON SKINS OF BUTCHERED BOVINES AT THE SLAUGHTERHOUSE OF PIRAI COUNTY, RIO DE JANEIRO, BRAZIL	II	749	22/08/00	16:30	CC		15	PS	15
Moya, M. C.	4142	SOCIOECONOMIC ANALYSIS OF THE IMPACT OF PLATYPUS SULCATUS CHAPUIS AT A FOREST FARM IN THE DELTA BONAERENSE	II	1046	21/08/00	16:30	CC		24	PS	24
Moya-Borja, G. E.	2994	INFLUENCE OF DIFFERENT MIXTURES OF BOVINE FECIES WITH SOME INGREDIENTS TO REAR STOMOXYS CALCITRANS UNDER LABORATORY CONDITIONS	II	755	21/08/00	16:30	CC		15	PS	15
Moya-Raygoza, G.	3649	HOST-PARASITE RELATIONSHIP OF HALICTOPHAGUS NAULTI PARASITIC IN LEAFHOPPER PESTS OF MAIZE IN MEXICO	II	921	23/08/00	14:35	HB	E	21	5	21
Muegge, M. A.	1562	SAMPLING PREDATORY INSECTS AND SPIDERS IN COTTON	I	394	22/08/00	16:30	CC		8	PS	8
Mueller, U. G.	3434	THE ORIGIN OF THE ATTINE ANT-FUNGUS MUTUALISM	II	867	23/08/00	11:50	HM	Q	19	4	19
Mueller, U. G.	3429	USURPERS AND MARAUDERS: THE SOCIAL PREDATOR MEGALOMYRMEX SP. NOV. (FORMICIDAE: SOLENOPSIDINI) PILLAGES BOTH GARDEN AND BROOD FROM FUNGUS-GROWING ANTS (ATTINI)	II	866	23/08/00	10:35	HM	Q	19	4	19
Muggleton, J.	4111	MORPHOLOGICAL DESCRIPTION OF HYBRIDS FROM INTER-SPECIFIC CROSSES BETWEEN A. FARRIS AND A. SIRO	II	1038	25/08/00	16:30	CC		23	PS	23
Mugrábi-Oliveira, E.	3981	THREAT ON THE GREEN BELT AT COMPANHIA SIDERÚRGICA DE TUBARÃO - CST	II	1005	24/08/00	16:30	CC		22	PS	22
Muir, W. E.	4041	CANADIAN GRAIN STORAGE CD-ROM	II	1020	23/08/00	15:30	HB	J	23	7	23
Mukunthan, N.	332	ATTRACTION OF SHOOT BORER, CHILO INFUSCATELLUS, DAMAGED SUGARCANE TO THE BRACONID COTESIA FLAVIPES	I	84	24/08/00	16:30	CC		2	PS	2
Mukunthan, N.	723	EFFECT OF BUCCAL CAVITY SECRETIONS OF PARASITISED AND UNPARASITISED CHILO INFUSCATELLUS LARVAE ON THE SYNOMONAL ACTIVITY OF SUGRACANE PLANT	I	183	25/08/00	16:30	CC		4	PS	4

Sub-titles: (HB=Hotel Bourbon) - (HM=Hotel Mabu) - (CC=Convention Center) - (Bol=Foz Boulevard) - (PS=Poster Session) - (PL=Plenary Lecturer)

AUTHOR	Nº	TITLE	Book	Page	Date	Time	Local	Room	Session	Symp	New Session
Mulla, M.	2932	MICROBIAL PESTICIDES: CURRENT AND FUTURE USES FOR INTEGRATED MOSQUITO CONTROL	II	740	25/08/00	14:15	Bol	R	15	10	15
Mullens, B.	2922	THE INTERACTION BETWEEN CLIMATIC FACTORS AND BLUETONGUE OUTBREAKS IN ISRAEL, THE EASTERN MEDITERRANEAN AND THE FEASIBILITY OF ESTABLISHING BLUETONGUE-FREE ZONES	II	737	25/08/00	10:05	Bol	R	15	9	15
Mullens, B.	2922	THE INTERACTION BETWEEN CLIMATIC FACTORS AND BLUETONGUE OUTBREAKS IN ISRAEL, THE EASTERN MEDITERRANEAN AND THE FEASIBILITY OF ESTABLISHING BLUETONGUE-FREE ZONES	II	737	25/08/00	10:05	Bol	R	15	9	15
Muller, C.	1597	HOST SELECTION CUES OF A POTENTIAL BIOLOGICAL CONTROL AGENT FOR THE LILY LEAF BEETLE, LILIOCERIS LILII	I	403	23/08/00	16:30	CC		8	PS	8
Muller, C.	4131	THE ABDOMINAL SHIELDS OF TANSY FEEDING CASSIDINE SPECIES – DEFENCE VERSUS ATTRACTION	II	1043	25/08/00	15:00	HM	P	24	2	24
Muller, C.	3165	THE ABDOMINAL SHIELDS OF TANSY FEEDING CASSIDINE SPECIES – DEFENCE VERSUS ATTRACTION	II	798					16		16
Muller, C. B.	1613	IMPACT OF A SYMBIOTIC GRASS-ENDOPHYTE ASSOCIATION ON INSECT HERBIVORES AND THEIR NATURAL ENEMIES	I	407	23/08/00	16:30	CC		8	PS	8
Muller, C. B.	1079	EFFECTS OF NATURAL ENEMIES AND RESOURCE QUALITY ON HERBIVORE ESABLISHMENT IN TWO HABITATS	I	272	23/08/00	16:30	CC		6	PS	6
Müller, H-M.	2358	GENOMIC STRUCTURE AND ECDYSONE REGULATION OF THE PROPHENOLOXIDASE 1 GENE IN THE MALARIA VECTOR ANOPHELES GAMBIAE	II	596	23/08/00	14:20	HB	I	13	5	13
Mullick, S.	1080	FEEDING RESPONSES AND GROWTH OF HELICOVERPA ARMIGERA (LEPIDOPTERA: NOCTUIDAE) LARVAE MAINTAINED ON CHICKPEA, COWPEA, BLACKGRAM AND PIGEONPEA DIETS	I	272	23/08/00	16:30	CC		6	PS	6
Mullick, S.	1159	ORIENTATIONAL RESPONSES OF HELICOVERPA ARMIGERA LARVAE TOWARDS LEAVES OF DIFFERENT LEGUMINOUS CROPS	I	292	25/08/00	16:30	CC		6	PS	6
Mullick, S.	3349	FEEDING RESPONSES AND GROWTH OF HELICOVERPA ARMIGERA (LEPIDOPTERA: NOCTUIDAE) LARVAE MAINTAINED ON CHICKPEA, COWPEA, BLACKGRAM AND PIGEONPEA DIETS	II	846	23/08/00	16:30	CC		18	PS	18
Mullins, D. E.	3350	STRUCTURAL BASIS FOR WATER EXCHANGE BETWEEN THE FEMALE COCKROACH (BLATTELLA GERMANICA L.) AND HER OOTHECAE	II	846	23/08/00	16:30	CC		18	PS	18
Mullins, K. J.	3350	STRUCTURAL BASIS FOR WATER EXCHANGE BETWEEN THE FEMALE COCKROACH (BLATTELLA GERMANICA L.) AND HER OOTHECAE	II	846	23/08/00	16:30	CC		18	PS	18
Mumcuoglu, K. Y.	2105	DESTRUCTION OF BACTERIA IN THE DIGESTIVE TRACT OF THE MAGGOT OF THE GREEN BOTTLE FLY, PHAENICIA SERICATA	I	531	23/08/00	16:30	CC		11	PS	11
Mumcuoglu, K. Y.	4093	LOUSE COMB VERSUS HAND EXAMINATION FOR THE DIAGNOSIS OF HEAD LOUSE INFESTATIONS	II	1033	25/08/00	16:30	CC		23	PS	23
Mumcuoglu, M.	2105	DESTRUCTION OF BACTERIA IN THE DIGESTIVE TRACT OF THE MAGGOT OF THE GREEN BOTTLE FLY, PHAENICIA SERICATA	I	531	23/08/00	16:30	CC		11	PS	11
Mun, J.	2205	MIGRATION OF RICE PESTS IN ASIA: GENETICS AND GIS	I	557	24/08/00	11:35	HB	L	12	7	12
Munguira, M. L.	4077	PARSIMONY ANALYSIS OF ENDEMICITY AND ITS APPLICATION TO DETECT HIGH ENDEMISM AREAS USING COMBINED DATA FROM INSECTS, VERTEBRATES, AND PLANTS, FROM THE IBERIAN PENINSULA	II	1029	21/08/00	16:30	CC		23	PS	23
Munster-Swendsenb, M.	860	TOP-DOWN REGULATION OF SPRUCE NEEDLEMINER AND OTHER FOREST LEPIDOPTERA	I	217	25/08/00	11:35	HB	D	6	7	6
Murai, T.	3353	DIAPAUSE TERMINATION IN EGGS OF COTTON APHID, APHIS GOSSYPII (HEMIPTERA: APHIDIDAE), FOR CROSSINGS IN THE LABORATORY	II	847	23/08/00	16:30	CC		18	PS	18
Murakami, T.	706	SUITABILITY OF SEVERAL RUTACEOUS PLANTS FOR A PAPILIONID BUTTERFLY, PAPILIO POLYTES	I	178	24/08/00	16:30	CC		4	PS	4
Murakami, T.	3426	MYCOPHAGY AND FUNGUS-GROWING BEHAVIOR IN ATTINE ANTS: IMPLICATIONS FOR THE ORIGIN OF ATTINE FUNGICULTURE	II	865	23/08/00	9:50	HM	Q	19	4	19
Murari, O.	3526	ATTRACTION OF ARNTICUS SP (COLEOPTERA: CURCULIONIDAE) IN THREE MULBERRY CULTIVARS (MORUS ALBA) IN PIRACICABA - SP	II	890	24/08/00	16:30	CC		19	PS	19
Murari, O.	3527	PRESENCE OF THE ARNTICUS SP (COLEOPTERA: CURCULIONIDAE) IN MULBERRY (MORUS ALBA) IN PIRACICABA-SP	II	890	24/08/00	16:30	CC		19	PS	19
Murata, A. T.	2419	EVALUATION OF VELVETBEEN CATERPILLAR SUSCEPTIBILITY TO ETANOLIC EXTRACTS ISOLATED FROM SEEDS OF CRYPTOCARIA MOSCHATA	II	611	21/08/00	16:30	CC		13	PS	13
Murata, A. T.	1200	BIOLOGICAL AND NUTRITIONAL ASPECTS OF ANTICARSIA GEMMATALIS (LEPIDOPTERA: NOCTUIDAE), RAISED ON SOYBEAN, PEANUT AND ARTIFICIAL DIET.	I	302	25/08/00	16:30	CC		6	PS	6
Murata, A. T.	1365	INSECTICIDE PROPERTIES OF ETHANOLIC EXTRACT ISOLATED FROM SEEDS OF PIPER TUBERCULATUM SEEDS (PIPERACEAE) ON DIATRAEA SACCHARALIS (LEPIDOPTERA: PYRALI DAE)	I	344	25/08/00	16:30	CC		7	PS	7
Murata, A. T.	3522	MORPHOLOGICAL DESCRIPTION OF THE CATERPILLAR OF BOMBYX MORI (LEPIDOPTERA: BOMBYCIDAE) WITH THE USE OF SCANNING ELECTRONIC MICROSCOPY	II	889	23/08/00	16:30	CC		19	PS	19
Murata, A. T.	955	GREEN LACEWINGS OCCURENCE ON WEEDS IN CROP CORN	I	241	22/08/00	16:30	CC		6	PS	6
Murata, A. T.	978	VELVETBEAN CATERPILLAR PREFERENCE TO SOYBEAN AND PENUTS VARIETIES	I	247	22/08/00	16:30	CC		6	PS	6
Murata, A. T.	1687	EFFECT OF DIATRAEA SACCHARALIS TREATED EGGS ON CRISOPIDS LARVAE	I	425	25/08/00	16:30	CC		8	PS	8
Murata, A. T.	715	AZADIRACTA INDICA AND BOUGAINVILLEA SPECTABILIS EXTRACTS TO CONTROL VELVETBEAN CATERPILLAR	I	181	24/08/00	16:30	CC		4	PS	4
Murata, A.T.	703	SUSCEPTIBILITY TESTS OF 4,5-DIIDROPIPERLONGUMININA ISOLATED FROM PIPER TUBERCULATUM SEEDS ON VELVETBEAN CATERPILLAR	I	178	24/08/00	16:30	CC		4	PS	4
Murata, A.T.	1081	NUTRITIONAL AND BIOLOGICAL ASPECTS OF VELVETBEAN CATERPILLAR ON SOYBEAN GENOTYPES WITH AND WITHOUT INJURY	I	273	23/08/00	16:30	CC		6	PS	6
Murata, A.T.	1082	VELVETBEAN CATERPILLARS PREFERENCE TO SOYBEAN GENOTYPES WITH AND WITHOUT INJURY	I	273	23/08/00	16:30	CC		6	PS	6
Murata, A.T.	3111	EFFECT OF TWO PLANT EXTRACTS ON CERAEOCHRYSA CINCTA AND C. CUBANA (NEUROPTERA: CHRYSOPIDAE)	II	785	21/08/00	16:30	CC		16	PS	16
Murata, A.T.	3166	EXTERN ANATOMY DESCRIPTION OF ANTICARSIA GEMMATALIS (LEPIDOPTERA: NOCTUIDAE) THROUGH THE SCANNING ELECTRONIC MICROSCOPY	II	799	21/08/00	16:30	CC		16	PS	16
Murata, M.	1083	OCCURRENCE PATTERNS OF SPODOPTERA LITURA (LEPIDOPTERA: NOCTUIDAE) IN SOUTHERN JAPAN AND SOUTH-EASTERN ASIA	I	273	23/08/00	16:30	CC		6	PS	6
Murdoch, W. W.	820	INTERSPECIFIC INTERACTIONS, POPULATION DYNAMICS & COMMUNITY STRUCTURE	I	207	22/08/00	13:35	HB	D	6	4	6
Murdoch, W. W.	1182	RESPONSE OF APHYTIS MELINUS TO AN EXPERIMENTALLY-INDUCED OUTBREAK OF CALIFORNIA RED SCALE	I	298	25/08/00	16:30	CC		6	PS	6
Muredan, F.	1506	BIOLOGYCAL CONTROL OF SOME PHYTOPHAGUE INSECTS WITH TRICHOGRAMMA SPP. (INSECT., HYM.)	I	380	21/08/00	16:30	CC		8	PS	8
Murillo, E.	1305	BOTANICAL EXTRACT EFFECT ON ANASTREPHA FRATERCULUS (DIP., TEPHRITIDAE) BIOLOGY	I	329	21/08/00	16:30	CC		7	PS	7
Murlis, J.	608	SENSORY INPUTS GOVERNING UPWIND FLIGHT OF MALE MOTHS ALONG PHEROMONE PLUMES	I	154	23/08/00	15:35	Bol	S	4	5	4
Murphy, S.	1823	INTRODUCTION AND RELEASE OF RHISSINES TO CONTROL SIREX NOCTILIO IN BRAZIL	I	460	22/08/00	9:35	HB	M	10	2	10
Murphy, S.	3245	INSECT TRANSMISSION OF A VASCULAR WILT OF A TROPICAL HARDWOOD IN THE SEYCHELLES	II	819	25/08/00	16:30	CC		17	PS	17
Murray, D. A. H.	1999	POTENTIAL IN AUSTRALIA FOR A HELICOVERPA BACULOVIRUS	I	504	22/08/00	9:20	HM	P	11	3	11
Murray, D. A. H.	2106	POTENTIAL IN AUSTRALIA FOR A HELICOVERPA BACULOVIRUS	I	531	23/08/00	16:30	CC		11	PS	11

Sub-titles: (HB=Hotel Bourbon) - (HM=Hotel Mabu) - (CC=Convention Center) - (Bol=Foz Boulevard) - (PS=Poster Session) - (PL=Plenary Lecturer)

AUTHOR	N°	TITLE	Book	Page	Date	Time	Local	Room	Session	Symp	New Session
Murray, D. A. H.	129	LANDSCAPE LEVEL CULTURAL CONTROL: FUTURE PROSPECTS AND LIMITATIONS	I	33	24/08/00	11:30	HB	A	2	7	2
Murray, D. A. H.	751	SPATIAL ANALYSIS OF HELIOTHIS DISTRIBUTION AND ABUNDANCE FOR MEASURING THE EFFECTS OF MOTH MOVEMENT AT THE REGIONAL SCALE	I	190	21/08/00	14:10	Bol	T	5	1	5
Murray, D. L.	2107	PHYLOGENETIC RELATIONSHIPS AMONG EUPTYCHIINE BUTTERFLY GENERA USING MORPHOLOGY AND MOLECULAR DATA	I	531	23/08/00	16:30	CC		11	PS	21
Murúa, G.	1368	INSECTS ENEMIES OF THE BLACK SCALE, SAISSETIA OLEAE ON OLIVE IN ARGENTINA	I	345	24/08/00	16:30	CC		7	PS	7
Musolin, D. L.	3351	TIMING OF DIAPAUSE INDUCTION OUTSIDE THE NATURAL GEOGRAPHICAL RANGE OF A SPECIES: AN OUTDOOR EXPERIMENT WITH THE BEAN BUG RIPTORTUS CLAVATUS	II	846	23/08/00	16:30	CC		18	PS	18
Musolin, D. L.	3352	SUMMER DORMANCY ENSURES UNIVOLTINISM IN THE PREDATORY STINK BUG PICROMERUS BIDENS	II	846	23/08/00	16:30	CC		18	PS	18
Muthukrishnan, N.	1598	DEVELOPING A COMMERCIALLY VIABLE SYSTEM USING TRICHOGRAMMA CHILONIS FOR CONTROL OF COTTON BOLLWORM HELIOTHIS ARMIGERA IN INDIA	I	403	23/08/00	16:30	CC		8	PS	8
Muthukrishnan, N.	1599	DEVELOPING A COMMERCIALLY VIABLE SYSTEM USING CHRYSOPERLA CARNEA FOR CONTROL OF COTTON PESTS IN INDIA	I	403	23/08/00	16:30	CC		8	PS	8
Muthukrishnan, N.	2108	COMPARATIVE EFFICACY OF BACILLUS THURINGIENSIS FORMULATIONS FOR CONTROL OF RICE LEAF FOLDER AND THEIR EFFECTS ON BIODIVERSITY IN RICE ECOSYSTEM	I	532	25/08/00	16:30	CC		11	PS	11
Muthulakshmi, M.	3268	MICROSATELLITES DISTRIBUTION IN THE SILKMOTH, BOMBYX MORI AND THEIR EVOLUTIONARY CONSERVATION AMONG DIVERSE SPECIES OF SILKMOTHS	II	825	22/08/00	11:50	HB	K	18	2	18
Muzón, J.	558	A VIEWPOINT ON PATAGONIAN BIOGEOGRAPHY FROM THE CERATOPOGONIDAE CASE (DIPTERA: NEMATOCERA).	I	141	25/08/00	16:30	CC		3	PS	3
Muzón, J.	3813	REVISION AND CLADISTIC ANALYSIS OF THE NEOTROPICAL GENUS ANDINAGRION BULLA (ODONATA: COENAGRIONIDAE)	II	962	24/08/00	16:30	CC		21	PS	21
Muzón, J.	3814	REVISION OF THE NEOTROPICAL SUBGENUS AESHNA (MARMARAESCHNA) CALVERT (ODONATA: AESHNIDAE)	II	963	24/08/00	16:30	CC		21	PS	21
Myartseva, S. N.	1600	THE ENCARSIA SPECIES - PARASITOIDS OF WHITEFLIES (HOMOPTERA: ALEYRODIDAE) IN MÉXICO	I	403	23/08/00	16:30	CC		8	PS	8
Myska, P.	2538	THE ROLE OF MOULTING HORMONE IN DETERMINATION OF PUPARIATION BEHAVIOUR IN FLIES	II	641	25/08/00	16:30	CC		13	PS	13
N. C. Cabrera	1084	SYNOPSIS OF THE ARGENTINEAN DIABROTICINI (COLEOPTERA, CHRYSOMELIDAE, GALERUCINAE)	I	273	24/08/00	16:30	CC		6	PS	6
N. C. La Porta	1601	BASIC STUDIES ON TRISSOLCUS URICHI (HYMENOPTERA: SCELIONIDAE) RELATED TO EDESSA MEDITABUNDA (HEMIPTERA: PENTATOMIDAE)	I	404	23/08/00	16:30	CC		8	PS	8
N. C. La Porta	1602	ANALYSIS OF SURVIVAL AND FECUNDITY OF TRISSOLCUS URICHI (HYMENOPTERA: SCELIONIDAE) ON DICHELOPS FURCATUS (HEMIPTERA: PENTATOMIDAE)	I	404	23/08/00	16:30	CC		8	PS	8
N. SH. Saidov	1086	THE FAUNA HYMENOPTERA-BRACONIDAE MEDICAGO SATIVA IN SOUTH OF REPUBLIC TAJIKISTAN	I	274	24/08/00	16:30	CC		6	PS	6
N. Yamashita	1087	SEASONAL OCCURRENCES AND THE COMMUNITY STRUCTURE OF DUNG BEETLES IN NORTHERN JAPAN	I	274	24/08/00	16:30	CC		6	PS	6
Nachman, R.	2344	DIFFERENTIAL ACTIVATION OF AN INSECT G PROTEIN-COUPLED PEPTIDE RECEPTOR BY INSECTATACHYKININ-LIKE AGONISTS	II	592	21/08/00	14:35	HB	I	13	2	13
Nachman, R. J.	2345	MIMETIC INSECTATACHYKININ ANALOGS: INTERACTION WITH AN EXPRESSED STABLE FLY TACHYKININ-LIKE RECEPTOR AND ACTIVE CONFORMATION	II	592	21/08/00	15:05	HB	I	13	2	13
Nachman, R. J.	3251	MIMETIC ANALOGS OF REPRODUCTIVE/DEVELOPMENTAL INSECT NEUROPEPTIDES WITH ENHANCED CUTICLE PENETRABILITY AND/OR PEPTIDASE-RESISTANCE	II	821	21/08/00	10:05	HB	K	18	1	18
Nagarajan, P.	2287	MOLECULAR CHARACTERIZATION OF RICE BROWN PLANTHOPPER POPULATION	I	577	24/08/00	16:30	CC		12	PS	12
Nagarajan, P.	3886	MOLECULAR CHARACTERIZATION OF RICE BROWN PLANTHOPPER POPULATION	II	981	22/08/00	15:05	HB	H	22	3	22
Nagaraju J.	3268	MICROSATELLITES DISTRIBUTION IN THE SILKMOTH, BOMBYX MORI AND THEIR EVOLUTIONARY CONSERVATION AMONG DIVERSE SPECIES OF SILKMOTHS	II	825	22/08/00	11:50	HB	K	18	2	18
Nagashima, T.	1748	DEVELOPMENT AND UTILIZATION OF ANAPHE INFRACTA	I	440	21/08/00	16:30	CC		9	PS	9
Nagashima, T.	3415	DEVELOPMENT AND UTILIZATION OF ANAPHE INFRACTA	II	862	22/08/00	13:45	HM	Q	19	3	19
Nagashima, T.	3416	FUNCTION OF WILD COCOONS AND ITS UTILIZATION	II	862	22/08/00	14:00	HM	Q	19	3	19
Nagata, T.	3217	A WAY TO DIFFERENTIATE VECTOR SPECIFICITY BY THRIPS IN TOMATO SPOTTED WILT VIRUS TRANSMISSION	II	812	22/08/00	16:30	Bol	U	17	2	17
Nagata, T.	3233	THE TRANSMISSION SPECIFICITY AND EFFICIENCY OF BRAZILIAN TOSPOVIRUSES OCCURRING ON TOMATO BY FOUR THRIPS SPECIES	II	816	23/08/00	16:30	CC		17	PS	17
Nagel, W.	2465	CENTRAL ROLE OF METABOLISM IN ELECTROGENESIS AND EPITHELIAL TRANSPORT IN MALPIGHIAN TUBULES OF THE YELLOW FEVER MOSQUITO AEDES AEGYPTI	II	623	23/08/00	16:30	CC		13	PS	13
Nagel, W.	2398	TWO ELECTRODE VOLTAGE CLAMP METHODS IN SINGLE PRINCIPAL CELLS OF MALPIGHIAN TUBULES OF AEDES AEGYPTI: VALIDATION OF THE METHOD	II	606	21/08/00	16:30	CC		13	PS	13
Nagy, L. M.	3292	EVOLUTION OF INSECT LIMBS, A DEVELOPMENTAL GENETICS PERSPECTIVE	II	831	24/08/00	10:35	HB	K	18	6	18
Nagy, L. R.	1818	EFFECTS OF A MULTI-YEAR GYPSY MOTH ERADICATION PROGRAM ON DIVERSITY OF NONTARGET FOREST CANOPY ARTHROPODS AND THEIR BIRD PREDATORS IN THE OZARK MOUNTAINS	I	458	21/08/00	14:20	HB	M	10	1	10
Nagy, N. E.	2410	DEFENCE MECHANISMS OF NORWAY SPRUCE AGAINST BARK BEETLE-FUNGUS ATTACKS	II	609	21/08/00	16:30	CC		13	PS	13
Naidoo, N.	3270	PHOTIC ENTRAINMENT OF THE DROSOPHILA CIRCADIAN CLOCK	II	826	23/08/00	13:50	HB	K	18	3	18
Nair, S.	3980	MAPPING, TAGGING, MARKER-ASSISTED SELECTION AND MAP-BASED GENE CLONING OF GALL MIDGE RESISTANCE GENES IN RICE	II	1004	24/08/00	16:30	CC		22	PS	22
Naisbit, R. E.	2292	GENETICS ACROSS THE SPECIES BOUNDARY: HOST PLANT PREFERENCE AND COLOUR PATTERN IN HELICONIUS CYDNO AND H. MELPOMENE	I	578	23/08/00	16:30	CC		12	PS	12
Naisbit, R. E.	2293	MULTIPLE PARTIAL BARRIERS TO GENE FLOW BETWEEN HELICONIUS CYDNO AND H. MELPOMENE	I	579	23/08/00	16:30	CC		12	PS	12
Najle, S.	562	DISTRIBUTION OF SOME SWALLOWTAIL BUTTERFLIES OF POSADAS, MISIONES, ARGENTINA	I	142	25/08/00	16:30	CC		3	PS	3
Nakagawa, K.	3267	GENOMICS OF REPRODUCTION AND DIAPAUSE IN BOMBYX MORI	II	825	22/08/00	11:35	HB	K	18	2	18
Nakahara, Y.	1603	REQUIREMENT OF LIPOPHORIN AND ECDYSTEROID FOR IN VITRO DEVELOPMENT OF A LARVAL ENDOPARASITOID, VENTURIA CANESCENS (HYMENOPTERA: ICHNEUMONIDAE)	I	404	23/08/00	16:30	CC		8	PS	8
Nakajima, Y.	3167	ISOLATION AND COMPARISON OF MARINER-LIKE SEQUENCES (MLSS) AMONG SOME LEPIDOPTERAN INSECTS AND INVERTEBRATES	II	799	24/08/00	16:30	CC		16	PS	16
Nakama, P. A.	1471	EFFECT OF ALTERNATING TEMPERATURES ON THE DEVELOPMENT, LONGEVITY AND REPRODUCTION OF TRISSOLCUS BASALIS (HYMENOPTERA: SCELIONIDAE)	I	371	26/08/00	10:20	HM	O	8	8	8
Nakamichi, T.	2706	CONTROL EFFECTS TO THRIPS AND APHIDS USING FOAMED SURFACTANT ON FLOWERS AND VEGETABLES IN GREENHOUSE	II	683	22/08/00	16:30	CC		14	PS	14
Nakamura, G.	1411	INSECTICIDE THIAMETHOXAM USED ON DIFFERENT FORMULATIONS TO CONTROL MYZUS PERSICAE ON SMALL POTATO CROP	I	356	25/08/00	16:30	CC		7	PS	7

Sub-titles: (HB=Hotel Bourbon) - (HM=Hotel Mabu) - (CC=Convention Center) - (Bol=Foz Boulevard) - (PS=Poster Session) - (PL=Plenary Lecturer)

AUTHOR	Nº	TITLE	Book	Page	Date	Time	Local	Room	Session	Symp	New Session
Nakamura, A.	1607	STUDY ON INTERSPECIFIC COMPETITON BETWEEN TWO LARVAL PARASITOIDS OF THE DIAMONDBACK MOTH	I	405	23/08/00	16:30	CC		8	PS	8
Nakamura, A.	2685	DAMAGE LEVELS OF STINK BUGS ON SEED PRODUCTION OF SOYBEAN VARIETIES	II	678	23/08/00	16:30	CC		14	PS	14
Nakamura, A.	1604	HOST-AGE EFFECTS ON OVIPOSITION BEHAVIOR AND DEVELOPMENT OF AN EULOPHID LARVAL-PUPAL PARASITOID, OOMYZUS SOKOLOWSKII	I	404	23/08/00	16:30	CC		8	PS	8
Nakamura, G.	1361	EFFICIENCY OF SEEDS TREATMENTS WITH THIAMETHOXAM TO CONTROL Bemisia argentifolii ON COTTON CROP	I	343	23/08/00	16:30	CC		7	PS	7
Nakamura, G.	1363	DIFFERENT FORMULATIONS OF THIAMETHOXAM USED TO CONTROL LARVAE AND ADULTS OF DIABROTICA SPECIOSA ON SMALL POTATO CROP	I	344	23/08/00	16:30	CC		7	PS	7
Nakamura, G.	1344	CONTROL OF DIAMONDBACK MOTH (PLUTELLA XYLOSTELLA) BY SPINOSAD AND ITS INFLUENCE ON PARASITIC WASPS	I	339	23/08/00	16:30	CC		7	PS	7
Nakamura, M.	2368	LINKAGE OF NUTRITION AND SILK PRODUCTION IN BOMBYX MORI	II	598	24/08/00	10:50	HB	I	13	6	13
Nakamura, M.	2471	HOMEOSTASIS AND PHYSIOLOGY ON VITAMIN B2 OF THE SILKWORM, BOMBYX MORI	II	624	23/08/00	16:30	CC		13	PS	13
Nakamura, M.	685	AMINO ACID SECRETION IN DIGESTIVE JUICE: COUNTERADAPTATION OF HERBIVOROUS INSECTS AGAINST PROTEIN-DENATURING ACTIVITY OF PLANT IRIDOID GLYCOSIDES ACTIVATED BY PLANT BETA-GLUCOSIDASE	I	173	23/08/00	16:30	CC		4	PS	4
Nakamura, S.	1605	MULTIPLE OVIPOSITION BY THE PARASITOID FLY EXORISTA JAPONICA IS ADVANTAGEOUS IN INTERSPECIFIC COMPETITION WITH THE MICROTYPE-EGG STRATEGIST, PALES PAVIDA	I	405	23/08/00	16:30	CC		8	PS	8
Nakamura, S.	2472	JH BIOSYNTHESIS BY CORPORA ALLATA IN LOCUSTA MIGRATORIA AND SCHISTOCERCA GREGARIA ON ARTIFICIAL DIET	II	624	25/08/00	16:30	CC		13	PS	13
Nakamura, S.	1677	HOST LOCATION BEHAVIOR OF THE PARASITOID FLY, EXORISTA JAPONICA (DIPTERA: TACHINIDAE)	I	423	25/08/00	16:30	CC		8	PS	8
Nakamura, Y.	1023	THREATENED JAPANESE BUTTERFLIES LISTED BY THE ENVIRONMENT AGENCY OF JAPAN IN 2000	I	258	23/08/00	16:30	CC		6	PS	6
Nakamuta, K.	704	INFLUENCE OF EXPERIENCE ON THE OLFACTORY RESPONSES OF A PREDATORY BEETLE, TROGOSSITA JAPONICA (COLEPTERA: TROGOSSITIDAE) TO VOLATILES OF ITS PREY-HOST TREE COMPLEX	I	178	24/08/00	16:30	CC		4	PS	4
Nakamuta, K.	705	INCREASE OF TRAP CATCHES BY A COMBINATION OF MALE SEX PHEROMONES AND FLORAL ATTRACTANT IN LONGHORN BEETLE, ANAGLYPTUS SUBFASCIATUS (COLEOPTERA: CERAMBYCIDAE)	I	178	24/08/00	16:30	CC		4	PS	4
Nakano, J. A.	1841	TEBUFENOZIDE: AN EFFECTIVE AND SELECTIVE CONTROL AGENT FOR CATERPILLAR PESTS IN FORESTRY	I	464	23/08/00	11:05	HB	M	10	4	10
Nakano, O.	33	KETOENOLE: A NEW CHEMICAL GROUP TO THE MITES CONTROL IN THE CITRUS CULTURE	I	9	22/08/00	16:30	CC		1	PS	1
Nakano, O.	295	BIOLOGICAL ACTIVITY OF ORANGE MOTH, ECDYTOLOPHA AURANTIANUM, WHEN SUBMITED TO THE PHYSIOLOGICAL INSECTICIDE - METHOFENOZIDE	I	75	24/08/00	16:30	CC		2	PS	2
Nakano, O.	296	EFFICACY EVALUATION OF KARATE ZEON 50 CS FOR THE CONTROL OF Diloboperus costalimai, INSECT VECTOR OF CVC IN CITRUS	I	75	24/08/00	16:30	CC		2	PS	2
Nakano, O.	297	THE EFFECT OF SOME PHYSIOLOGICAL INSECTICIDES OVER THE SHARPSHOOTERS VETORS OF CVC IN CITRUS	I	75	24/08/00	16:30	CC		2	PS	2
Nakano, O.	16	EFFECT OF NUTRIENTS ON THE FLAT MITE, BREVIPALPUS PHOENICIS (ACARI:TENUIPALPIDAE) AND ON COFFEE RING SPOT VIRUS TRANSMISSION IN THE COFFEE (COFFEA ARABICA) CULTURE	I	4	21/08/00	16:30	CC		1	PS	1
Nakano, O.	2718	DEVELOPMENT OF TOMATO FRUITS IN PAPER BAGS (LYCOPERSICON ESCULENTUM) FOR PEST CONTROL AND PESTICIDE REDUCTION	II	686	23/08/00	16:30	CC		14	PS	14
Nakano, O.	3347	EFFECT OF INSECT GROWTH REGULATOR BUPROFEZIN ON GREEN LEAFHOPPER (EMPOASCA KRAEMERI ROSS & MOORE, 1957) (HEMIPTERA, CICADELLIDAE) NYMPHS AND ADULTS UNDER LABORATORY CONDITIONS	II	845	23/08/00	16:30	CC		18	PS	18
Nakano, O.	3348	EFFECT OF BUPROFEZIN ON GREEN LEAFHOPPER (EMPOASCA KRAEMERI ROSS & MOORE, 1957) (HEMIPTERA, CICADELLIDAE) FECUNDITY UNDER LABORATORY CONDITIONS	II	845	23/08/00	16:30	CC		18	PS	18
Nakano, O.	1393	MECHANISMS OF RESISTANCE TO THE INSECTICIDE METHIDATHION IN AMBLYSEIUS WOMERSLEYI (ACARI: PHYTOSEIIDAE)	I	351	22/08/00	16:30	CC		7	PS	7
Nakano, O.	1282	MANAGEMENT OF ACARICIDE RESISTANCE IN JAPAN	I	324	25/08/00	15:35	HM	N	7	10	7
Nakao, S.	1761	THE CHANGES OF SIGNALS IN MALE-FEMALE DUETS OF THE DEPHALICIDAE LEAFHOPPER, NEPHOTETTIX NIGROPICUTUS	I	444	22/08/00	16:30	CC		9	PS	9
Nakashima, T.	704	INFLUENCE OF EXPERIENCE ON THE OLFACTORY RESPONSES OF A PREDATORY BEETLE, TROGOSSITA JAPONICA (COLEPTERA: TROGOSSITIDAE) TO VOLATILES OF ITS PREY-HOST TREE COMPLEX	I	178	24/08/00	16:30	CC		4	PS	4
Nakashima, T.	705	INCREASE OF TRAP CATCHES BY A COMBINATION OF MALE SEX PHEROMONES AND FLORAL ATTRACTANT IN LONGHORN BEETLE, ANAGLYPTUS SUBFASCIATUS (COLEOPTERA: CERAMBYCIDAE)	I	178	24/08/00	16:30	CC		4	PS	4
Nakasono, K.	293	YIELD LOSS ASSESSMENT OF UPLAND RICE DUE TO INSECT PESTS IN CENTRAL KALIMANTAN, BORNEO, INDONESIA IN WET SEASON 1997/98	I	74	24/08/00	16:30	CC		2	PS	2
Nakata, K.	1804	DAILY PERIODICITY OF MATING- AND OVIPOSITING- BEHAVIOR IN DIAMONDBACK MOTH.	I	454	25/08/00	16:30	CC		9	PS	9
Nakayama, T.	706	SUITABILITY OF SEVERAL RUTACEOUS PLANTS FOR A PAPILIONID BUTTERFLY, PAPILIO POLYTES	I	178	24/08/00	16:30	CC		4	PS	4
Nakazawa, H.	2516	CDNA CLONING AND EXPRESSION ANALYSIS OF REL PROTEINS FROM BOMBYX MORI	II	635	25/08/00	16:30	CC		13	PS	13
Nakazawa, H.	2356	REGULATION OF TISSUE-SPECIFIC AND LIPOPOLYSACCHARIDE-INDUCIBLE GENE EXPRESSION OF AN ANTIBACTERIAL PROTEIN FROM THE SILKWORM, BOMBYX MORI	II	595	23/08/00	11:45	HB	I	13	4	13
Nakazawa, T.	3094	ULTRASTRUCTURE OF DIMORPHIC SPERMATOZOA AND THEIR FERTILIZATION IN CICADIDAE (HEMIPTERA)	II	781	26/08/00	10:50	HB	G	16	9	16
Nakazawa, T.	3096	PHYLOGENETIC RELATIONSHIP ON SPERM ULTRASTRUCTURE OF THE STAG BEETLES (COLEOPTERA-LUCANIDAE)	II	781	26/08/00	11:40	HB	G	16	9	16
Nam, K.-B.	2269	GRAM-NEGATIVE BACTERIA BINDING PROTEIN, A PATTERN RECOGNITION RECEPTOR FOR LIPOPOLYSACCHARIDE AND b-1,3-GLUCAN, WHICH MEDIATES THE SIGNALING FOR THE INDUCTION OF INNATE IMMUNE GENES IN DROSOPHILA MELANOGASTER CELLS	I	573	22/08/00	16:30	CC		12	PS	12
Nam, S. H.	933	LIFE HISTORY OF ACRONICTA RUMICIS REARED ON THE NATURALIZED PLANT, RUMEX OBTUSIFOLIUS AS A HOST PLANT	I	236	25/08/00	16:30	CC		6	PS	6
Nam, S. H.	1155	INSECT COMMUNITY ON RUMEX OBTUSIFOLIUS AS A HOST PLANT	I	291	25/08/00	16:30	CC		6	PS	6
Nandika, D.	3390	ECONOMICALLY IMPORTANT TERMITES IN INDONESIA AND THEIR CONTROL	II	856	21/08/00	10:50	HM	Q	19	1	19
Nansen, C.	4018	ANALYSING THE IMPACT OF TERETRIUS NIGRESCENS ON PROSTEPHANUS TRUNCATUS IN MAIZE STORES IN WEST AFRICA	II	1015	22/08/00	10:30	HB	J	23	3	23
Napp, D. S.	3162	COMPARATIVE MORPHOLOGY, TAXONOMIC STUDIES AND TRIBAL REASSIGNMENT OF THE NEOTROPICAL GENERA OF CLEOMENINI (COLEOPTERA, CERAMBYCIDAE)	II	798	24/08/00	16:30	CC		16	PS	21
Napp, D. S.	3799	ANALYSIS CLADISTIC OF THE TRIBE RHOPALOPHORINI BLANCHARD, 1845 (COLEOPTERA, CERAMBYCINAE)	II	959	23/08/00	16:30	CC		21	PS	21
Napp, D. S.	3802	REVISION AND TRANSFER TO HETEROPSININ OF THE GENUS EUPEMPELUS BATES (COLEOPTERA, CERAMBYCIDAE)	II	960	24/08/00	16:30	CC		21	PS	21
Napp, D. S.	3810	REVISION OF THE GENUS CERALOCYNA (COLEOPTERA, CERAMBYCIDAE)	II	962	24/08/00	16:30	CC		21	PS	21
Narai, Y.	3353	DIAPAUSE TERMINATION IN EGGS OF COTTON APHID, APHIS GOSSYPII (HEMIPTERA: APHIDIDAE), FOR CROSSINGS IN THE LABORATORY	II	847	23/08/00	16:30	CC		18	PS	18

Sub-titles: (HB=Hotel Bourbon) - (HM=Hotel Mabu) - (CC=Convention Center) - (Bol=Foz Boulevard) - (PS=Poster Session) - (PL=Plenary Lecturer)

AUTHOR	Nº	TITLE	Book	Page	Date	Time	Local	Room	Session	Symp	New Session
Naranjo, S. E.	102	CONSERVATION AND EVALUATION OF NATURAL ENEMIES IN IPM SYSTEMS	I	27	22/08/00	14:30	HB	A	2	4	2
Naranjo, S. E.	903	A COMPARATIVE ANALYSIS OF THE FLIGHT BEHAVIOR OF LYGUS HESPERUS AND LYGUS LINEOLARIS (HEMIPTERA: MIRIDAE)	I	228	24/08/00	11:15	HB	F	6	3	6
Naranjo, S. E.	2671	INTRODUCTION-PART 1: CHALLENGES AND OPPORTUNITIES FOR PEST MANAGEMENT OF BEMISIA IN THE NEW CENTURY	II	675	22/08/00	16:30	CC		14	PS	14
Naranjo, S. E.	2775	INTRODUCTION-PART 2: CHALLENGES AND OPPORTUNITIES FOR PEST MANAGEMENT OF BEMISIA IN THE NEW CENTURY	II	701	25/08/00	16:30	CC		14	PS	14
Naranjo, S. E.	101	ECOLOGICAL CONSIDERATIONS FOR MANAGEMENT OF A MULTIPLE-CROP PEST	I	26	22/08/00	14:00	HB	A	2	4	2
Naranjo, S. E.	1562	SAMPLING PREDATORY INSECTS AND SPIDERS IN COTTON	I	394	22/08/00	16:30	CC		8	PS	8
Nardi, F.	3730	THE PHYLOGENY OF BASAL INSECTS: MOLECULAR AND MORPHOLOGICAL DATA COMPARED	II	942	21/08/00	16:30	CC		21	PS	21
Nardo, E. A. B. De	1207	COMPETITION BETWEEN TWO ARMORED SCALES FOR CITRUS LEAVES COLONIZATION	I	304	23/08/00	16:30	CC		6	PS	6
Nardo, E. A. B. de	1675	TEN YEARS OF INTERNATIONAL EXCHANGE AND QUARANTINE OF BENEFICIAL ORGANISMS BY THE BRAZILIAN QUARANTINE LABORATORY FOR BIOLOGICAL CONTROL	I	422	25/08/00	16:30	CC		8	PS	8
Nardo, E. A. B. de	1676	NON-SUITABILITY OF THE BRAZILIAN SUGARCANE BORER, DIATRAEA SACCHARALIS, (LEPIDOPTERA: PYRALIDAE) AS A HOST FOR PEDIOBIUS FURVUS (HYMENOPTERA: EULOPHIDAE)	I	422	25/08/00	16:30	CC		8	PS	8
Nardo, E. A. B. De	2855	ARMORED SCALES POPULATION DYNAMICS IN SÃO PAULO STATE CITRUS REGION	II	721	21/08/00	16:30	CC		14	PS	14
Nardo, E. De	3914	RISK ASSESSMENT PROCEDURES FOR BIOCONTROL INTRODUCTIONS IN SOUTHERN SOUTH AMERICA AND A PROTOCOL FOR PREDICTING PARASITOID POST - INTRODUCTION HOST RANGE	II	988	25/08/00	11:00	HB	H	22	7	22
Nascimento, A. C. M.	3833	DIPTERA CALIPTRATA SUCESSION IN A CARCASS OF SUS SCROFA, IN TWO ECOSYSTEMS OF RIO DE JANEIRO, RJ	II	967	24/08/00	16:30	CC		21	PS	21
Nascimento, A. M.	1502	AGENIASPIS CITRICOLA: INTRODUCTION, LABORATORY REARING AND ADAPTATION IN BRAZIL	I	379	21/08/00	16:30	CC		8	PS	8
Nascimento, A. S.	1490	LONGEVITY AND REPRODUCTION OF DIACHASMIMORPHA LONGICAUDATA (HYMENOPTERA: BRACONIDAE) BRED IN LARVAE OF CERATITIS CAPITATA (DIPTERA: TEPHRITIDAE)	I	376	21/08/00	16:30	CC		8	PS	8
Nascimento, A. S.	3232	OCCURRENCE OF SHARPSHOTER IN CITRUS ORCHARDS AFFECTED BY CVC IN NORTH COAST OF BAHIA AND SOUTH OF SERGIPE STATE, BRAZIL	II	816	23/08/00	16:30	CC		17	PS	17
Nascimento, A. S.	3244	EXPERIMENTAL TRANSMISSION OF "STICKY DISEASE" OF PAPAYA BY BEMISIA ARGENTIFOLLI	II	819	25/08/00	16:30	CC		17	PS	17
Nascimento, A. S.	256	PERFORMANCE OF CERATITIS CAPITATA (DIPTERA, TEPHRITIDAE) ON FRUITS: COMPARISON OF TWO LABORATORY POPULATIONS	I	65	23/08/00	16:30	CC		2	PS	2
Nascimento, A. S. do	4161	GLANDULAR TRICHOMES IN PLANTS CAN ATTRACT HERBIVORE INSECTS	II	1051	21/08/00	16:30	CC		Erratum	PS	4
Nascimento, E.	1362	SELECTIVITY OF GROWTH REGULATORS, PHOSPHORATES AND PYRETROIDS UPON NATURAL ENEMIES OF PESTS ON SOYBEAN CROP	I	344	23/08/00	16:30	CC		7	PS	7
Nascimento, F. R.	1648	FUNCTIONAL RESPONSE OF CYCLONEDA SANGUINEA (COLEOPTERA : COCCINELLIDAE) AT DIFFERENT DENSITIES OF THE APHID MYZUS PERSICAE (HOMOPTERA: APHIDIDAE)	I	415	22/08/00	16:30	CC		8	PS	8
Nascimento, L. O.	2751	DIAMONDBACK MOTH POPULATION DYNAMICS AND PARASITOID SURVEY IN THE FEDERAL DISTRICT, BRAZIL	II	695	24/08/00	16:30	CC		14	PS	14
Nascimento, M. L.	2109	EFFECT OF A FORMULATION OF BACILUS THURINGIENSIS VAR. KURSTAKI ON THE IMMATURE STAGES, LONGEVITY AND FEEDING PREFERENCE OF PODISUS NIGRISPINUS	I	532	23/08/00	16:30	CC		11	PS	11
Nascimento, M. L.	2110	SUSCEPTIBILITY OF IMMATURE STAGES OF THYRINTEINA ARNOBIA (LEPIDOPTERA: GEOMETRIDAE) TO A POSSIBLE PICORNAVIRUS	I	532	23/08/00	16:30	CC		11	PS	11
Nash, D. R.	429	HOST-SPECIFICITY IN MACULINEA ALCON: A LARGE BLUE BUTTERFLY CONSERVATION ISSUE IN EUROPE	I	109	24/08/00	14:05	HB	C	3	6	3
Naskrecki, P.	756	THE INTERNET-BASED MULTIMEDIA TAXONOMIC DATABASES AS TOOLS IN ENTOMOLOGICAL EDUCATION	I	191	22/08/00	14:05	Bol	T	5	3	5
Naskrecki, P.	1736	THE EVOLUTION OF SIGNALING MECHANISMS IN KATYDIDS AND THEIR RELATIVES (ORTHOPTERA: ENSIFERA: TETTIGONIOIDEA)	I	437	23/08/00	9:45	HB	F	9	3	9
Nasr, J. A.	1899	RESPONSES OF THE PINE PROCESSIONARY MOTH THAUMETOPOEA WILKINSONI TO EXTRACTS OF THE CHINABERRY TREE, MELIA AZEDARACH	I	479	21/08/00	16:30	CC		10	PS	10
Natale, W.	920	INFLUENCE OF PHOSPHATE-POTASSIC FERTILIZATION ON THE OCCURRENCE THE NATURAL ENEMIES ASSOCIATED TO SOYBEAN	I	232	21/08/00	16:30	CC		6	PS	6
Natale, W.	922	INFLUENCE OF PHOSPHATE-POTASSIC FERTILIZATION ON THE OCCURRENCE OF SOYBEAN INSECT PESTS	I	233	21/08/00	16:30	CC		6	PS	6
Natori, S.	2263	CONCENTRATED EXPRESSION OF THE GENES FOR PROTEINS INVOLVED IN CALCIUM SIGNALING IN THE MUSHROOM BODIES OF THE BRAIN OF THE WORKER HONEYBEE APIS MELLIFERA	I	571	22/08/00	16:30	CC		12	PS	12
Natori, S.	3558	IDENTIFICATION AND CHARACTERIZATION OF A NOVEL GENE (KL-1), WHICH IS EXPRESSED PREFERENTIALLY IN LARGE TYPE KENYON CELLS OF THE HONEYBEE BRAIN	II	898	25/08/00	16:30	CC		19	PS	19
Natori, S.	2448	CONCENTRATED EXPRESSION OF THE GENES FOR PROTEINS INVOLVED IN CALCIUM SIGNALING IN THE MUSHROOM BODIES OF THE BRAIN OF THE WORKER HONEYBEE APIS MELLIFERA	II	618	23/08/00	16:30	CC		13	PS	13
Natori, S.	2336	IDENTIFICATION AND CHARACTERIZATION OF THE KS-1 GENE, WHICH IS EXPRESSED PREFERENTIALLY IN THE SMALL TYPE-KENYON CELLS OF THE HONEYBEE BRAIN	I	589	25/08/00	16:30	CC		12	PS	12
Natuhara, Y.	3374	PHOTOPERIODIC CONTROL OF SEASONAL DEVELOPMENT IN THE SCUTELLERID BUG, POECILOCORIS LEWISI	II	852	25/08/00	16:30	CC		18	PS	18
Natwick, E. T.	2765	COTTON HOST PLANT RESISTANCE TO THE SILVERLEAF WHITEFLY TRANSMITTED COTTON LEAF CRUMPLE DISEASE	II	698	24/08/00	16:30	CC		14	PS	14
Nauen, R.	1230	INVESTIGATIONS ON NEONICOTINOID RESISTANCE IN BEMISIA TABACI FROM ALMERIA/SPAIN	I	311	21/08/00	15:05	HM	N	7	2	7
Nauen, R.	1405	BIOCHEMICAL MECHANISMS OF RESISTANCE IN TETRANYCHUS URTICAE	I	354	25/08/00	16:30	CC		7	PS	7
Nauen, R.	2492	JUVENILE HORMONE BIOSYNTHESIS AND REGULATION OF VITELLOGENESIS IN THE FALL ARMYWORM, SPODOPTERA FRUGIPERDA (LEPIDOPTERA: NOCTUIDAE)	II	629	24/08/00	16:30	CC		13	PS	13
Nault, L. R.	3234	MIGRATION AS A STRATEGY FOR SURVIVAL OF DALBULUS MAIDIS (HEMIPTERA: CICADELLIDAE) DURING CORN OVERSEASON IN CENTRAL BRAZIL	II	816	23/08/00	16:30	CC		17	PS	17
Naumann, I. D.	104	IPM OF BEMISIA TABACI IN AUSTRALASIA	I	27	22/08/00	15:30	HB	A	2	4	2
Nauwelaers, S.	3259	TMOF BIOTECHNOLOGY: A NEW BIORATIONAL APPROACH TO CONTROL INSECTS WITH PEPTIDE HORMONES	II	823	21/08/00	15:30	HB	K	18	1	18
Navajas, M.	7	GENETIC SIGNATURES OF DISPERSION	I	2	22/08/00	9:30	Bol	U	1	2	1
Navarrete-Heredia, J. L.	3815	AN ILLUSTRATED GUIDE TO THE STAPHYLINIDAE (COLEOPTERA) OF MEXICO	II	963	24/08/00	16:30	CC		21	PS	21
Navarro, F. R.	3816	PHYLOGENETIC STUDIES OF THE SUBFAMILY ERIOPINAE (LEPIDOPTERA: NOCTUIDAE): FIRST RESULTS	II	963	24/08/00	16:30	CC		21	PS	21
Navarro, S.	4043	STATUS OF CONTROLLED ATMOSPHERES AS INTEGRATED STORAGE INSECT CONTROL	II	1021	24/08/00	9:45	HB	J	23	8	23
Navarro, S.	4049	APPLICATION OF GASTIGHT STORAGE IN THE TROPICS	II	1022	24/08/00	11:15	HB	J	23	8	23

Sub-titles: (HB=Hotel Bourbon) - (HM=Hotel Mabu) - (CC=Convention Center) - (Bol=Foz Boulevard) - (PS=Poster Session) - (PL=Plenary Lecturer)

AUTHOR	Nº	TITLE	Book	Page	Date	Time	Local	Room	Session	Symp	New Session
Navarro, S.	4044	LEVELS OF GASTIGHTNESS AND CONTAINMENT OF FUMIGANTS – CONSEQUENCES FOR ARTHROPOD PEST CONTROL	II	1021	24/08/00	10:00	HB	J	23	8	23
Naves, P. M.	1975	DISTRIBUTION OF BARK AND WOOD-BORING INSECTS IN MARITIME PINE TREES INFECTED WITH BURSAPHELENCHUS XYLOPHILUS IN PORTUGAL	I	498	25/08/00	16:30	CC		10	PS	10
Naves, R. V.	3998	INSECT DIVERSITY OCCURRING ON CAGAITA IN SAVANNAS OF GOIÁS, BRAZIL	II	1009	25/08/00	16:30	CC		22	PS	22
Navia, D.	3982	PEST RISK ASSESSMENT TO MANGO CROP IN BRAZIL	II	1005	24/08/00	16:30	CC		22	PS	22
Navia, D.	3986	DATA BASE OF QUARANTINE PESTS TO BRAZIL	II	1006	24/08/00	16:30	CC		22	PS	22
Návia, D.	2272	BEMISIA TABACI POPULATIONS IN BRAZIL: GENETIC DIVERSITY REVEALED BY RAPD MARKERS	I	573	23/08/00	16:30	CC		12	PS	12
Navickiene, H. M. D.	1365	INSECTICIDE PROPERTIES OF ETHANOLIC EXTRACT ISOLATED FROM SEEDS OF PIPER TUBERCULATUM SEEDS (PIPERACEAE) ON DIATRAEA SACCHARALIS (LEPIDOPTERA: PYRALI DAE)	I	344	25/08/00	16:30	CC		7	PS	7
Navickiene, H. M. D.	703	SUSCEPTIBILITY TESTS OF 4,5-DIIDROPIPERLONGUMININA ISOLATED FROM PIPER TUBERCULATUM SEEDS ON VELVETBEAN CATERPILLAR	I	178	24/08/00	16:30	CC		4	PS	4
Navrozidis, E. I.	2111	EFFICACY OF SPINOSAD NATURALYTE INSECT CONTROL AGAINST LOBESIA BOTRANA (LEPIDOPTERA: TORTRICIDAE) ON GREEK VINEYARDS	I	532	23/08/00	16:30	CC		11	PS	11
Navrozidis, E. I.	2083	COMBINED APPLICATION OF MATING DISRUPTION AND BACILLUS THURINGIENSIS FOR CONTROL OF THE BERRY MOTH IN GREEK ISLANDS, LIMNOS AND SAMOS	I	525	22/08/00	16:30	CC		11	PS	11
Nazarova L.	1088	COPPER INFLUENCE ON CHIRONOMID LARVAE IN NATURAL AND LABORATORY POPULATIONS	I	274	24/08/00	16:30	CC		6	PS	6
Ndiaye, A.	4038	GRAIN QUALITY MAINTENANCE: USING QUALITATIVE REASONING IN GRAIN PEST MANAGEMENT	II	1020	23/08/00	14:15	HB	J	23	7	23
Ndiaye, S. M.	4038	GRAIN QUALITY MAINTENANCE: USING QUALITATIVE REASONING IN GRAIN PEST MANAGEMENT	II	1020	23/08/00	14:15	HB	J	23	7	23
Neal, D. E.	1254	CURENT DEVELOPMENTS WITH ETHNOBOTANICAL INSECTICIDES FROM GHANA: REVIVING AND MODERNISING AGE-OLD PRACTICE	I	317	24/08/00	10:20	HM	N	7	7	7
Nealis, V.	1871	DEVELOPMENT OF INTEGRATED MANAGEMENT OF DEFOLIATING INSECTS IN CANADA	I	472	25/08/00	11:20	HB	M	10	7	10
Negishi, T.	3167	ISOLATION AND COMPARISON OF MARINER-LIKE SEQUENCES (MLSS) AMONG SOME LEPIDOPTERAN INSECTS AND INVERTEBRATES	II	799	24/08/00	16:30	CC		16	PS	16
Negreiros, D.	664	PLANT HYPERSENSITIVE RESPONSE TO GALL INDUCTION ACROSS HOST TAXA	I	168	22/08/00	16:30	CC		4	PS	4
Negreiros, D.	1722	HYPERSENSITIVITY AND PLANT BEHAVIOR AGAINST PARASITES	I	434	22/08/00	10:05	HB	F	9	2	9
Negreiros, D.	1856	MECHANISMS OF RESISTANCE IN TREES TO GALL-FORMING INSECTS	I	468	24/08/00	11:35	HB	M	10	5	10
Negreiros, D. P.	842	PLANT RESISTANCE AGAINST GALL-FORMING INSECTS: THE ROLE OF PLANT HYPERSENSITIVITY	I	213	23/08/00	15:15	HB	D	6	5	6
Nelson, C. R.	3817	SYSTEMATIC KEY TO THE PROCTACANTHUS OF NORTH AMERICA, THE PHILADELPHICUS GROUP (DIPTERA: ASILIDAE)	II	963	24/08/00	16:30	CC		21	PS	21
Nelson, D. R.	1089	CHARACTERIZATION OF THE WAXY PARTICLES, AND THE PENETRATION AND FEEDING PROCESS OF WHITEFLIES	I	275	24/08/00	16:30	CC		6	PS	6
Nemer, N. M.	1899	RESPONSES OF THE PINE PROCESSIONARY MOTH THAUMETOPOEA WILKINSONI TO EXTRACTS OF THE CHINABERRY TREE, MELIA AZEDARACH	I	479	21/08/00	16:30	CC		10	PS	10
Nemeyer, P.	273	LIFE-TIME ACTIVITY BUDGET OF MANGO (MARULA) FRUIT FLY, CERATITIS COSYRA, AND ITS RESPONSE TO ATTRACTANTS	I	69	23/08/00	16:30	CC		2	PS	2
Nentwig, G.	4094	ARTIFICIAL FEEDING OF MOSQUITOS VIA A MEMBRANELESS SYTSTEM	II	1034	24/08/00	16:30	CC		23	PS	23
Nepstad, D. C.	3432	LEAF CUTTING ANT (ATTA SEXDENS) EFFECTS ON SOIL, ROOT DISTRIBUTION AND TREE GROWTH IN A SECONDARY FOREST OF EASTERN AMAZONIA	II	866	23/08/00	11:20	HM	Q	19	4	19
Nero, S.	3648	MORPHOLOGY AND BIOGEOGRAPHY OF FEMALE MYRMECOLACIDAE PARASITIC IN ORTHOPTERA IN PAPUA NEW GUINEA	II	921	23/08/00	14:20	HB	E	21	5	21
Nessimian, J. L.	1022	BELOSTOMA (HETEROPTERA: BELOSTOMATIDAE) FROM THE STATE OF RIO DE JANEIRO, SE BRAZIL	I	258	23/08/00	16:30	CC		6	PS	6
Nessler, C.	2733	BIOLOGY OF SWEET POTATO WHITEFLY, (HOMOPTERA: ALEYRODIDAE) ON TRANSGENIC TOBACCO AND INTERACTIONS WITH A PARASITE	II	690	23/08/00	16:30	CC		14	PS	14
Nestel, D.	2473	LIPID CONTENT IN MASS-REARED MEDFLIES	II	625	23/08/00	16:30	CC		13	PS	13
Nestel, D.	3983	GIS, GEOSTATISTICS AND MEDFLY: ECOLOGY AND CONTROL	II	1005	24/08/00	16:30	CC		22	PS	22
Neto, J. V.	23	PLAN OF SAMPLING OF DICHOPELMUS NOTUS (ACARI, ERIOPHYIDAE) IN PARAGUAY-TEA ORCHARDS	I	6	21/08/00	16:30	CC		1	PS	1
Neto, O. B.	2132	CARACTERIZATION OF NEW STRAINS OF BACILLUS THURINGIENSIS TOXIC AGAINST BOLL WEVILL, ANTHONOMUS GRANDIS	I	538	24/08/00	16:30	CC		11	PS	11
Neuhaum, D. M.	3300	CONTROL OF DROSOPHILA REPRODUCTION BY MALE-DERIVED PROTEINS IN THE SEMINAL FLUID	II	833	25/08/00	13:35	HB	K	18	7	18
Neuvonen, S.	1204	CLIMATE DETERMINED PATTERNS IN THE OUTBREAKS OF THE AUTUMNAL MOTH (EPIRRITA AUTUMNATA, LEP.: GEOMETRIDAE)	I	303	25/08/00	16:30	CC		6	PS	6
Neven, L. G.	2554	POSTHARVEST CONTROL OF CODLING MOTH: CHALLENGES AND RECENT ADVANCES	II	645	21/08/00	16:20	HB	B	14	2	14
Neven, L. G.	3927	GENERIC TREATMENTS: RESEARCH PANACEA OR PIPE DREAM?	II	991	26/08/00	10:30	HB	H	22	8	22
Neven, L. G.	2766	POSTHARVEST CONTROL OF CODLING MOTH: CHALLENGES AND RECENT ADVANCES	II	698	24/08/00	16:30	CC		14	PS	14
Neves, P. M. O. J.	306	CHEMICAL CONTROL OF THE BOLLWEEVIL, ANTHONOMUS GRANDIS, WITH PYRETHROIDS	I	78	24/08/00	16:30	CC		2	PS	2
Neves, P. M. O. J.	307	CHEMICAL CONTROL OF THE VELVETBEAN CATERPILLAR, ANTICARSIA GEMMATALIS WITH PYRETHROIDS	I	78	24/08/00	16:30	CC		2	PS	2
Neves, F. S.	1090	GALLING HERBIVORY MEDIATED BY MUTUALISTIC INTERACTIONS BETWEEN ANTS AND APHIDS IN BACCHARIS DRACUNCULIFOLIA (ASTERACEAE)	I	275	24/08/00	16:30	CC		6	PS	6
Neves, P.	1369	INSECTICIDES FOR PSEUDALETIA SEQUAX CONTROL IN WHEAT TRITICUM AESTIVUM	I	345	24/08/00	16:30	CC		7	PS	7
Neves, P. J.	298	EFFECT OF DIFFERENT DOSAGES OF NOVALURON (RIMON 100 EC) FOR SPODOPTERA FRUGIPERDA CONTROL IN CORN AT LONDRINA - PR - BRAZIL	I	76	25/08/00	16:30	CC		2	PS	2
Neves, P. J.	2112	COMPATIBILITY OF ENTOMOPATOGENIC FUNGI WITH NEONICOTINOIDS INSECTICIDES	I	533	23/08/00	16:30	CC		11	PS	11
Neves, P. J.	2113	GROOMING CAPACITY INHIBITION IN CORNITERMES CUMULANS INOCULATED WITH ENTOMOPATHOGENIC FUNGI WHEN TREATED WITH IMIDACLOPRID	I	533	23/08/00	16:30	CC		11	PS	11
Neves, P. J.	2114	DEVELOPMENTAL CYCLES OF THE ENTOMOPATHOGENIC FUNGI BEAUVERIA BASSIANA AND METARHIZIUM ANISOPLIAE ON THE TERMITE CORNITERMES CUMULANS AS DETERMINED FROM SCANNING ELECTRON MICROSCOPE (SEM) STUDY	I	533	23/08/00	16:30	CC		11	PS	11
Neves, P. J.	2004	MICROBIAL CONTROL OF TERMITES IN BRAZIL	I	506	22/08/00	14:05	HM	P	11	4	11
Neves, P. M. O. J.	2849	CONTROL OF ASCIA MONUSTE ORSEIS BY PYRETHROID INSECTICIDES IN COLLARD	II	719	25/08/00	16:30	CC		14	PS	14
Neves, P. M. O. J.	2850	CONTROL OF THRIPS TABACI BY PYRETHROID INSECTICIDES IN ONION	II	719	25/08/00	16:30	CC		14	PS	14
Newcomb, R. D.	1263	A HITCH-HIKER'S GUIDE TO RESISTANCE IN THE SHEEP BLOWFLY	I	319	24/08/00	14:50	HM	N	7	8	7
Newcomb, R. D.	580	PHEROMONE BINDING PROTEINS: STRUCTURAL, FUNCTIONAL AND GENETIC IMPERATIVES IN TORTRICID MOTHS	I	147	21/08/00	15:00	Bol	S	4	1	4
Newton, A.	3701	LEIODIDAE BEETLES: A NEW ZEALAND PERSPECTIVE	II	934	26/08/00	13:35	HB	E	21	10	21
Newton, A. F.	3702	THE TURTLE LEIODID - A CHILEAN ENIGMA (COLEOPTERA: LEIODIDAE)	II	935	26/08/00	14:05	HB	E	21	10	21
Newton, A. F.	3815	AN ILLUSTRATED GUIDE TO THE STAPHYLINIDAE (COLEOPTERA) OF MEXICO	II	963	24/08/00	16:30	CC		21	PS	21

Sub-titles: (HB=Hotel Bourbon) - (HM=Hotel Mabu) - (CC=Convention Center) - (Bol=Foz Boulevard) - (PS=Poster Session) - (PL=Plenary Lecturer)

AUTHOR	Nº	TITLE	Book	Page	Date	Time	Local	Room	Session	Symp	New Session
Neyestanak, M. M.	1091	A FAUNAL INVESTIGATION ON THE LONG-HORNED GRASSHOPPERS (ORTHOPTERA-TETTIGONIIDAE) OF GAZVIN TO DAMAVAND DISTINCT	I	275	24/08/00	16:30	CC		6	PS	6
Nezisa, I. P.	3042	STAGE SPECIFIC APOPTOTIC PATTERNS DURING DROSOPHILA OOGENESIS	II	768	21/08/00	15:30	HB	G	16	1	16
Ng, R.	2206	HOST CONTROL OF COPIA RETROTRANSPOSITION RATE IN DROSOPHILA MELANOGASTER	I	557	24/08/00	13:35	HB	L	12	8	12
Ngi-Song, A. J.	1606	DISTRIBUTION OF WOLBACHIA INFECTION AMONG COTESIA SESAMIAE (HYMENOPTERA: BRACONIDAE) POPULATIONS IN EASTERN AND SOUTHERN AFRICA	I	405	23/08/00	16:30	CC		8	PS	8
Ni, X.	2442	CHARACTERIZATION OF PROTEIN CHANGES IN BUFFALOGRASSES CHALLENGED BY CHINCH BUG FEEDING	II	617	22/08/00	16:30	CC		13	PS	13
Nicácio, J. N.	2843	FIRST SURVEY ON FRUIT FLIES, FRUGIVOROUS LONCHAEIDAE (DIPTERA: TEPHRITOIDEA) AND THEIR HOST FRUITS IN THE SOUTH PANTANAL, MATO GROSSO DO SUL STATE, BRAZIL	II	718	25/08/00	16:30	CC		14	PS	14
Nicácio, J. N.	2844	FRUIT FLIES AND FRUGIVOROUS LONCHAEIDAE (DIPTERA: TEPHRITOIDEA) ON URBAN HOSTS IN TWO CITIES OF THE STATE OF MATO GROSSO DO SUL, BRAZIL	II	718	25/08/00	16:30	CC		14	PS	14
Nicholls, C. I.	2578	ECOSYSTEMS ECOLOGY AND IPM	II	651	23/08/00	15:30	HB	B	14	5	14
Nicholls, C. N.	432	LANDSCAPE MANAGEMENT FOR THE LARGE COPPER BUTTERFLY, LYCAENA DISPAR BATAVUS	I	110	24/08/00	15:35	HB	C	3	6	3
Nichols, B.	530	THE ALL TAXA BIODIVERSITY INVENTORY IN GREAT SMOKY MOUNTAINS NATIONAL PARK	I	134	24/08/00	16:30	CC		3	PS	3
Nichols, M. A.	1353	MATRICAP®: NOVEL SYSTEMS FOR CONTROLLED DELIVERY OF PESTICIDES IN AQUATIC OR TERRESTRIAL HABITATS	I	341	23/08/00	16:30	CC		7	PS	7
Nichols, R.	3046	THE STRUCTURE, EXPRESSION, AND FUNCTION OF DROSOPHILA MYOSUPPRESSIN	II	769	22/08/00	10:35	HB	G	16	2	16
Nielsen, E. S.	377	THE INVENTORY OF THE WORLDS INSECT BIODIVERSITY: DOING THE POSSIBLE	I	96	21/08/00	10:05	HB	C	3	1	3
Nielsen, E. S.	769	THE GLOBAL BIODIVERSITY INFORMATION FACILITY (GBIF): WHAT IT IS, WHAT IT WILL DO AND HOW IT WILL BE ESTABLISHED	I	194	24/08/00	9:50	Bol	T	5	5	5
Nielsen, E. S.	776	DEVELOPING AND SHARING DATA GLOBALLY: THE 'GLOBAL BUTTERFLY INFORMATION SYSTEM' – GLOBIS	I	196	24/08/00	14:00	Bol	T	5	5	5
Niemelä, J.	417	ASSESSING ANTHROPOGENIC IMPACTS ON BIODIVERSITY USING CARABIDS: A GLOBAL NETWORK	I	106	23/08/00	15:20	HB	C	3	4	3
Niemelä, J.	418	CARABID BEETLES (COLEOPTERA, CARABIDAE) ACROSS URBAN-RURAL GRADIENTS IN BULGARIA, CANADA AND FINLAND; AN INTERNATIONAL COLLABORATIVE EFFORT	I	106	23/08/00	15:35	HB	C	3	4	3
Niemelä, J.	1037	ABUNDANCE-REGIONAL DISTRIBUTION RELATIONSHIPS IN NORTHERN EUROPEAN CARABIDS (COLEOPTERA: CARABIDAE)	I	262	23/08/00	16:30	CC		6	PS	6
Niemelä, J.	1819	INSECTS AND BOREAL FOREST MANAGEMENT	I	459	21/08/00	15:05	HB	M	10	1	10
Niemelä, P.	1040	LARVAL FOOD AND FEEDING HABIT CONTRIBUTE TO PERIODICITY AND MAGNITUDE OF DENSITY FLUCTUATIONS IN SUBARCTIC FOREST MOTHS	I	262	23/08/00	16:30	CC		6	PS	6
Niemeyer, H. M.	999	DO HOST PLANT TRAITS AND GALLING INSECTS AFFECT THE ABUNDANCE OF ISSUS SP. ON COLLIGUAJA ODORIFERA ALONG AN ALTITUDINAL GRADIENT?	I	252	22/08/00	16:30	CC		6	PS	6
Niemeyer, H. M.	1539	AN EXOTIC APHID SPECIES IS FAVOURED BY ADJACENT TROPHIC LEVELS: HOST PLANT AND NATURAL ENEMY IMPACT ON CEREAL APHID COMPETITION	I	388	22/08/00	16:30	CC		8	PS	8
Niemeyer, H. M.	2232	GENETIC CONSTRAINTS IN THE SPECIALIZATION PATTERN OF AN APHID	I	563	22/08/00	16:30	CC		12	PS	12
Nieminen, M.	1092	SPATIAL PATTERNS IN OVERWINTERING SURVIVAL OF MELITAEA CINXIA ON TWO HOST PLANT SPECIES	I	275	24/08/00	16:30	CC		6	PS	6
Nieves Aldrey, J. L.	827	HOW GALL WASPS BECAME GALL WASPS	I	209	23/08/00	10:05	HB	D	6	5	6
Nieves Aldrey, J. L.	3827	HOW GALL WASPS BECAME GALL WASPS	II	966	24/08/00	16:30	CC		21	PS	21
Nieves, J. L.	3857	CONTRIBUTION TO THE KNOWLEDGE OF BUTTERFLIES IN THE COIBA NATIONAL PARK, PANAMA. (LEPIDOPTERA: PAPILIONOIDEA)	II	973	24/08/00	16:30	CC		21	PS	21
Nieves-Aldrey, J. L.	531	INSECT INDUCED GALL DIVERSITY IN COIBA NATIONAL PARK (PANAMA)	I	134	24/08/00	16:30	CC		3	PS	3
Nieves-Aldrey, J. L.	532	HYMENOPTERA FROM "EL VENTORRILLO" (CENTRAL SPAIN): AN EXAMPLE OF HIGH ABUNDANCE AND RICHNESS AT THE LOCAL GEOGRAPHIC SCALE	I	135	24/08/00	16:30	CC		3	PS	3
Nighorn, A.	579	THE NITRIC OXIDE – SOLUBLE GUANYLYL CYCLASE SIGNALING SYSTEM IS INVOLVED IN THE PROCESSING OF OLFACTORY INFORMATION IN THE HAWKMOTH, MANDUCA SEXTA	I	147	21/08/00	14:15	Bol	S	4	1	4
Nijima, K.	1783	CHARACTERISTICS OF COURTSHIP SONGS IN SEVERAL JAPANESE GREEN LACEWINGS (CHRYSOPIDAE) AND THE CROSSING EXPERIMENTS BETWEEN SOME STRAINS WITH DIFFERENT SONGS	I	449	23/08/00	16:30	CC		9	PS	9
Niimi, T.	2291	DIAPAUSE HORMONE AND PHEROMONE BIOSYNTHESIS ACTIVATING NEUROPEPTIDE (DH-PBAN) GENE EXPRESSION IN THE EMBRYO OF THE SILKWORM, BOMBYX MORI	I	578	23/08/00	16:30	CC		12	PS	12
Niimi, S.	2726	MODE OF ACTION AND CHARACTARISTICS OF A NOVEL INSECT PEST CONTROL AGENT, CHROMAFENOZIDE	II	688	23/08/00	16:30	CC		14	PS	14
Nijhout, H. F.	2182	THE EVOLUTION OF ADAPTIVE POLYPHENISMS	I	551	22/08/00	13:35	HB	L	12	4	12
Nils M. Andersen	II	The impact of W. Hennig's 'phylogenetic systematics' on contemporary entomology	I	IV	21/08/00	8:00	HB			PL	
Nirmala, R.	332	ATTRACTION OF SHOOT BORER, CHILO INFUSCATELLUS, DAMAGED SUGARCANE TO THE BRACONID COTESIA FLAVIPES	I	84	24/08/00	16:30	CC		2	PS	2
Nirmala, R.	723	EFFECT OF BUCCAL CAVITY SECRETIONS OF PARASITISED AND UNPARASITISED CHILO INFUSCATELLUS LARVAE ON THE SYNOMONAL ACTIVITY OF SUGRACANE PLANT	I	183	25/08/00	16:30	CC		4	PS	4
Nishida, R.	3354	UTILIZATION OF SPECIFIC PLANT VOLATILES IN MATING STRATEGIES IN THE ORIENTAL FRUIT FLY AND MEDFLY	II	847	23/08/00	16:30	CC		18	PS	18
Nishida, T.	837	TIMING OF GALL-FORMATION CAUSING DIFFERENTIAL PERFORMANCE OF A STEM MOTHER IN NEOTHORACAPHIS YANONIS (APHIDIDAE)	I	212	23/08/00	14:00	HB	D	6	5	6
Nishida, T.	1801	RANDOM MATING SECONDARILY DERIVED FROM LMC (LOCAL MATE COMPETITION) IN A GALL APHID, NEOTHORACAPHIS YANONIS	I	454	25/08/00	16:30	CC		9	PS	9
Nishikawa, M.	2474	MODALITY-SPECIFIC PROJECTIONS OF ANTENNAL SENSORY AFFERENTS IN THE COCKROACH BRAIN	II	625	23/08/00	16:30	CC		13	PS	13
Nishimura, M.	198	CONTROL OF THE DICHELOPS SPP. BY TREATING THE CORN SEEDS OF DIFFERENT SIZES WITH A MIXTURE OF THIAMETHOXAM AND THIODICARB	I	51	21/08/00	16:30	CC		2	PS	2
Nishimura, M.	1410	PULVERIZATIONS WITH THIAMETHOXAM TO CONTROL ADULTS OF DIABROTICA SPECIOSA ON SMALL POTATO CROP	I	356	25/08/00	16:30	CC		7	PS	7
Nisimura, T.	3355	BIMODAL LIFE CYCLE AND SUMMER DIAPAUSE IN THE BURYING BEETLE, NICROPHORUS QUADRIPUNCTATUS	II	847	23/08/00	16:30	CC		18	PS	18
Nisimura, T.	3311	CIRCANNUAL RHYTHM IN ANTHRENUS VERBASCI: A RE-EVALUATION OF BLAKE'S RESULTS	II	836	25/08/00	13:30	HB	K	18	8	18
Niva, C. C.	3356	PHOTOPERIOD AND TEMPERATURE CONTROL ON MORPHOLOGY, PIGMENTATION AND REPRODUCTION IN HALYOMORPHA BREVIS	II	847	24/08/00	16:30	CC		18	PS	18
Niwa, C. G.	1931	CHEMOTAXIS OF SOME SCOLYTIDS AND THEIR PREDATORS TO 4-ALLYLANISOLE AND ETHANOL IN CENTRAL OREGON PINE FORESTS	I	487	22/08/00	16:30	CC		10	PS	10
Noble-Nesbitt, J.	2381	ACTIVE AND PASSIVE COMPONENTS OF WATER VAPOUR ABSORPTION	II	602	25/08/00	11:35	HB	I	13	8	13
Nobre, S. D. N.	299	BIONOMY OF THE BOLL WEVILL REARED ON ARTIFICIAL DIET	I	76	24/08/00	16:30	CC		2	PS	2
Nobre, S. D. N.	2103	PATHOGENICITY OF NEW ISOLATES OF BACILLUS THURINGIENSIS AGAINST LEPIDOPTERAN AND DIPTERAN PESTS	I	530	23/08/00	16:30	CC		11	PS	11
Nobre, S. D. N.	2102	A CULTURE COLLECTION OF BACILLUS THURINGIENSIS AND BACILLUS SPHAERICUS PATHOGENIC TO INSECTS	I	530	23/08/00	16:30	CC		11	PS	11

Sub-titles: (HB=Hotel Bourbon) - (HM=Hotel Mabu) - (CC=Convention Center) - (Bol=Foz Boulevard) - (PS=Poster Session) - (PL=Plenary Lecturer)

AUTHOR	Nº	TITLE	Book	Page	Date	Time	Local	Room	Session	Symp	New Session
Noda, H.	2161	PROTOZOAN AND ENDOGENOUS CELLULASES FROM TERMITES OF THE GENUS COPTOTERMES	I	545	25/08/00	16:30	CC		11	PS	11
Noda, S. C. M.	3529	MORPHOLOGICAL CASTE DIFFERENCES IN SYNOECA CYANEA (HYMENOPTERA, VESPIDAE, EPIPONINI), ACCORDING TO ONTOGENETIC DEVELOPMENT OF THE COLONIES WITH SPECIAL REFERENCES ON MULTIVARIATE ANALYSIS	II	890	24/08/00	16:30	CC		19	PS	19
Noda, T.	2834	SEASONAL OCCURRENCE OF MAJOR INSECT PESTS AND ESTIMATION OF THE LEAF DAMAGES ON GLOSSY-LEAVED AND NORMAL VARIETIES OF BRASSICA NAPUS	II	715	25/08/00	16:30	CC		14	PS	14
Noda, T.	1607	STUDY ON INTERSPECIFIC COMPETITON BETWEEN TWO LARVAL PARASITOIDS OF THE DIAMONDBACK MOTH	I	405	23/08/00	16:30	CC		8	PS	8
Noda, T.	1604	HOST-AGE EFFECTS ON OVIPOSITION BEHAVIOR AND DEVELOPMENT OF AN EULOPHID LARVAL-PUPAL PARASITOID, OOMYZUS SOKOLOWSKII	I	404	23/08/00	16:30	CC		8	PS	8
Noda, T.	1344	CONTROL OF DIAMONDBACK MOTH (PLUTELLA XYLOSTELLA) BY SPINOSAD AND ITS INFLUENCE ON PARASITIC WASPS	I	339	23/08/00	16:30	CC		7	PS	7
Noguchi, H.	3875	DEVELOPMENT OF A STRAIN OF THE SMALLER TEA TORTRIX, ADOXOPHYES HONMAI (LEPIDOPTERA: TORTRICIDAE) RESISTANT TO A MATING DISRUPTANT IN JAPAN	II	978	21/08/00	14:30	HB	H	22	I	22
Nogueira, A. H. C.	3317	ACARICIDE ACTION OF ROPE TOBACCO (NICOTINA TABACUM) OVER LARVAE OF BOOPHILUS MICROPLUS UNDER LABORATORY CONDITIONS	II	838	21/08/00	16:30	CC		18	PS	18
Nogueira, M. D.	2115	PATHOLOGY AND SUSCEPTIBILITY STUDIES ON URBANUS ACAWOIOS (LEPIDOPTERA: HESPERIIDAE) LARVAE INFECTED BY BACILLUS THURINGIENSIS VAR. KURSTAKI (H-3A:3B)	I	533	24/08/00	16:30	CC		11	PS	11
Nogueira, N. L.	65	POPULATION DYNAMICS OF BREVIPALPUS PHOENICIS ON DIFFERENT CITRUS VARIETIES IN BRAZIL: II - INFLUENCE OF CITRUS VARIETY	I	17	25/08/00	16:30	CC		1	PS	1
Nohata, J.	3530	CHANGE OF GENE EXPRESSION PATTERN CAUSED BY COMPOUND EYE METAMORPHOSIS OF BOMBYX MORI	II	891	24/08/00	16:30	CC		19	PS	19
Nohata, J.	3266	BOMBYX EST DATABASE, SILKBASE, FOR GENOME ANALYSIS OF BOMBYX MORI	II	825	22/08/00	11:05	HB	K	18	2	18
Nolan, T.	2918	STABLE TRANSFORMATION OF ANOPHELINE MOSQUITOES WITH THE MINOS TRANSPOSABLE ELEMENT FROM DROSOPHILA HYDEI	II	736	24/08/00	15:35	Bol	R	15	8	15
Noldus, L. P. J. J.	746	COMPUTERIZED VIDEO TRACKING, MOVEMENT ANALYSIS AND BEHAVIOR RECOGNITION IN INSECTS	I	188	21/08/00	10:55	Bol	T	5	1	5
Noll, F. B.	2475	ON THE EVOLUTION OF CASTE DIMORPHISM IN THE EPIPONINE WASPS: A PHYLOGENETIC PERSPECTIVE	II	625	23/08/00	16:30	CC		13	PS	13
Nomukou, M.	300	PROSPECTS FOR BIOLOGICAL CONTROL OF THE WHITEFLY BEMISIA TABACI WITH PHYTOSEIID PREDATORS	I	76	24/08/00	16:30	CC		2	PS	2
Nomura, M.	2476	BIPHASIC EFFECT OF LOW TEMPERATURE ON COMPLETION OF WINTER DIAPAUSE IN THE ONION MAGGOT	II	625	23/08/00	16:30	CC		13	PS	13
Nomura, M.	3818	INTRASPECIFIC VARIATION IN GREEN LACEWING, CHRYSOPERLA NIPPONENSIS OF JAPAN USING COURTSHIP SONG AND MOLECULAR PHYLOGENETIC ANALYSES	II	964	24/08/00	16:30	CC		21	PS	21
Nora, I.	1093	AN ENTOMOFAUNA STUDY RELATED TO THE GROWING OF THE JAPANESE PEAR, VARIETIES (HOUSUI, KOUSUI AND NIJISEIKI), IN SANTA CATARINA STATE, BRAZIL	I	276	24/08/00	16:30	CC		6	PS	6
Nora, I.	2767	EVALUATION OF THE EFFICIENCY OF THE INSECTICIDE ACTARA 10 GR®, THIAMETHOXAN IN DIFFERENT DOSES FOR THE CONTROL OF OYSTERSHELL SCALE, LEPIDOSAPHES ULMI (HOMOPTERA, DIASPIDIDAE), UNDER SEMI-CONTROLED CONDITIONS, IN APPLE FUJI, IN SC, BRAZIL	II	699	25/08/00	16:30	CC		14	PS	14
Norambuena, H. L.	2768	INTRODUCTION AND REARING OF PHYTOMYZA OROBANCHIA AS PART OF AN INTEGRATED PEST MANAGEMENT PROGRAM ON BROOMRAPE	II	699	24/08/00	16:30	CC		14	PS	14
Norden, B.	3429	USURPERS AND MARAUDERS: THE SOCIAL PREDATOR MEGALOMYRMEX SP. NOV. (FORMICIDAE: SOLENOPSIDINI) PILLAGES BOTH GARDEN AND BROOD FROM FUNGUS-GROWING ANTS (ATTINI)	II	866	23/08/00	10:35	HM	Q	19	4	19
Nordlander, G.	1027	IS A LIMITED DISPERSAL PROPENSITY THE REASON FOR THE RARITY OF THE BEETLE OPLOCEPHALA HAEMORRHOIDALIS IN NORTHERN EUROPE?	I	259	23/08/00	16:30	CC		6	PS	6
Nordlund, D. A.	1433	RECENT ADVANCES IN THE DEVELOPMENT OF ARTIFICIAL DIET BASED MASS REARING SYSTEMS FOR EGG PARASITOIDS	I	362	21/08/00	15:20	HM	O	8	2	8
Nordlund, D. A.	1440	AUTOMATION IN MASS REARING - MAKING THINGS POSSIBLE.	I	363	22/08/00	13:35	HM	O	8	4	8
Nordlund, D. A.	1448	QUALITY CONTROL IN AUTOMATED MASS REARING	I	365	22/08/00	15:35	HM	O	8	4	8
Noriega, A.	3357	ARTIFITIAL INDUCTION OF SEXUALS IN GREENBUG	II	848	24/08/00	16:30	CC		18	PS	18
Noriega, F. G.	2294	A MOLECULAR VIEW OF TRYPSIN SYNTHESIS IN AEDES AEGYPTI.	I	579	24/08/00	16:30	CC		12	PS	12
Noriega, F. G.	2477	REGULATION OF JH LEVELS IN MOSQUITOES	II	626	23/08/00	16:30	CC		13	PS	13
Norman, R. A.	2053	ENTOMOPATHOGENIC NEMATODES AS BIOLOGICAL CONTROL AGENTS OF INSECT PESTS: A CLEARER UNDERSTANDING	I	518	21/08/00	16:30	CC		11	PS	11
Norman, R. A.	2054	MODELS OF ENTOMOPATHOGENIC NEMATODES FOR BIOLOGICAL CONTROL	I	518	21/08/00	16:30	CC		11	PS	11
Normark, B. B.	3841	THE PHYLOGENESIS OF CONIFER/ ANGIOSPERM HOST SHIFT AND DIVERSIFICATION IN GONDWANAN BARK BEETLES	II	969	25/08/00	16:30	CC		21	PS	21
Normark, B. B.	2260	EVOLUTION OF LARVIFORM MALES IN THE INBREEDING BARK BEETLE OZOPEMON: FIERCE FIGHTERS OR JUST WEIRD?	I	570	22/08/00	16:30	CC		12	PS	12
Norris, D. M.	593	REPELLENTS: NATURE'S FIRST LINE OF CHEMICAL DEFENSE	I	150	22/08/00	14:05	Bol	S	4	3	4
Norton, A. P.	2581	INTERACTIONS BETWEEN MITES AND PLANT PATHOGENS AND IMPLICATIONS FOR BIOLOGICAL CONTROL IN GRAPES	II	652	24/08/00	10:35	HB	B	14	6	14
Norton, G.	781	INSECT INFORMATION TECHNOLOGY TRANSFER - SOFTWARE TOOLS FOR IDENTIFICATION, DIAGNOSIS AND IPM DECISION SUPPORT	I	197	25/08/00	9:35	Bol	T	5	6	5
Not Informed	384	APPROACHES TO MEGADIVERSITY AREAS: THE NEOTROPICS	I	98	21/08/00	14:15	HB	C	3	1	3
Not Informed	438	HEMINOPTERA	I	111	25/08/00	11:35	HB	C	3	7	3
Not Informed	873	THE MIGRATORY LOCUSTS OF SOUTH AMERICA	I	221	26/08/00	11:05	HB	D	6	9	6
Not Informed	3207	STATUS OF XYLELA FASTIDIOSA IN EUROPE AND IMPLICATIONS FOR QUARANTINE STRATEGIES WORLDWIDE	II	810	21/08/00	15:20	Bol	U	17	1	17
Notario, A.	1914	VARIATIONS IN THE SPECIES COMPOSITION OF CURCULIONOIDEA IN NATURAL AND PLANTED FORESTS OF CENTRAL SPAIN	I	482	21/08/00	16:30	CC		10	PS	10
Notario, M. J.	3394	TERMITE DAMAGE TO BUILDINGS IN THE PROVINCE OF CORDOBA	II	857	21/08/00	11:50	HM	Q	19	1	19
Novaes, Q.	2110	SUSCEPTIBILITY OF IMMATURE STAGES OF THYRINTEINA ARNOBIA (LEPIDOPTERA: GEOMETRIDAE) TO A POSSIBLE PICORNAVIRUS	I	532	23/08/00	16:30	CC		11	PS	11
Novak, R. J.	2938	INTEGRATED MOSQUITO MANAGEMENT PHILOSOPHY AND IMPLEMENTATION	II	741	25/08/00	15:45	Bol	R	15	10	15
Novaretti, W. R. T.	3401	TERMITE AS PESTS OF SUGARCANE IN THE SOUTHEAST AND NORTHEAST REGIONS OF BRAZIL	II	859	21/08/00	15:15	HM	Q	19	1	19
Novillo, C.	2482	PHYSIOLOGICAL RESPONSES OF COLORADO POTATO BEETLE AND BEET ARMYWORM LARVAE TO ANTISENSE-MEDIATED DEPLETION OF WOUND-INDUCIBLE PROTEINASE INHIBITORS IN POTATO	II	627	25/08/00	16:30	CC		13	PS	13
Novo, J. P. S.	2769	DEVELOPMENT AND DAMAGE OF THE RICE WEEVIL ON TRITICALE AND WHEAT CULTIVARS	II	699	21/08/00	16:30	CC		14	PS	23
Novo, J. P. S.	4095	EVALUATION OF INSECTICIDES IN THE CONTROL OF RICE WEEVIL AND LESSER GRAIN BORER ON STORED BARLEY	II	1034	25/08/00	16:30	CC		23	PS	23
Novo, J. P. S.	2846	EFFECT OF INSECTICIDES ON NYMPHS OF BEMISIA TABACI B BIOTYPE	II	718	25/08/00	16:30	CC		14	PS	14
Novotny, V.	570	INSECT HERBIVORES AS PREDICTORS OF PLANT PHYLOGENY: EXAMPLES FROM NEW GUINEA FICUS	I	144	25/08/00	16:30	CC		3	PS	3
Novotny, V.	3576	STUDYING HOST AND MICROHABITAT USE BY ARTHROPODS IN TROPICAL RAIN FOREST CANOPIES: ISSUES & PERSPECTIVES	II	902	24/08/00	9:35	Bol	U	20	2	20

Sub-titles: (HB=Hotel Bourbon) - (HM=Hotel Mabu) - (CC=Convention Center) - (Bol=Foz Boulevard) - (PS=Poster Session) - (PL=Plenary Lecturer)

AUTHOR	Nº	TITLE	Book	Page	Date	Time	Local	Room	Session	Symp	New Session
Nowierski, R. M.	1094	DYNAMIC STATE VARIABLE MODEL OF OPTIMAL CLUTCH SIZE IN UROPHORA AFFINIS (DIPTERA: TEPHRITIDAE) ON SPOTTED KNAPWEED, CENTAUREA MACULOSA	I	276	24/08/00	16:30	CC		6	PS	6
Nozzolillo, C.	1857	THE BIOCHEMICAL MECHANISM FOR THE RESISTANCE OF RED MAPLE TREES TO FOREST TENT CATERPILLAR FEEDING	I	468	24/08/00	11:50	HB	M	10	5	10
Numata, C.	3875	DEVELOPMENT OF A STRAIN OF THE SMALLER TEA TORTRIX, ADOXOPHYES HONMAI (LEPIDOPTERA: TORTRICIDAE) RESISTANT TO A MATING DISRUPTANT IN JAPAN	II	978	21/08/00	14:30	HB	H	22	1	22
Numata, H.	3260	ANATOMY AND FUNCTIONS OF BRAIN NEUROSECRETORY NEURONS WITH REGARD TO REPRODUCTIVE DIAPAUSE IN PROTOPHORMIA TERRAENOVAE	II	823	21/08/00	16:00	HB	K	18	1	18
Numata, H.	3374	PHOTOPERIODIC CONTROL OF SEASONAL DEVELOPMENT IN THE SCUTELLERID BUG, POECILOCORIS LEWISI	II	852	25/08/00	16:30	CC		18	PS	18
Numata, H.	3311	CIRCANNUAL RHYTHM IN ANTHRENUS VERBASCI: A RE-EVALUATION OF BLAKE'S RESULTS	II	836	25/08/00	13:30	HB	K	18	8	18
Numata, H.	3327	THE EFFECTS OF EGG AND ADULT TEMPERATURES ON INDUCTION OF EMBRYONIC DIAPAUSE IN DIANEMOBIUS NIGROFASCIATUS (ORTHOPTERA: GRYLLIDAE)	II	840	21/08/00	16:30	CC		18	PS	18
Numata, H.	3351	TIMING OF DIAPAUSE INDUCTION OUTSIDE THE NATURAL GEOGRAPHICAL RANGE OF A SPECIES: AN OUTDOOR EXPERIMENT WITH THE BEAN BUG RIPTORTUS CLAVATUS	II	846	23/08/00	16:30	CC		18	PS	18
Numata, H.	3355	BIMODAL LIFE CYCLE AND SUMMER DIAPAUSE IN THE BURYING BEETLE, NICROPHORUS QUADRIPUNCTATUS	II	847	23/08/00	16:30	CC		18	PS	18
Nunes, A. L. O. S.	360	FIRST EVIDENCE OF COPTOTERMES HAVILANDI IN CAMPOS DOS GOYTACAZES (RJ), BRAZIL	I	91	25/08/00	16:30	CC		2	PS	2
Nunes, A. P.	2757	IPM PROGRAMMES FOR PROTECTED VEGETABLE CROPS (IN OESTE REGION OF PORTUGAL)	II	696	23/08/00	16:30	CC		14	PS	14
Nunes, C. C. C.	1608	MORPHOLOGICAL AND QUANTITATIVE STUDIES OF THE HEMOCYTES IN DIATRAEA SACCHARALIS (LEPIDOPTERA: PYRALIDAE) LARVAE PARASITIZED BY COTESIA FLAVIPES (HYMENOPTERA: BRACONIDAE)	I	405	23/08/00	16:30	CC		8	PS	8
Nunes, M. C.	1609	PARASITISM OF HEXACLADIA SMITHII ON THE NEOTROPICAL BROWN STINK BUG EUSCHISTUS HEROS DURING AND AFTER THE SOYBEAN SEASON	I	406	22/08/00	16:30	CC		8	PS	8
Nunes, M. C.	1610	EFFECT OF PARASITISM BY HEXACLADIA SMITHII ON SURVIVAL AND REPRODUCTIVE CAPACITY OF EUSCHISTUS HEROS FEMALES	I	406	22/08/00	16:30	CC		8	PS	8
Núñez, J. A.	3457	ALARM PHEROMONE COMPONENTS AND OPIOID SYSTEM ACTIVATION IN HONEYBEES	II	873	21/08/00	16:30	CC		19	PS	19
Núñez, J. A.	3531	BEHAVIOURAL RESPONSES OF THE HONEYBEE TO ALARM-SCENTS AT THE FOOD SOURCE	II	891	24/08/00	16:30	CC		19	PS	19
Nunzio, I.	1456	SPIRACULAR GLANDS OF DROSOPHILA MELANOGASTER PUPARIA ELICIT RECOGNITION REPONSE IN TRICHOPRIA DROSOPHILAE	I	367	23/08/00	15:15	HM	O	8	6	8
Nuttall, P. A.	48	INVESTIGATION OF THE MECHANISMS OF ANTI-COMPLEMENT ACTIVITY IN IXODES TICKS	I	12	23/08/00	16:30	CC		1	PS	1
Nuttall, P. A.	34	INTERACTION OF TICK SALIVA WITH THE HOST IMMUNE MECHANISMS AND ITS SIGNIFICANCE FOR PATHOGEN TRANSMISSION	I	9	22/08/00	16:30	CC		1	PS	1
Nuttall, P. A.	2893	TICK-HOST INTERACTIONS IN THE CO-FEEDING TRANSMISSION OF TICK-BORNE ENCEPHALITIS VIRUS: CELL INVOLVEMENT	II	730	22/08/00	15:50	Bol	R	15	4	15
Nuttall, P. A.	3026	SUCCESSFUL INTERRUPTED FEEDING OF ADULT RHIPICEPHALUS APPENDICULATUS (IXODIDEA) AND INTRA-STADIAL TICK-BORNE THOGOTO VIRUS (ORTHOMYXOVIRIDAE) TRANSMISSION	II	763	25/08/00	16:30	CC		15	PS	15
Nuzhdin, S. V.	2206	HOST CONTROL OF COPIA RETROTRANSPOSITION RATE IN DROSOPHILA MELANOGASTER	I	557	24/08/00	13:35	HB	L	12	8	12
Nylin, S.	466	INTRASPECIFIC GEOGRAPHIC VARIATION IN HOST-PLANT UTILIZATION OF BUTTERFLIES	I	118	21/08/00	16:30	CC		3	PS	3
Nyrop, J. P.	2581	INTERACTIONS BETWEEN MITES AND PLANT PATHOGENS AND IMPLICATIONS FOR BIOLOGICAL CONTROL IN GRAPES	II	652	24/08/00	10:35	HB	B	14	6	14
O. DeSouza	424	TERMITES AS INDICATORS OF HABITAT FRAGMENTATION IN THE CERRADO IN BRAZIL	I	108	24/08/00	11:05	HB	C	3	5	3
O.-Olsen, E.	4168	THE CONCEPT OF TICK-SPIROCHETE SPECIFICITY REVISITED	II	1053	22/08/00	15:05	Bol	R	Erratum	4	15
O'Brien, J. G.	763	THE EXOTIC FOREST PEST INFORMATION SYSTEM FOR NORTH AMERICA	I	193	23/08/00	11:05	Bol	T	5	4	5
O'Brien, J. G.	1928	THE EXOTIC FOREST PEST INFORMATION SYSTEM FOR NORTH AMERICA	I	486	22/08/00	16:30	CC		10	PS	5
O'Brochta, D. A.	2217	HAT MEDIATED TRANSFORMATION OF INSECTS	I	560	25/08/00	13:35	HB	L	12	10	12
O'Brochta, D. A.	2334	WEAK EXPRESSION OF EGFP IN TRANSGENIC AEDES AEGYPTI AND STOMOXYS CALCITRANS DESPITE THE PRESENCE OF MULTIPLE COPIES OF THE TRANSGENE	I	589	25/08/00	16:30	CC		12	PS	12
O'Donnell, M. J.	2511	EXCRETION IN THE HOUSE CRICKET, ACHETA DOMESTICUS: EFFECTS OF SECRETAGOGUES ON MALPIGHIAN TUBULE ELECTROPHYSIOLOGY AND SECRETION RATE	II	634	25/08/00	16:30	CC		13	PS	13
O'Hara, R. B.	1037	ABUNDANCE-REGIONAL DISTRIBUTION RELATIONSHIPS IN NORTHERN EUROPEAN CARABIDS (COLEOPTERA: CARABIDAE)	I	262	23/08/00	16:30	CC		6	PS	6
O'Keeffe, C.	602	MOLECULAR STUDIES ON THE ENDOCRINE REGULATION AND TISSUE LOCALIZATION OF DE NOVO MONOTERPENOID PHEROMONE COMPONENT BIOSYNTHESIS IN PINE BARK BEETLES	I	152	23/08/00	11:25	Bol	S	4	4	4
Oakeshott, J. G.	1263	A HITCH-HIKER'S GUIDE TO RESISTANCE IN THE SHEEP BLOWFLY	I	319	24/08/00	14:50	HM	N	7	8	7
Ober, K. A.	3819	PHYLOGENETIC RELATIONSHIPS OF THE CARABID (COLEOPTERA) SUBFAMILY HARPALINAE BASED ON MOLECULAR SEQUENCE DATA	II	964	24/08/00	16:30	CC		21	PS	21
Ober, K. A.	3684	PHYLOGENY OF THE BEETLE SUBORDER ADEPHAGA AND FAMILY CARABIDAE, AS INFERRED USING RIBOSOMAL DNA AND THE WINGLESS GENE	II	930	25/08/00	14:50	HB	E	21	8	21
Oberprieler, R. G.	446	WEEVIL DIVERSITY IN AFRICA: EXTRAPOLATIONS FROM HOST SURVEYS AND SYSTEMATIC STUDY (COLEOPTERA: CURCULIONOIDEA)	I	113	26/08/00	10:20	HB	C	3	9	3
Oberprieler, R. G.	3620	NEGLECTED ANTIPODEANS ON WEEVIL CLASSIFICATION AND PHYLOGENY (COLEOPTERA: CURCULIONOIDEA)	II	914	21/08/00	14:20	HB	E	21	2	21
Oberprieler, R. G.	778	BEETLES AND BEETLE LARVAE OF THE WORLD: INTERACTIVE IDENTIFICATION AND INFORMATION SYSTEMS FOR FAMILIES AND SUBFAMILIES	I	196	24/08/00	14:45	Bol	T	5	5	5
Oberto, A. M.	1095	DIURNAL AND NOCTURNAL DRIFT OF AQUATIC INSECTS	I	276	24/08/00	16:30	CC		6	PS	6
O'Brien, C. W.	3622	EVOLUTION OF "DERELOMINE FLOWER WEEVILS" (COLEOPTERA: CURCULIONIDAE) IN ASSOCIATION WITH PALMS AND CYCLANTHS	II	915	21/08/00	15:05	HB	E	21	2	21
O'Brien, L. B.	3615	TROPIDUCHIDAE (FULGOROMORPHA, HEMIPTERA), GREEN GEMS OF THE FOREST	II	913	21/08/00	11:05	HB	E	21	1	21
O'Brien, L. B.	3614	A SYNOPSIS OF THE NEOTROPICAL NOGODINIDAE (HEMIPTERA: FULGOROMORPHA)	II	913	21/08/00	10:50	HB	E	21	1	21
Obrycki, J. J.	1242	NON-TARGET EFFECTS OF TRANSGENIC INSECTICIDAL CORN – THE MONARCH AND BEYOND	I	314	23/08/00	10:05	HM	N	7	5	7
Ocampo, F. C.	3676	A SYNOPSIS OF THE NEW WORLD HYBOSORIDAE (COLEOPTERA: SCARABAEOIDEA)	II	928	24/08/00	15:50	HB	E	21	7	21
Ocampo, V.	3650	ECOLOGY OF TWO SPECIES OF STREPSIPTERA PARASITIC ON MANGO LEAFHOPPERS IN THE PHILIPPINES	II	922	23/08/00	14:50	HB	E	21	5	21

Sub-titles: (HB=Hotel Bourbon) - (HM=Hotel Mabu) - (CC=Convention Center) - (Bol=Foz Boulevard) - (PS=Poster Session) - (PL=Plenary Lecturer)

AUTHOR	Nº	TITLE	Book	Page	Date	Time	Local	Room	Session	Symp	New Session
Ochiai, M.	2478	A NEW COMPONENT OF THE PROPHENOLOXIDASE CASCADE, β-1,3-GLUCAN RECOGNITION PROTEIN II FROM THE SILKWORM, Bombyx mori	II	626	23/08/00	16:30	CC		13	PS	13
Ochiai, M.	2409	PROCESSING OF DROSOPHILA SPÄTZLE PROTEIN BY A SERINE PROTEASE IN THE PROPHENOLOXIDASE CASCADE OF THE SILKWORM PLASMA	II	609	21/08/00	16:30	CC		13	PS	13
Oconnor, B. M.	51	MORPHOLOGICAL DIFFERENCES IN AQUATIC AND TERRESTRIAL SUBANTARCTIC ALGOPHAGUS SPECIES (ACARI: ASTIGMATA)	I	13	23/08/00	16:30	CC		1	PS	1
O'Connor, K.	2479	TWO FAMILIES OF CHLORIDE CHANNELS IN APICAL MEMBRANE PATCHES OF STELLATE CELLS OF MALPIGHIAN TUBULES OF THE YELLOW FEVER MOSQUITO AEDES AEGYPTI	II	626	23/08/00	16:30	CC		13	PS	13
Oda, R. A. M.	1096	TRI-TROPHIC INTERACTIONS AMONG SPECIES ON MIKANIA GLOMERATA (ASTERACEAE) GALLS ON SOUTHEASTERN BRAZIL: A SPECIES RICH SYSTEM	I	276	24/08/00	16:30	CC		6	PS	6
Odegaard, F.	3582	SPECIES COMPOSITION AND HOST SPECIFICITY OF PHYTOPHAGOUS BEETLES IN THE CANOPY OF A TROPICAL DRY FOREST IN PANAMA	II	904	24/08/00	14:00	Bol	U	20	2	20
Odello, E.	36	EFFECTS OF CHLORPYRIFOS AND TEFLUTHRIN ON LUMBRICUS TERRESTRIS	I	9	22/08/00	16:30	CC		1	PS	1
Oeh, U.	2492	JUVENILE HORMONE BIOSYNTHESIS AND REGULATION OF VITELLOGENESIS IN THE FALL ARMYWORM, SPODOPTERA FRUGIPERDA (LEPIDOPTERA: NOCTUIDAE)	II	629	24/08/00	16:30	CC		13	PS	13
Oehlschlager, A.C.	612	PHEROMONE-BASED MASS TRAPPING OF THE BANANA WEEVIL, COSMOPOLITES SORDIDUS & THE WEST INDIAN SUGARCANE WEEVIL, METAMASIUS HEMIPTERUS IN BANANA & PLANTAIN	I	155	24/08/00	11:05	Bol	S	4	6	4
Oetting, R. D.	301	SUBIRRIGATION APPLICATION OF IMIDACLOPRID FOR CONTROL OF BEMISIA ARGENTIFOLII	I	76	24/08/00	16:30	CC		2	PS	2
Ogai, S.	3313	ECDYSTEROID CONTROL OF WING MORPHOGENESIS DURING METAMORPHOSIS AND PUPAL DEVELOPMENT	II	837	23/08/00	16:30	CC		18	PS	18
Ogata, K.	533	DISTRIBUTION PATTERNS OF ANTS IN EAST ASIA (HYMENOPTERA: FORMICIDAE)	I	135	24/08/00	16:30	CC		3	PS	3
Ogner, G.	1364	RESISTANCE IN NORWAY SPRUCE AGAINST THE GREEN SPRUCE APHID	I	344	23/08/00	16:30	CC		7	PS	7
Ogol, C. K. P. O.	1544	SURVEY FOR NATIVE TRICHOGRAMMATID SPECIES IN KENYA	I	389	22/08/00	16:30	CC		8	PS	8
Oh, H. W.	2116	ULTRASTRUCTURAL AND MOLECULAR IDENTIFICATION OF A WOLBACHIA ENDOSYMBIONT IN A SPIDER, NEPHILA CLAVATA	I	534	24/08/00	16:30	CC		11	PS	11
O'Hara, J. E.	3666	PHYLOGENETIC RELATIONSHIPS AMONG THE POLIDEINI (DIPTERA: TACHINIDAE)	II	926	24/08/00	11:50	HB	E	21	6	21
Ohashi, D.	1580	CLASSICAL BIOLOGICAL CONTROL OF SOLANUM VIARUM (SOLANACEAE) IN THE USA	I	398	23/08/00	16:30	CC		8	PS	8
Ohashi, D.	2064	SAFETY OF GRATIANA BOLIVIANA AS A BIOCONTROL AGENT OF TROPICAL SODA APPLE (SOLANUM VIARUM): IS EGGPLANT A SUITABLE HOST?	I	521	22/08/00	16:30	CC		11	PS	11
Ohashi, D. V.	302	INSECTS ASSOCIATED WITH TOBACCO CULTURE WITHOUT CHEMICAL MANAGEMENT IN MISIONES ARGENTINA	I	77	25/08/00	16:30	CC		2	PS	2
Ohashi, D. V.	303	INSECTS RELATED TO BEAN AND CUCUMBER INTERCROPPING CULTURE IN MISIONES, ARGENTINA	I	77	25/08/00	16:30	CC		2	PS	2
Ohba, M.	2332	OCCURRENCE OF TWO DELTA-ENDOTOXIN GENES, THE CRY9DA AND A NOVEL ALLIED GENE, IN JAPANESE BACILLUS THURINGIENSIS ENVIRONMENTAL ISOLATES THAT PRODUCE SPHERICAL PARASPORAL INCLUSIONS WITH LEPIDOPTERA-SPECIFIC TOXICITY	I	588	25/08/00	16:30	CC		12	PS	12
Ohbayashi, F.	2295	A HOMOLOGUE OF THE DROSOPHILA MELANOGASTER SEX- DETERMINING GENE DOUBLESEX IS TRANSCRIBED INTO SEX-SPECIFIC ISOFORMES IN THE SILKWORM, BOMBYX MORI	I	579	24/08/00	16:30	CC		12	PS	12
Ohbayashi, F.	2324	SEX-SPECIFIC ALTERNATIVE SPLICING OF THE LEPIDOPTERAN HOMOLOGS OF THE DROSOPHILA MELANOGASTER SEX DETERMINING GENE DOUBLESEX	I	586	25/08/00	16:30	CC		12	PS	12
Ohbayashi, F.	3267	GENOMICS OF REPRODUCTION AND DIAPAUSE IN BOMBYX MORI	II	825	22/08/00	11:35	HB	K	18	2	18
Ohishi, T.	73	STABILITY ANALYSIS IN A CLASSICAL PREDATOR-PREY MODEL: EXAMPLE OF CASSAVA MITES SYSTEM	I	19	25/08/00	16:30	CC		1	PS	1
Ohnishi, E.	2357	PHENOLOXIDASES IN INSECTS; INTRODUCTORY REMARKS	II	595	23/08/00	13:35	HB	I	13	5	13
Ohno, K.	1673	ATTEMPTS OF USING INDIGENOUS PARASITOIDS AS A CONTROL AGENT TO LIRIOMYZA TRIFOLII IN GREENHOUSES IN JAPAN	I	422	25/08/00	16:30	CC		8	PS	8
Ohsaki, N.	837	TIMING OF GALL-FORMATION CAUSING DIFFERENTIAL PERFORMANCE OF A STEM MOTHER IN NEOTHORACAPHIS YANONIS (APHIDIDAE)	I	212	23/08/00	14:00	HB	D	6	5	6
Ohsaki, N.	1801	RANDOM MATING SECONDARILY DERIVED FROM LMC (LOCAL MATE COMPETITION) IN A GALL APHID, NEOTHORACAPHIS YANONIS	I	454	25/08/00	16:30	CC		9	PS	9
Ohsaki, N.	838	HOST PLANT DEFENSE INHIBITING SYNCHRONY WITH ITS FRUIT GALL MIDGE, ASPONDYLIA AUCUBAE	I	212	23/08/00	14:15	HB	D	6	5	6
Ohta, I.	3358	VARIETAL DIFFERENCE IN NYMPHAL SURVIVAL RATE, ADULT FECUNDITY AND LONGEVITY OF FRANKLINIELLA OCCIDENTALIS (THYSANOPTERA: THRIPIDAE) ON JAPANESE CHRYSANTHEMUM LEAVES	II	848	24/08/00	16:30	CC		18	PS	18
Ohta, I.	2101	DETECTION OF WOLBACHIA FROM ORIUS SPP. IN JAPAN	I	530	23/08/00	16:30	CC		11	PS	11
Ohtani, K.	1282	MANAGEMENT OF ACARICIDE RESISTANCE IN JAPAN	I	324	25/08/00	15:35	HM	N	7	10	7
Oi, D. H.	3408	THE MANAGEMENT OF UNDESIRABLE ANTS IN THE URBAN ENVIRONMENT	II	860	22/08/00	10:35	HM	Q	19	2	19
Oi, D. H.	2006	INTRODUCTION OF A PROTOZOAN FOR CONTROL OF IMPORTED FIRE ANTS IN THE USA	I	506	22/08/00	15:05	HM	P	11	4	11
Oi, F. M.	3409	AN INTEGRATED MANAGEMENT APPROACH FOR CONTROLLING TERMITES IN THE URBAN AREAS OF NORTH AMERICA	II	861	22/08/00	10:50	HM	Q	19	2	19
Oishi, K.	3380	CLONING OF VITELLOGENIN cDNA OF PERILTANETA AMERICANA AND ITS STYRUCTURE AND EXPRESSION	II	853	25/08/00	16:30	CC		18	PS	18
Ojha, G. P.	3984	ACCELERATING ADOPTION OF AGRICULTURAL RECOMMENDATIONS THROUGH PARTNERSHIPS BETWEEN GOs, NGOs, And Pos	II	1005	24/08/00	16:30	CC		22	PS	22
Ojimelukwe, P.C.	4053	EFFICACY OF CHENOPODIUM AMBROSIOIDES, PIPER GUINENSE, AND XYLOPIA AETHIOPICA AS GRAIN PROTECTANTS AGAINST STORED PRODUCT PESTS	II	1023	24/08/00	14:00	HB	J	23	9	23
Ojo, D.	38	EFFECTS OF CASSAVA CULTIVAR ON ABUNDANCE OF EXOTIC PHYTOSEIID MITES IN AFRICA	I	10	22/08/00	16:30	CC		1	PS	1
Oka, N. P.	1083	OCCURRENCE PATTERNS OF SPODOPTERA LITURA (LEPIDOPTERA: NOCTUIDAE) IN SOUTHERN JAPAN AND SOUTH-EASTERN ASIA	I	273	23/08/00	16:30	CC		6	PS	6
Okabe, K.	53	PARASITIC AND MUTUALISTIC RELATIONSHIPS BETWEEN ASTIGMATID MITES AND BEES OR WASPS IN JAPAN	I	14	24/08/00	16:30	CC		1	PS	1
Okada, K.	2525	PURIFICATION AND PROPERTIES OF TWO CAROTENOIDS BINDING PROTEINS FROM SILK GLAND OF BOMBYX MORI	II	638	25/08/00	16:30	CC		13	PS	13
Okada, M.	1184	THE INFLUENCE OF INCREASED ATMOSPHERIC CO2 AND TEMPERATURE ON NEPHOTETTIX CINCTICEPS LIFE CYCLES ANDECOSYSTEMS	I	298	25/08/00	16:30	CC		6	PS	6
Okada, M.	3312	MOLECULAR BIOLOGY OF INSECT CLOCKS FOR PHOTOPERIODISM	II	836	25/08/00	14:00	HB	K	18	8	18
Okada, S.	685	AMINO ACID SECRETION IN DIGESTIVE JUICE: COUNTERADAPTATION OF HERBIVOROUS INSECTS AGAINST PROTEIN-DENATURING ACTIVITY OF PLANT IRIDOID GLYCOSIDES ACTIVATED BY PLANT BETA-GLUCOSIDASE	I	173	23/08/00	16:30	CC		4	PS	4
Okano, K.	3262	RECENT PROGRESS IN GENOMIC MAPPING IN BOMBYX MORI: WHERE SHOULD WE GO FROM HERE?	II	824	22/08/00	9:35	HB	K	18	2	18
Okano, K.	3267	GENOMICS OF REPRODUCTION AND DIAPAUSE IN BOMBYX MORI	II	825	22/08/00	11:35	HB	K	18	2	18
Okano, K.	597	MOLECULAR MECHANISM OF SEX PHEROMONE PRODUCTION IN THE SILKWORM, BOMBYX MORI	I	151	23/08/00	10:00	Bol	S	4	4	4

Sub-titles: (HB=Hotel Bourbon) - (HM=Hotel Mabu) - (CC=Convention Center) - (Bol=Foz Boulevard) - (PS=Poster Session) - (PL=Plenary Lecturer)

AUTHOR	Nº	TITLE	Book	Page	Date	Time	Local	Room	Session	Symp	New Session
Okano, K.	2295	A HOMOLOGUE OF THE DROSOPHILA MELANOGASTER SEX- DETERMINING GENE DOUBLESEX IS TRANSCRIBED INTO SEX-SPECIFIC ISOFORMES IN THE SILKWORM, BOMBYX MORI	I	579	24/08/00	16:30	CC		12	PS	12
Okano, K.	3266	BOMBYX EST DATABASE, SILKBASE, FOR GENOME ANALYSIS OF BOMBYX MORI	II	825	22/08/00	11:05	HB	K	18	2	18
Okech, S. H. O.	2697	MANAGEMENT OF THE BANANA WEEVIL COSMOPOLITES SORDIDUS (COLEOPTERA:CURCULIONIDAE) IN BANANA-BASED CROPPING SYSTEMS IN NTUNGAMO, UGANDA	II	681	22/08/00	16:30	CC		14	PS	14
Oki, Y.	2480	LEPIDOPTERA ROLLERS AND BYRSONIMA INTERMEDIA RELATIONSHIP: THE ROLE OF SECONDARY METABOLITES AND NUTRICIONAL STATUS	II	626	23/08/00	16:30	CC		13	PS	4
Okochi, I.	1815	EFFECTS OF FORESTRY ON MOTH COMMUNITIES	I	458	21/08/00	11:35	HB	M	10	1	10
Okuda, T.	2472	JH BIOSYNTHESIS BY CORPORA ALLATA IN LOCUSTA MIGRATORIA AND SCHISTOCERCA GREGARIA ON ARTIFICIAL DIET	II	624	25/08/00	16:30	CC		13	PS	13
Okuda, T.	2481	SIGNIFICANCE OF TERATOCYTES AS A SOURCE OF NUTRIENTS FOR DEVELOPING LARVAE OF 3 SPECIES OF EUPHORINE PARASITOIDS OF THE ADULT HOSTS	II	627	24/08/00	16:30	CC		13	PS	13
Okuda, T.	2493	IDENTIFICATION AND CHARACTERIZATION OF A LIPOPHORIN RECEPTOR FROM THE TERATOCYTES OF DINOCAMPUS COCCINELLAE	II	630	24/08/00	16:30	CC		13	PS	13
Olano, C.	2256	EXPLORING THE MITOCHONDRIAL GENOME OF ANASTREPHA SUSPENSA	I	569	22/08/00	16:30	CC		12	PS	12
Oldroyd, B. P.	3458	WHAT MAKES AN ANARCHIST? THE DEVELOPMENT AND BEHAVIOUR OF ANARCHISTIC BEES (APIS MELLIFERA)	II	873	21/08/00	16:30	CC		19	PS	19
Oldroyd, B. P.	3505	EXAMINING THE GENETIC CONTROL OF DANCE IN HONEY BEES (APIS MELLIFERA)	II	885	23/08/00	16:30	CC		19	PS	19
Olejnicek, J.	992	CHANGES IN THE DEVELOPMENT OF MOSQUITOES OF THE CULEX PIPIENS COMPLEX CAUSED BY HORMONES, TEMPERATURE AND POPULATION DENSITY	I	250	22/08/00	16:30	CC		6	PS	6
Oliva, A.	2945	INSECTS OF FORENSIC SIGNIFICANCE IN ARGENTINA	II	743	26/08/00	11:05	Bol	R	15	11	15
Oliva, A.	2974	PRELIMINARY FOUNDINGS OF NECROPHAGOUS FAUNA ON DOMESTIC PIG IN ARGENTINA	II	750	22/08/00	16:30	CC		15	PS	15
Oliveira, L. M.	1686	EFFECTS OF CONVENTIONAL PESTICIDES ON THE PREIMAGINAL DEVELOPMENT OF TRICHOGRAMMA CORDUBENSIS (HYMENOPTERA: TRICHOGRAMMATIDAE)	I	425	25/08/00	16:30	CC		8	PS	8
Oliveira E. A. R. de	225	EFFECT OF THE INSECT GROWTH REGULATOR DIFLUBENZURON ON REPRODUCTION OF EUSCHISTUS HEROS (FABR.) (HETEROPTERA: PENTATOMIDAE)	I	57	22/08/00	16:30	CC		2	PS	2
Oliveira Neto, O. B.	299	BIONOMY OF THE BOLL WEVILL REARED ON ARTIFICIAL DIET	I	76	24/08/00	16:30	CC		2	PS	2
Oliveira, A. C.	1513	EFFECT OF A NUCLEAR POLYHEDROSIS VIRUS ON SPODOPTERA FRUGIPERDA LARVAE, ITS DAMAGE AND YIELD OF MAIZE CROP AT DIFFERENT EGG MASS INFESTATION LEVELS	I	382	21/08/00	16:30	CC		8	PS	8
Oliveira, A. C.	1895	MANAGEMENT PROGRAMS FOR LEAF CUTTING ANTS IN BRAZIL	I	478	26/08/00	15:50	HB	M	10	10	10
Oliveira, A. C.	236	POPULATIONAL COMPOSITION AND SOIL MOBILITY OF SCAPTOCORIS CASTANEA (HETEROPTERA:CYDNIDAE) IN GOIÁS, BRAZIL	I	60	22/08/00	16:30	CC		2	PS	2
Oliveira, A. C.	1887	USE OF STRIPS OF NATIVE VEGETATION WITHIN EUCALYPTUS PLANTATIONS AS A STRATEGY TO REDUCE LEPIDOTERA PEST POPULATIONS	I	476	26/08/00	13:35	HB	M	10	10	10
Oliveira, A. F.	2059	OCCURRENCE OF CULICIDAE (DIPTERA) LARVAE IN WATER HELD IN AQUASCYPHA HYDROPHORA (FUNGUS:STEREACEAE) IN CENTRAL AMAZON, BRAZIL	I	519	23/08/00	16:30	CC		11	PS	11
Oliveira, A. L. V.	2271	THE COMPLETE MITOCHONDRIAL GENOME OF THE PRIMARY SCREWWORM FLY COCHLIOMYIA HOMINIVORAX (DIPTERA: CALLIPHORIDAE)	I	573	22/08/00	16:30	CC		12	PS	12
Oliveira, A. R.	543	LITTER MICROARTHROPOD COMMUNITY IN AN URBAN FOREST STAND OF SÃO JOSÉ DO RIO PRETO, STATE OF SÃO PAULO, BRAZIL	I	137	24/08/00	16:30	CC		3	PS	3
Oliveira, B. L.	2140	SELECTION OF ENTOMOPATHOGENIC FUNGI FOR USE IN COMBINATION WITH SUBLETHAL DOSES OF IMIDACLOPRID: PERSPECTIVES FOR THE CONTROL OF THE LEAF-CUTTING ANT ATTA SEXDENS (HYMENOPTERA: FORMICIDAE)	I	540	21/08/00	16:30	CC		11	PS	11
Oliveira, C. A. L.	1056	SAMPLING AND POPULATION DISTRIBUTION OF MITES FROM STIGMAEIDAE FAMILY IN CITRUS ORCHARDS IN SÃO PAULO STATE	I	266	23/08/00	16:30	CC		6	PS	6
Oliveira, C. A. L.	1057	FOOD PREFERENCE OF AGISTEMUS AFF. BAKERI (ACARI: STIGMAEIDAE)	I	267	23/08/00	16:30	CC		6	PS	6
Oliveira, C. M.	3234	MIGRATION AS A STRATEGY FOR SURVIVAL OF DALBULUS MAIDIS (HEMIPTERA: CICADELLIDAE) DURING CORN OVERSEASON IN CENTRAL BRAZIL	II	816	23/08/00	16:30	CC		17	PS	17
Oliveira, C. M. F.	2117	SELECTION OF CULEX QUINQUEFASCIATUS POPULATION RESISTANT TO BACILLUS SPHAERICUS STRAIN 2362	I	534	24/08/00	16:30	CC		11	PS	11
Oliveira, D. C.	1919	SCOLYTIDAE TRAPPINGS IN YOUNG LOBLOLLY PINE (PINUS TAEDA) STANDS	I	484	22/08/00	16:30	CC		10	PS	10
Oliveira, D. M. de	2770	EFFECT OF POTASSIUM FOR THE CONTROL OF WHITEFLY, BEMISIA TABACI (GENN., 1889) B GENOTYPE IN COTTON (GOSSYPIUM HIRSUTUM L.) PLANT	II	699	24/08/00	16:30	CC		14	PS	14
Oliveira, D. R. S. de	1784	WILL BE CERATITIS CAPITATA COMPETING WITH ANASTREPHA FRATERCULUS?	I	449	23/08/00	16:30	CC		9	PS	9
Oliveira, E. D. M.	304	PERFORMANCE AND FEEDING PREFERENCE OF NYMPHS AND ADULTS OF PIEZODORUS GUILDINII (HEMIPTERA: PENTATOMIDAE) ON SOYBEAN PODS AT DIFFERENT DEVELOPMENTAL STAGES	I	77	21/08/00	16:30	CC		2	PS	2
Oliveira, E. D. M. de	2680	EFFECT OF INSECT RESISTANT AND SUSCEPTIBLE GENOTYPES ON SURVIVAL AND INSTAR LENGTH OF NEZARA VIRIDULA (HETEROPTERA:PENTATOMIDAE)	II	677	21/08/00	16:30	CC		14	PS	14
Oliveira, E. E.	1401	CARTAP RESISTANCE AND SYNERGISM IN POPULATIONS OF TUTA ABSOLUTA (LEPIDOPTERA: GELECHIIDAE)	I	353	25/08/00	16:30	CC		7	PS	7
Oliveira, E. G.	534	BUTTERFLY DIVERSITY IN SERRA DO CIPÓ, BRAZIL: A RELIMINARY SURVEY	I	135	24/08/00	16:30	CC		3	PS	3
Oliveira, E. G.	814	INVESTIGATING OPTIMAL MIGRATION STRATEGIES IN BUTTERFLIES: THE USE OF LOCAL AND CELESTIAL CUES TO ADJUST COURSE AND FLIGHT SPEED	I	206	24/08/00	10:45	HB	F	6	3	6
Oliveira, E. G.	814	INVESTIGATING OPTIMAL MIGRATION STRATEGIES IN BUTTERFLIES: THE USE OF LOCAL AND CELESTIAL CUES TO ADJUST COURSE AND FLIGHT SPEED	I	206	24/08/00	10:45	HB	F	6	3	6
Oliveira, E. G.	1370	BUTTERFLY DIVERSITY IN SERRA DO CIPÓ, BRAZIL: A PRELIMINARY SURVEY	I	346	25/08/00	16:30	CC		7	PS	7
Oliveira, F. F. de	213	AFRICANIZED HONEYBEE AND STINGLESS BEE AS POTENCIAL POLLINATORS OF SOME TROPICAL AND EXOTIC FRUITS IN BAHIA STATE, BRAZIL	I	54	22/08/00	16:30	CC		2	PS	2
Oliveira, F. R.	1101	BIOLOGY AND ONTOGENY OF ZELUS LEUCOGRAMMUS, (HEMIPTERA: REDUVIIDAE) IN CERRADO-SAVANNA, BRAZIL: THE IMPORTANCE OF CLIMATIC VARIATIONS	I	278	24/08/00	16:30	CC		6	PS	6
Oliveira, F. R.	1786	THE PREDATORY BEHAVIOR OF ZELUS LEUCOGRAMMUS, (HEMIPTERA: REDUVIIDAE) IN CERRADO-SAVANNA, BRAZIL	I	450	23/08/00	16:30	CC		9	PS	9
Oliveira, G. G. F. B. de	297	THE EFFECT OF SOME PHYSIOLOGICAL INSECTICIDES OVER THE SHARPSHOOTERS VETORS OF CVC IN CITRUS	I	75	24/08/00	16:30	CC		2	PS	2
Oliveira, G. V.	3532	DIGESTIBILITY OF POLLEN GRAINS COLLECTED BY HONEYBEE, APIS MELLIFERA (HYMENOPTERA, APINI), IN THE MICROREGION OF VIÇOSA, MG, BRAZIL	II	891	24/08/00	16:30	CC		19	PS	19
Oliveira, H. N. de	1474	PARASITISM RATE AND VIABILITY OF TRICHOGRAMMA MAXACALII (HYM.: TRICHOGRAMMATIDAE) ON EGGS OF THE EUCALYPTUS DEFOLIATOR EUSELASIA APISAON (LEP.: RIODINIDAE)	I	372	26/08/00	11:05	HM	O	8	8	8
Oliveira, H. N. de	315	RELATIONSHIP BETWEEN THE ARTIFICIAL INFESTATION OF DIATRAEA SACCHARALIS EGGS AND THE DAMAGE IN SUGARCANE STALKS	I	80	24/08/00	16:30	CC		2	PS	2
Oliveira, H. N. de	1470	EFFECT OF DENSITY OF DIATRAEA SACCHARALIS EGGS IN THE PARASITISM OF TRICHOGRAMMA GALLOI IN SUGARCANE	I	371	26/08/00	10:05	HM	O	8	8	8
Oliveira, J. V.	1330	EFFECT OF VEGETAL AQUEOUS EXTRACTS ON IMMATURE STAGES AND FEMALES OF THE CASSAVA GREEN MITE MONONYCHELUS TANAJOA	I	336	22/08/00	16:30	CC		7	PS	7

Sub-titles: (HB=Hotel Bourbon) - (HM=Hotel Mabu) - (CC=Convention Center) - (Boi=Foz Boulevard) - (PS=Poster Session) - (PL=Plenary Lecturer)

AUTHOR	Nº	TITLE	Book	Page	Date	Time	Local	Room	Session	Symp	New Session
Oliveira, J. V.	1371	CONTROL OF BEAN LEAFHOPPER EMPOASCA KRAEMERI (HEMIPTERA: CICADELLIDAE) WITH THIAMETHOXAM ON COWPEA	I	346	22/08/00	16:30	CC		7	PS	7
Oliveira, J. V.	1372	INTERCROPPING SYSTEM AND THIAMETHOXAM SPRAYING FOR EMPOASCA KRAEMERI (HEMIPTERA: CICADELLIDAE) CONTROL IN COWPEA	I	346	22/08/00	16:30	CC		7	PS	7
Oliveira, J. V.	1399	REPELLENCY OF VEGETABLE OILS ON ADULTS OF ZABROTES SUBFASCIATUS (COLEOPTERA: BRUCHIDAE) IN BEAN GRAINS	I	353	25/08/00	16:30	CC		7	PS	7
Oliveira, J. V.	4085	IDENTIFICATION OF COWPEA VIGNA UNGUICULATA GENOTYPES RESISTANT TO CALLOSOBRUCHUS MACULATUS	II	1031	23/08/00	16:30	CC		23	PS	23
Oliveira, J. V.	4096	EFFECT OF VEGETABLE OILS ON THE PREFERENCE FOR OVIPOSITION AND VIABILITY OF IMATURE PHASE OF CALLOSODRUCHUS MACULATUS (COLEOPTERA: BRUCHIDAE) IN COWPEA GRAINS	II	1034	23/08/00	16:30	CC		23	PS	23
Oliveira, J. V.	349	EVALUATION OF THE THIAMETHOXAN IN THE CONTROL OF "RICE WATER WEEVIL" ORYZOPHAGUS ORYZAE (COLEOPTERA-CURCULIONIDAE)	I	88	25/08/00	16:30	CC		2	PS	2
Oliveira, L.	3328	FECUNDITY OF TRICHOGRAMMA CORDUBENSIS FEMALES FROM SEXUAL AND ASEXUAL LINES	II	840	22/08/00	16:30	CC		18	PS	18
Oliveira, L. J.	1785	DISTRIBUTION OF SCAPTOCORIS CASTANEA POPULATION IN THE SOIL PROFILE	I	450	25/08/00	16:30	CC		9	PS	9
Oliveira, L. M.	1532	EFFECTS OF WASP DENSITY ON THE BIOLOGY OF TRICHOGRAMMA CORDUBENSIS	I	386	22/08/00	16:30	CC		8	PS	8
Oliveira, M. A. C.	2771	AGRONOMICAL EFFICACY OF DIFFERENT FORMULATIONS AND MIXTURES OF THE INSECTICIDE LAMBDACYHALOTHRIN FOR THE CONTROL OF PERILEUCOPTERA COFFEELLA, ON COFFEE CROP THROUGH FOLIAR SPRAY	II	700	24/08/00	16:30	CC		14	PS	14
Oliveira, M. A. C.	2772	AGRONOMICAL EFFICACY OF THE PRODUCTS CYPROCONAZOLE AND THIAMETHOXAM IN THE CONTROL OF HEMILEIA VASTATRIX, PERILEUCOPTERA COFFEELLA AND QUESADA GIGAS, THROUGH APPLICATION IN THE SOIL	II	700	24/08/00	16:30	CC		14	PS	14
Oliveira, M. A. S.	1021	MAJOR PESTS OF SOURSOP (ANNONA MURICATA) IN BRAZILIAN CERRADOS REGION AND THEIR NATURAL ENEMIES	I	258	23/08/00	16:30	CC		6	PS	6
Oliveira, M. A. S.	1622	BIOLOGICAL DATA OF SOME NATURAL ENEMIES OF THE SOURSOP BORER CERCONOTA ANONELLA (LEPIDOPTERA: OECOPHORIDAE) IN PLANALTINA, FEDERAL DISCTRICT, BRAZIL	I	409	24/08/00	16:30	CC		8	PS	8
Oliveira, M. C. M.	2845	SCREENING FORAGE GRASSES OF THE GENUS BRACHIARIA FOR RESISTANCE TO THE SPITTLEBUGS (HOMOPTERA: CERCOPIDAE)	II	718	25/08/00	16:30	CC		14	PS	14
Oliveira, M. F.	2507	HEME GENERATION AND PROCESSING IN THE MIDGUT LUMEN AND ITS STORAGE IN THE EPITHELIAL CELLS OF THE RHODNIUS PROLIXUS (HEMIPTERA: REDUVIIDAE)	II	633	24/08/00	16:30	CC		13	PS	13
Oliveira, M. L.	535	SAFETY OF PROTECTIVE CLOTHING AND SEMI-CABIN FOR TRACTOR DRIVER APPLYING INSECTICIDES AND ACARICIDES BY TRACTOR-TRAILED AIR-CARRIED SPRAYER IN CITRUS (CITRUS SINENSIS)	I	135	24/08/00	16:30	CC		3	PS	3
Oliveira, M. L.	1373	SAFETY OF TWO TRACTOR CABINS IN APPLICATION OF INSECTICIDE AND ACARICIDE BY TRACTOR-TRAILED AIR CARRIED SPRAYER IN CITRUS (CITRUS SINENSIS)	I	346	25/08/00	16:30	CC		7	PS	7
Oliveira, M. L.	1374	SAFETY OF PROTECTIVE CLOTHING AND SEMI-CABIN IN INSECTICIDES AND ACARICIDES APPLICATIONS BY TRACTOR-TRAILED HAND GUN SPRAYER IN CITRUS	I	347	25/08/00	16:30	CC		7	PS	7
Oliveira, M. L.	54	EFFICIENCY OF BAJ 2740 (SPIRODICLOFEN) 240 FW AND PEROPAL (AZOCYCLOTIN) 250 WP AND 500 FW IN THE CONTROL OF CITRUS LEPROSIS MITE IN CITRUS ORCHARD.	I	14	24/08/00	16:30	CC		1	PS	1
Oliveira, M. L.	55	OVICIDE ACTION OF BAJ 2740 (SPIRODICLOFEN) AND PEROPAL (AZOCYCLOTIN) 250 WP AND 500 FW ON CITRUS LEPROSIS MITE BREVIPALPUS PHOENICIS	I	14	24/08/00	16:30	CC		1	PS	1
Oliveira, M. L.	56	CONTROL OF PHYLLOCOPTRUTA OLEIVORA IN CITRUS WITH SPIRODICLOFEN AND AZOCYCLOTIN	I	14	25/08/00	16:30	CC		1	PS	1
Oliveira, M. L.	57	MITECIDE ACTION OF SPIRODICLOFEN AND AZOCYCLOTIN ON POLYPHAGOTARSONEMUS LATUS ON CITRUS	I	15	25/08/00	16:30	CC		1	PS	1
Oliveira, M. L.	58	ACTION OF THIAMETHOXAN ON THE POPULATION DYNAMICS OF THE BROAD MITE Polyphagotarsonemus latus (Banks) ON COTTON AND ITS SELECTIVITY TO PREDATOR MITE Euseius concordis (Chant).	I	15	25/08/00	16:30	CC		1	PS	1
Oliveira, M. L.	2773	SAFETY OF PROTECTIVE CLOTHING AND SEMI-CADIN FOR TRACTOR DRIVER APPLYING INSECTICIDES AND ACARICIDES BY TRACTOR-TRAILED AIR-CARRIED SPRAYER IN CITRUS (CITRUS SINENSIS)	II	700	21/08/00	16:30	CC		14	PS	14
Oliveira, M. R. V.	1611	PARASITISM OF THREE ENCARSIA SPECIES ON TRIALEURODES VAPORARIORUM (HEMIPTERA, ALEYRODIDAE)	I	406	23/08/00	16:30	CC		8	PS	8
Oliveira, M. R. V.	1612	BIOLOGICAL STUDIES OF NEPHASPIS GEMINII (COLEOPTERA: COCCINELIDAE) A PREDATOR OF BEMISIA TABACI BIOTYPE B (HEMIPTERA: ALEYRODIDADE), IN BRAZIL	I	406	23/08/00	16:30	CC		8	PS	8
Oliveira, M. R. V.	2296	MORPHOLOGICAL AND MOLECULAR IDENTIFICATION OF WHITEFLIES SPECIES IN BRAZIL	I	579	24/08/00	16:30	CC		12	PS	12
Oliveira, M. R. V.	2555	HISTORY AND CURRENT STATUS OF BEMISIA	II	646	22/08/00	9:50	HB	B	14	3	14
Oliveira, M. R. V.	2774	INTEGRATED METHODS TO CONTROL BEMISIA TABACI BIOTYPE B, IN MELONS	II	700	25/08/00	16:30	CC		14	PS	14
Oliveira, M. R. V.	2775	INTRODUCTION-PART 2: CHALLENGES AND OPPORTUNITIES FOR PEST MANAGEMENT OF BEMISIA IN THE NEW CENTURY	II	701	25/08/00	16:30	CC		14	PS	14
Oliveira, M. R. V.	3982	PEST RISK ASSESSMENT TO MANGO CROP IN BRAZIL	II	1005	24/08/00	16:30	CC		22	PS	22
Oliveira, M. R. V.	2671	INTRODUCTION-PART 1: CHALLENGES AND OPPORTUNITIES FOR PEST MANAGEMENT OF BEMISIA IN THE NEW CENTURY	II	675	22/08/00	16:30	CC		14	PS	14
Oliveira, M. R. V.	2272	BEMISIA TABACI POPULATIONS IN BRAZIL: GENETIC DIVERSITY REVEALED BY RAPD MARKERS	I	573	23/08/00	16:30	CC		12	PS	12
Oliveira, M. R. V.	3986	DATA BASE OF QUARANTINE PESTS TO BRAZIL	II	1006	24/08/00	16:30	CC		22	PS	22
Oliveira, P. F. M.	3483	MONITORING TERMITES IN SUGAR CANE FIELDS IN GOIAS, BRAZIL: A PROFITABLE INVESTIMENT.	II	879	23/08/00	16:30	CC		19	PS	19
Oliveira, P. L.	2507	HEME GENERATION AND PROCESSING IN THE MIDGUT LUMEN AND ITS STORAGE IN THE EPITHELIAL CELLS OF THE RHODNIUS PROLIXUS (HEMIPTERA: REDUVIIDAE)	II	633	24/08/00	16:30	CC		13	PS	13
Oliveira, P. S.	807	ANT-WHITEFLY INTERACTION IN A NEOTROPICAL FOREST: ANT ATTENDANCE REDUCES FUNGAL AND PARASITOID ATTACK	I	204	24/08/00	14:35	HB	F	6	2	6
Oliveira, R. C.	2118	VIRULENCE OF BEAUVERIA BASSIANA ISOLATES TO OLIGONYCHUS YOTHERSI (ACARI: TETRANICHIDAE)	I	534	24/08/00	16:30	CC		11	PS	11
Oliveira, R. C.	15	DAMAGE CHARACTERIZATION OF OLIGONYCHUS YOTHERSI (ACARI: TETRANICHIDAE) TO ERVA-MATE (ILEX PARAGUARIENSIS) (AQUIFOLIACEAE)	I	4	21/08/00	16:30	CC		1	PS	7
Oliveira, R. L. de	3658	NA OVERVIEW OF THE SYSTEMATICS OF THE NEOTROPICAL CULICIDAE	II	924	24/08/00	9:50	HB	E	21	6	21
Oliveira, S. G.	536	GEOGRAPHIC DISTRIBUTION AND PHENOLOGY OF FIELD PLANTS AS PARAMETERS OF TROPHIC RESOURCES IN NEOTROPICAL ENTOMOTAXOCENOSES	I	136	22/08/00	16:30	CC		3	PS	3
Oliveira, S. G.	1097	MODELLING THE POPULATION DYNAMICS OF ATHERIGONA ORIENTALIS (DIPTERA, MUSCIDAE)	I	277	25/08/00	16:30	CC		6	PS	6
Oliveira, S. G.	2297	GENETIC VARIABILITY OF CACOPHONY GENE IN LUTZOMYIA LONGIPALPIS POPULATIONS	I	580	24/08/00	16:30	CC		12	PS	12
Oliveira, S. G.	2416	POST-EMBRYONIC DEVELOPMENT OF CALYPTRATE FLIES IN ARTIFICIAL DIETS I. CHRYSOMYA MEGACEPHALA (DIPTERA: CALLIPHORIDAE)	II	610	21/08/00	16:30	CC		13	PS	13

Sub-titles: (HB=Hotel Bourbon) - (HM=Hotel Mabu) - (CC=Convention Center) - (Bol=Foz Boulevard) - (PS=Poster Session) - (PL=Plenary Lecturer)

AUTHOR	Nº	TITLE	Book	Page	Date	Time	Local	Room	Session	Symp	New Session
Oliveira, W. P. de	1641	POS-INTRODUCTION OF THE NATURAL ENEMY AGENIAPIS CITRICOLA IN CITRUS GROVES IN JAGUARIÚNA AND AGUAÍ REGIONS, SÃO PAULO STATE, BRAZIL: PRELIMINARY RESULTS	I	414	24/08/00	16:30	CC		8	PS	8
Oliveira,C. A. L.	54	EFFICIENCY OF BAJ 2740 (SPIRODICLOFEN) 240 FW AND PEROPAL (AZOCYCLOTIN) 250 WP AND 500 FW IN THE CONTROL OF CITRUS LEPROSIS MITE IN CITRUS ORCHARD.	I	14	24/08/00	16:30	CC		1	PS	1
Oliveira,C. A. L.	55	OVICIDE ACTION OF BAJ 2740 (SPIRODICLOFEN) AND PEROPAL (AZOCYCLOTIN) 250 WP AND 500 FW ON CITRUS LEPROSIS MITE BREVIPALPUS PHOENICIS	I	14	24/08/00	16:30	CC		1	PS	1
Oliveira,C. A. L.	56	CONTROL OF PHYLLOCOPTRUTA OLEIVORA IN CITRUS WITH SPIRODICLOFEN AND AZOCYCLOTIN	I	14	25/08/00	16:30	CC		1	PS	1
Oliveira,C. A. L.	57	MITECIDE ACTION OF SPIRODICLOFEN AND AZOCYCLOTIN ON POLYPHAGOTARSONEMUS LATUS ON CITRUS	I	15	25/08/00	16:30	CC		1	PS	1
Oliveira,C. A. L.	58	ACTION OF THIAMETHOXAN ON THE POPULATION DYNAMICS OF THE BROAD MITE Polyphagotarsonemus latus (Banks) ON COTTON AND ITS SELECTIVITY TO PREDATOR MITE Euseius concordis (Chant)	I	15	25/08/00	16:30	CC		1	PS	1
Oliveira-Costa, J.	2923	APPLICATION OF THE FORENSIC ENTOMOLOGY TO ESTIMATE OF POST MORTEM INTERVAL, IN INVESTIGATIONS OF HOMICIDE, BY THE DEPARTMENT OF POLICE OF RIO DE JANEIRO - BRAZIL	II	738	25/08/00	10:20	Bol	R	15	9	15
Oliveira-Neto, O. B.	2119	CHARACTERIZATION OF THE PROTEOLYTIC ACTIVITY OF ANTHONOMUS GRANDIS AND ISOLATION OF CDNAS ENCODING SERINE AND CYSTEINE PROTEASES	I	534	24/08/00	16:30	CC		11	PS	11
Oliveira-Neto, O. B.	2063	EFFECTS IN VITRO AND IN VIVO OF SOYBEAN KUNITZ TRYPSIN INHIBITORS AGAINST THE BOOL WEEVIL ANTHONOMUS GRANDIS	I	520	22/08/00	16:30	CC		11	PS	11
Oliver, I.	483	BIOTRACK: CONCEPTUAL AND INFORMATION TECHNOLOGY SOLUTIONS FOR UNDERSTANDING MORE OF BIODIVERSITY	I	122	22/08/00	16:30	CC		3	PS	3
Ollivier, L.	682	CONTROL OF SCAPANES AUSTRALIS A MAJOR PEST OF COCONUT USING SEMIOCHEMICALS	I	172	23/08/00	16:30	CC		4	PS	4
Olsen, A. O.	2913	ALLERGENIC MITES: AN EMERGING FOOD SAFETY ISSUE	II	735	24/08/00	11:35	Bol	R	15	7	15
Olsen, A. R.	2911	THE ROLE OF FLIES AS VECTORS OF SALMONELLA IN EGG FARM LAYER HOUSES	II	735	24/08/00	10:50	Bol	R	15	7	15
Olsen, K.	2049	BT COTTON: RELATIONSHIP BETWEEN BIOEFFICACY, GENE EXPRESSION AND PROTEIN	I	517	21/08/00	16:30	CC		11	PS	11
Olsen, K. P.	1261	NATURE'S SELECTION: GENETICS AND EVOLUTION OF RESISTANCE IN HELICOVERPA ARMIGERA	I	318	24/08/00	14:20	HM	N	7	8	7
Olson, K.	2354	THE ROLE OF INNATE IMMUNE PEPTIDES TO REDUCE PARASITE DEVELOPMENT IN AEDES AEGYPTI	II	595	23/08/00	11:05	HB	I	13	4	13
Olson, K. E.	2916	GENETICALLY-ENGINEERED MOSQUITOES RESISTANT TO THE TRANSMISSION OF MALARIA	II	736	24/08/00	14:35	Bol	R	15	8	15
Olsson, C.	721	MALE EMITTED SEX PHEROMONES IN CONFUSED FLOUR BEETLE-BEHAVIOUR AND POSSIBLE PRODUCTION SITE	I	182	25/08/00	16:30	CC		4	PS	4
Olszak, R. W.	2021	CODLING MOTH (CYDIA POMONELLA) CONTROL WITH BACTERIAL AND VIRAL PREPARATIONS UNDER POLISH WEATHER CONDITIONS	I	510	24/08/00	11:35	HM	P	11	7	11
Omacini, M.	1613	IMPACT OF A SYMBIOTIC GRASS-ENDOPHYTE ASSOCIATION ON INSECT HERBIVORES AND THEIR NATURAL ENEMIES	I	407	23/08/00	16:30	CC		8	PS	8
Oman, C.	2903	SPATIAL AND TEMPORAL HETEROGENEITY IN DENGUE VIRUS TRANSMISSION AND AEDES AEGYPTI POPULATION DENSITIES IN IQUITOS, PERU	II	733	23/08/00	14:35	Bol	R	15	6	15
Omar, B.	2951	THE PRESENT OF OPHYRA SPP. (DIPTERA: MUSCIDAE) AS IMPORTANT CLUES IN THE STIMULATION OF POST-MORTEM INTERVAL OF HIGHLY DECOMPOSED BODIES FOUND IN MALASYA	II	745	26/08/00	14:15	Bol	R	15	11	15
Ombok, M.	2905	MICROEPIDEMIOLOGY OF MALARIA IN WESTERN KENYA	II	733	23/08/00	15:35	Bol	R	15	6	15
Ometto, A. C. F.	905	SURVEY AND IDENTIFICATION OF FRUIT FLY SPECIES IN THE REGION OF BAIXO JAGUARIBE, STATE OF CEARÁ, BRAZIL	I	229	21/08/00	16:30	CC		6	PS	6
Omoto, C.	1275	RECENT ADVANCES IN PESTICIDE RESISTANCE MANAGEMENT PROGRAMS IN BRAZIL	I	322	25/08/00	13:35	HM	N	7	10	7
Omoto, C.	1375	BASES FOR AN INSECTICIDE RESISTANCE MANAGEMENT OF SPODOPTERA FRUGIPERDA IN CORN IN BRAZIL	I	347	24/08/00	16:30	CC		7	PS	7
Omoto, C.	1317	INHERITANCE AND FITNESS COST OF RESISTANCE TO LAMBDA-CYHALOTHRIN IN SPODOPTERA FRUGIPERDA (LEPIDOPTERA: NOCTUIDAE)	I	332	22/08/00	16:30	CC		7	PS	7
Omoto, C.	338	BASELINE SUSCEPTIBILITY OF SPODOPTERA FRUGIPERDA (LEPIDOPTERA: NOCTUIDAE) POPULATIONS TO LUFENURON IN BRAZIL	I	86	25/08/00	16:30	CC		2	PS	2
Omoto, C.	2082	BASELINE SUSCEPTIBILITY OF BREVIPALPUS (ACARI: TENUIPALPIDAE) TO ORGANOTIN ACARICIDES IN BRAZILIAN CITRUS GROVES	I	525	22/08/00	16:30	CC		11	PS	7
Omoto, C.	14	BASES FOR AN ACARICIDE RESISTANCE MANAGEMENT PROGRAM OF BREVIPALPUS PHOENICIS (ACARI: TENUIPALPIDAE) TO THE ACARICIDE DICOFOL IN BRAZILIAN CITRUS	I	4	21/08/00	16:30	CC		1	PS	7
Omoto, K.	3820	MOLECULAR SYSTEMATICS AND EVOLUTION OF BUTTERFLIES OF THE GENUS PARNASSIUS, PAPILIONIDAE, BASED ON MITOCHONDRIAL DNA SEQUENCE DATA	II	964	24/08/00	16:30	CC		21	PS	21
O'Neill, S.	2897	WOLBACHIA AS AGENT FOR CONTROLLING INSECT-BORNE DISEASES IN HUMANS	II	731	23/08/00	10:05	Bol	R	15	5	15
O'Neill, S. L.	1098	THE POTENTIAL USE OF WOLBACHIA INFECTIONS AS TOOLS FOR MODIFYING INSECT POPULATIONS	I	277	24/08/00	16:30	CC		6	PS	6
Ono, M.	588	A PHEROMONE COMPONENT OF THE BEAN BUG, RIPTORTUS CLAVATUS, ATTRACTS AN EGG PARASITOID, OOENCYRTUS NEZARAE	I	149	22/08/00	11:05	Bol	S	4	2	4
Ono, M.	2498	MASKING OF CIRCADIAN ACTIVITY RHYTHM IN BUMBLE BEES: A NOVEL ADAPTATION MECHANISM TO HIGH-LATITUDE CONDITION	II	631	24/08/00	16:30	CC		13	PS	13
Onofrio, V. C.	1902	RELATIONSHIP BETWEEN TICKS AND SMALL WILD MAMMALS IN A DISTURBED ATLANTIC FOREST FRAGMENT IN ITAPEVI COUNTY, STATE OF SÃO PAULO, BRAZIL	I	479	21/08/00	16:30	CC		10	PS	10
Onzo, A.	38	EFFECTS OF CASSAVA CULTIVAR ON ABUNDANCE OF EXOTIC PHYTOSEIID MITES IN AFRICA	I	10	22/08/00	16:30	CC		1	PS	1
Opp, W. R.	1353	MATRICAP®: NOVEL SYSTEMS FOR CONTROLLED DELIVERY OF PESTICIDES IN AQUATIC OR TERRESTRIAL HABITATS	I	341	23/08/00	16:30	CC		7	PS	7
Oraze, M. J.	3725	A PREDICTIVE MODEL TO ENHANCE SAFEGUARDING CAPABILITIES AGAINST WEEVILS BASED ON ECOLOGY, BEHAVIOR AND PHYLOGENY	II	940	21/08/00	16:30	CC		21	PS	21
Orchard, I.	2349	THE INTEGRATIVE ACTIONS OF PEPTIDES AND AMINES ON IDENTIFIED TARGET TISSUES OF RHODNIUS PROLIXUS.	II	593	22/08/00	11:05	HB	I	13	3	13
Orchard, I.	3047	ALLATOSTATINS AND THE REGULATION OF THE CORPORA ALLATA IN A COCKROACH	II	769	22/08/00	11:05	HB	G	16	2	16
Orellano, P.	4086	ANALYSIS OF VARIATION OF SPECIFIC CHARACTERS OF CULEX (CULEX) IN TWO ENVIROMENTS AND DETECTION OF NEW SPECIES IN THE CITY OF BUENOS AIRES	II	1032	23/08/00	16:30	CC		23	PS	23
Orellano, P.	3024	POTENTIAL GEOGRAPHIC RANGE OF AEDES ALBOPICTUS (DIPTERA: CULICIDAE) IN ARGENTINA	II	763	23/08/00	16:30	CC		15	PS	15
Orlato, C.	1948	EFFICIENCY OF DIFFERENT INSECTICIDES IN CONTROL OF NURSERY FLY SCYTHROPOCHROA SP. (DIPTERA: SCIARIDAE) IN EUCALYPTUS SEEDLINGS	I	491	23/08/00	16:30	CC		10	PS	10
Orlato, C.	1980	EVALUATION OF TWO TRAP CARDS TO MONITORING OF SCYTHROPOCHROA SP. (DIPTERA: SCIARIDAE) IN EUCALYPTUS SEEDLINGS NURSERY	I	499	25/08/00	16:30	CC		10	PS	10
Orlato, C.	1979	EVALUATION OF THIAMETHOXAM ON COSTALIMAITA FERRUGINEA (COLEOPTERA: CHRYSOMELIDAE) CONTROL IN EUCALYPTUS PLANTATIONS	I	499	25/08/00	16:30	CC		10	PS	10

Sub-titles: (HB=Hotel Bourbon) - (HM=Hotel Mabu) - (CC=Convention Center) - (Bol=Foz Boulevard) - (PS=Poster Session) - (PL=Plenary Lecturer)

AUTHOR	Nº	TITLE	Book	Page	Date	Time	Local	Room	Session	Symp	New Session
Orlato, C.	2110	SUSCEPTIBILITY OF IMMATURE STAGES OF THYRINTEINA ARNOBIA (LEPIDOPTERA: GEOMETRIDAE) TO A POSSIBLE PICORNAVIRUS	I	532	23/08/00	16:30	CC		11	PS	11
Orrell, I.	3648	MORPHOLOGY AND BIOGEOGRAPHY OF FEMALE MYRMECOLACIDAE PARASITIC IN ORTHOPTERA IN PAPUA NEW GUINEA	II	921	23/08/00	14:20	HB	E	21	5	21
Ortego, F.	2460	ANTIFEEDANT ACTIVITY AND POST-INGESTIVE EFFECT OF TERPENOIDS ISOLATED FROM TRICHILIA HAVANENSIS AND SCUTELLARIA ALPINA ON COLORADO POTATO BEETLE LARVAE	II	621	25/08/00	16:30	CC		13	PS	13
Ortego, F.	2482	PHYSIOLOGICAL RESPONSES OF COLORADO POTATO BEETLE AND BEET ARMYWORM LARVAE TO ANTISENSE-MEDIATED DEPLETION OF WOUND-INDUCIBLE PROTEINASE INHIBITORS IN POTATO	II	627	25/08/00	16:30	CC		13	PS	13
Ortelli, F.	1376	DDT- AND ORGANOPHOSPHATE-RESISTANCE IN ANOPHELES GAMBIAE MEDIATED BY GLUTATHIONE S-TRANSFERASE GENES	I	347	24/08/00	16:30	CC		7	PS	7
Ortius-Lechner, D.	3430	MATING SYSTEM EVOLUTION IN ATTINE FUNGUS GROWING ANTS	II	866	23/08/00	10:50	HM	Q	19	4	19
Ortiz, C. C.	1948	EFFICIENCY OF DIFFERENT INSECTICIDES IN CONTROL OF NURSERY FLY SCYTHROPOCHROA SP. (DIPTERA: SCIARIDAE) IN EUCALYPTUS SEEDLINGS	I	491	23/08/00	16:30	CC		10	PS	10
Ortiz, C. C.	1980	EVALUATION OF TWO TRAP CARDS TO MONITORING OF SCYTHROPOCHROA SP. (DIPTERA: SCIARIDAE) IN EUCALYPTUS SEEDLINGS NURSERY	I	499	25/08/00	16:30	CC		10	PS	10
Ortiz, T. A.	702	VOLATILE BIOACTIVE CONSTITUENTS FROM THE FLOWERS OF TAGETES ZYPAQUIRENSIS (ASTERACEAE)	I	177	24/08/00	16:30	CC		4	PS	4
Ortman, E. E.	252	DEVELOPING PRACTICAL RECOMMENDATIONS FOR MANAGING INSECT RESISTANCE TO BT TRANSGENIC MAIZE	I	64	23/08/00	16:30	CC		2	PS	2
Ortman, E. E.	1286	DEVELOPING PRACTICAL RECOMMENDATIONS FOR MANAGING INSECT RESISTANCE TO BT TRANSGENIC MAIZE	I	325	26/08/00	9:35	HM	N	7	11	7
Ortu, S.	3951	POPULATION DYNAMICS OF MEDFLY IN A MEDITERRANEAN AREA (SARDINIA, ITALY)	II	997	22/08/00	16:30	CC		22	PS	22
Osaka, J.	1603	REQUIREMENT OF LIPOPHORIN AND ECDYSTEROID FOR IN VITRO DEVELOPMENT OF A LARVAL ENDOPARASITOID, VENTURIA CANESCENS (HYMENOPTERA: ICHNEUMONIDAE)	I	404	23/08/00	16:30	CC		8	PS	8
Osakabe, Mh.	59	OCCURRENCE OF LATENT MITE PEST AFTER BIOLOGICAL CONTROL OF DOMINANT SPIDER MITE BY INTRODUCED NATURAL ENEMY AND EFFICIENCY OF INDIGENOUS PHYTOSEIID MITE	I	15	24/08/00	16:30	CC		1	PS	1
Osakabe, Mh.	2298	ANALYSIS OF GENETIC STRUCTURE CHANGES WITH POPULATION DENSITY IN PANONYCHUS CITRI IN A SMALL HABITAT USING AN ESTERASE LOCUS	I	580	25/08/00	16:30	CC		12	PS	12
Osborne, L.	2559	BIOLOGICAL CONTROL WITH FUNGI	II	647	22/08/00	11:20	HB	B	14	3	14
Oscherov, E. B.	2962	TRIATOMINES INVOLVED IN DOMESTIC AND WILD TRYPANOSOMA CRUZI TRANSMISSION IN CONCEPCIÓN, CORRIENTES, ARGENTINA	II	747	21/08/00	16:30	CC		15	PS	15
Osoegawa, K.	3510	STRUCTURAL ANALYSIS OF THE Z CHROMOSOME IN BOMBYX MORI BY USING THE BAC LIBRARY	II	886	23/08/00	16:30	CC		19	PS	19
Osorno, R.	650	SEX ATTRACTION OF MALES OF COPITARSIA CONSUETA (LEPIDOPTERA: NOCTUIDAE) UNDER CONDITIONS OF LABORATORY	I	164	22/08/00	16:30	CC		4	PS	4
Osorio, R.	3118	ANTENNAL SENSILLA OF COPITARSIA CONSUETA (LEPIDOPTERA: NOCTUIDAE)	II	787	21/08/00	16:30	CC		16	PS	16
Ossa, G. A. O.	2527	DIGESTIVE ALPHA-AMYLASES FROM COFFEE BERRY BORER (HYPOTHENEMUS HAMPEI) AND THEIR INHIBITION BY AMYLASE INHIBITORS FROM PLANTS.	II	638	25/08/00	16:30	CC		13	PS	13
Ostman, O.	1614	THE ROLE OF LANDSCAPE STRUCTURE AND FARMING PRACTICE ON PREDATION OF APHID	I	407	24/08/00	16:30	CC		8	PS	8
Ote, M.	3530	CHANGE OF GENE EXPRESSION PATTERN CAUSEDBY COMPOUND EYE METAMORPHOSIS OF BOMBYX MORI	II	891	24/08/00	16:30	CC		19	PS	19
Ote, M.	3267	GENOMICS OF REPRODUCTION AND DIAPAUSE IN BOMBYX MORI	II	825	22/08/00	11:35	HB	K	18	2	18
Otero-Colina, G.	1384	RELATION DOSE-LETHALITY OF THREE PESTICIDES ON VARROA JACOBSONI (GAMASIDA: VARROIDAE) AND APIS MELLIFERA (HYMENOPTERA: APIDAE): COMPARISON OF TWO ADMINISTRATION METHODS	I	349	24/08/00	16:30	CC		7	PS	7
Ott, J. R.	986	IMPLICATIONS OF HOST-PLANT CARBON UPTAKE PATTERNS AND LEAF SIZE ON THE PERFORMANCE AND ABUNDANCE OF A CYNIPID GALLFORMER	I	249	22/08/00	16:30	CC		6	PS	6
Ottati, A. L. T.	1099	BIOLOGY OF THYRINTEINA ARNOBIA (LEPIDOPTERA: GEOMETRIDAE) ON THREE SPECIES OF EUCALYPTUS	I	277	24/08/00	16:30	CC		6	PS	6
Ottati, A. L. T.	1949	CONSUMPTION AND UTILIZATION OF THREE SPECIES OF EUCALYPTUS BY THYRINTEINA ARNOBIA (LEPIDOPTERA: GEOMETRIDAE)	I	491	23/08/00	16:30	CC		10	PS	10
Otto, D. J.	1694	MASSIVE PARASITISM OF GRASSHOPPERS BY TACHINID MAGGOTS	I	427	25/08/00	16:30	CC		8	PS	8
Ottoni, G.	2120	THE EFFECT OF CULTURE MEDIA ON VIRULENCE OF PAECILOMYCES AMOENEROSEUS ON SILVERLEAF WHITEFLY BEMISIA ARGENTIFOLII	I	535	25/08/00	16:30	CC		11	PS	11
Ottoni, G.	2121	SUSCEPTIBILITY OF DIFFERENT LIFE STAGES OF BEMISIA ARGENTIFOLII TO THE ENTOMOPATHOGENIC FUNGUS PAECILOMYCES AMOENEROSEUS	I	535	25/08/00	16:30	CC		11	PS	11
Ottoni, G.	236	POPULATIONAL COMPOSITION AND SOIL MOBILITY OF SCAPTOCORIS CASTANEA (HETEROPTERA:CYDNIDAE) IN GOIÁS, BRAZIL	I	60	22/08/00	16:30	CC		2	PS	2
Otvos, I. S.	1871	DEVELOPMENT OF INTEGRATED MANAGEMENT OF DEFOLIATING INSECTS IN CANADA	I	472	25/08/00	11:20	HB	M	10	7	10
Ouvrard, D.	2299	STRUCTURE AND EVOLUTION OF THE WING ARTICULATION AND PLEURITES OF THE PSYLLOIDEA (HEMIPTERA, STERNORRHYNCHA)	I	580	24/08/00	16:30	CC		12	PS	16
Overal, W. L.	396	HYMENOPTERA OF LOWER AMAZONIA: WILL THIS BE THE CENTURY WHEN WE GET IT TOGETHER?	I	101	22/08/00	14:35	HB	C	3	2	3
Overal, W. L.	399	SOCIAL INSECTS AND THE KAYAPÓ INDIANS OF THE BRAZILIAN AMAZON: INDIGENOUS APPRECIATION AND NOMENCLATURE OF BIODIVERSITY	I	101	22/08/00	15:35	HB	C	3	2	3
Overholt, W. A.	1606	DISTRIBUTION OF WOLBACHIA INFECTION AMONG COTESIA SESAMIAE (HYMENOPTERA: BRACONIDAE) POPULATIONS IN EASTERN AND SOUTHERN AFRICA	I	405	23/08/00	16:30	CC		8	PS	8
Overholt, W. A.	1703	THE RELATIONSHIP OF STEM BORER COMPOSITION IN MAIZE TO PARASITOID DIVERSITY	I	429	25/08/00	16:30	CC		8	PS	8
Overholt, W. A.	1535	EFFECTS OF MOLASSES GRASS (MELINIS MINUTIFLORA) VOLATILES ON THE FORAGING BEHAVIOUR OF THE STEMBORER PARASITOID COTESIA SESAMIAE	I	387	22/08/00	16:30	CC		8	PS	8
Ovruski, N. E.	1517	PRELIMINARY EVALUATION OF AGENIASPIS CITRICOLA (HYM: ENCYRTIDAE) ATTACKING PHYLLOCNISTIS CITRELLA (CITRUS LEAFMINER) IN ARGENTINA	I	383	21/08/00	16:30	CC		8	PS	8
Ovruski, S. M.	1615	HYMENOPTERAN PARASITOIDS ON FRUIT – INFESTING TEPHRITIDAE (DIPTERA) IN LATIN AMERICA AND THE SOUTHERN UNITED STATES: DIVERSITY, DISTRIBUTION, TAXONOMIC STATUS AND THEIR USE IN FRUIT FLY BIOLOGICAL CONTROL	I	407	24/08/00	16:30	CC		8	PS	8
Ozaki, M.	4179	TASTE OF NOXIOUS LIPOPHILIC SUBSTANCES: AVERSIVE BEHAVIOR AND TASTE RESPONSE TO LIMONENE IN THE BLOWFLY, PHORMIA REGINA	II	1055	22/08/00	16:30	CC		Erratum	PS	13
Ozaki, M.	2530	TASTE ENHANCING EFFECT OF GLYCINE ON THE SWEETNESS OF GLUCOSE: A GUSTATORY TRICK FOR THE SYMBIOSIS BETWEEN THE ANT, CAMPONOTUS JAPONICUS AND THE LARVAE OF THE LYCAENID BUTTERFLY, NIPHANDA FUSCA	II	639	25/08/00	16:30	CC		13	PS	13
Ozawa, A.	1673	ATTEMPTS OF USING INDIGENOUS PARASITOIDS AS A CONTROL AGENT TO LIRIOMYZA TRIFOLII IN GREENHOUSES IN JAPAN	I	422	25/08/00	16:30	CC		8	PS	8
Ozman, S. K.	4097	MITES OF STORED HAZELNUTS IN TURKEY	II	1034	24/08/00	16:30	CC		23	PS	23
Ozorio, C. P.	3608	SPATIAL AND TEMPORAL VARIATION OF EFFLAGITATUS FREUDEI (HETEROCERIDAE) POPULATIONS AT THE SUPRALITTORAL OF RONDINHA SANDY BEACH, RS, BRAZIL, BETWEEN AUTUMN AND SPRING	II	910	25/08/00	16:30	CC		20	PS	20
P. A. Follett	1265	ESTIMATING FITNESS IN COLORADO POTATO BEETLE	I	319	24/08/00	15:20	HM	N	7	8	7

Sub-titles: (HB=Hotel Bourbon) - (HM=Hotel Mabu) - (CC=Convention Center) - (Bol=Foz Boulevard) - (PS=Poster Session) - (PL=Plenary Lecturer)

AUTHOR	N°	TITLE	Book	Page	Date	Time	Local	Room	Session	Symp	New Session
P. A. Moore I	3052	HOW TO BUILD A BETTER INSECT ANTENNA: LESSONS FROM THE PHYSICS OF CHEMORECEPTION	II	770	22/08/00	15:05	HB	G	16	3	16
P. A. Viana	164	MANAGEMENT OF DIABROTICA SPECIOSA IN BRAZIL	I	42	26/08/00	15:35	HB	A	2	11	2
P. Juetterschenke	3910	ASSOCIATION OF PHYSICAL CONTROL MEANS FOR THE CONTROL OF INSECTS IN CEREAL INDUSTRIES AND PRODUCTS	II	987	24/08/00	15:00	HB	H	22	6	22
P. W. Price	846	HOST-PLANT ARCHITECTURE AND THE DYNAMICS OF GALL-INDUCING SPECIES	I	214	23/08/00	16:15	HB	D	6	5	6
P.C. Jepson	155	PESTICIDES, ECOLOGY AND IPM: OPTIMIZING PESTICIDE USE WITHIN PEST MANAGEMENT SYSTEMS	I	40	26/08/00	11:05	HB	A	2	10	2
Paarmann, W.	391	GROUND BEETLE COMMUNITIES (COLEOPTERA, CARABIDAE) AT FRUIT FALLS IN A TERRA FIRME RAINFOREST NEAR MANAUS (AMAZONIA) - A FIRST REVIEW	I	99	22/08/00	11:35	HB	C	3	2	3
Paarmann, W.	392	DUNG BEETLES OF CENTRAL AMAZONIAN FLOODPLAINS	I	100	22/08/00	13:35	HB	C	3	2	3
Paarmann, W.	390	DIVERSITY AND LIFE HISTORY TRAITS OF TIGER BEETLES (COLEOPTERA: CICINDELIDAE) FROM CENTRAL AMAZONIA (BRAZIL)	I	99	22/08/00	11:20	HB	C	3	2	3
Packer, L.	3780	BEHAVIOURAL AND BIOGEOGRAPHICAL IMPLICATIONS OF AGAPOSTEMON PHYLOGENY (HYMENOPTERA: HALICTIDAE)	II	954	23/08/00	16:30	CC		21	PS	21
Paço, R. S.	1902	RELATIONSHIP BETWEEN TICKS AND SMALL WILD MAMMALS IN A DISTURBED ATLANTIC FOREST FRAGMENT IN ITAPEVI COUNTY, STATE OF SÃO PAULO, BRAZIL	I	479	21/08/00	16:30	CC		10	PS	10
Padilha, M. T. S.	473	THE INFLUENCE OF ORGANIC MATTER ON THE DIVERSITY OF SIMULIDAE ON THE MICROBASIN OF LAGEADO DOS FRAGOSOS IN CONCÓRDIA, SANTA CATARINA STATE, BRAZIL	I	120	21/08/00	16:30	CC		3	PS	3
Padilla, A.	3531	BEHAVIOURAL RESPONSES OF THE HONEYDEE TO ALARM-SCENTS AT THE FOOD SOURCE	II	891	24/08/00	16:30	CC		19	PS	19
Paes Santos, M. J.	2994	INFLUENCE OF DIFFERENT MIXTURES OF BOVINE FECES WITH SOME INGREDIENTS TO REAR STOMOXYS CALCITRANS UNDER LABORATORY CONDITIONS	II	755	21/08/00	16:30	CC		15	PS	15
Paes, M. J.	2470	INFLUENCE OF DIFFERENT AGES OF FISH PUTREFATION ON THE POST EMBRIONIC DEVELOPMENT OF LUCÍLIA CUPRINA (DIPTERA:CALLIPHORIDAE) UNDER LABORATORY CONDITIONS	II	624	23/08/00	16:30	CC		13	PS	13
Paes, M. J.	2965	CORRELATION BETWEEN THE WEIGHT OF THE THIRD INSTAR LARVAE AND THE SEX OF ADULTS OF DERMATOBIA HOMINIS (LINNAEUS, JR) (DIPTERA: CUTEREBRIDAE)	II	748	21/08/00	16:30	CC		15	PS	15
Paes, M. J.	2967	SEASONAL FLUCTUATION OF DERMATOBIA HOMINIS (DIPTERA: CUTEREBRIDAE) ON HIDES OF BUTCHERED BOVINES AT THE SLAUGHTERHOUSE OF PIRAI COUNTY, RIO DE JANEIRO, BRAZIL	II	749	21/08/00	16:30	CC		15	PS	15
Paes, M. J.	2968	STUDIES OF THE EFFECT OF CLIMATIC FACTORS ON SEASONAL FLUCTUATION OF DERMATOBIA HOMINIS (DIPTERA: CUTEREBRIDAE) ON SKINS OF BUTCHERED BOVINES AT THE SLAUGHTERHOUSE OF PIRAI COUNTY, RIO DE JANEIRO, BRAZIL	II	749	22/08/00	16:30	CC		15	PS	15
Paes, M. J.	2966	CORRESPONDENCE BETWEEN THE WEIGHT OF THE LARVAE OF 3RD STATED AND THE ADULTS' SEX OF DERMATOBIA HOMINIS (DIPTERA: CUTEREBRIDAE)	II	748	21/08/00	16:30	CC		15	PS	15
Paes, M. J.	3002	INFLUENCE OF A DIET BASE OF FISH MEAT IN DIFFERENT PUTRAFATION STAGES ON THE POST-EMBRYONIC DEVELOPMENT OF LUCILIA CUPRINA (DIPTERA:CALLIPHORIDAE) UNDER LABORATORY CONDITIONS	II	757	24/08/00	16:30	CC		15	PS	15
Paganotti, G.	3116	FLUCTUATING ASYMMETRY, MATING SUCCESS, BODY SIZE AND HETEROZYGOSITY IN MALES OF COENAGRION SCITULUM (ODONATA: COENAGRIONIDAE)	II	786	21/08/00	16:30	CC		16	PS	16
Pageaux, J. F.	1665	FOOD AND CARCASS ANALYSES OF THE PREDATORY BUG HARMONIA AXYRIDIS (COLEOPTERA: COCCINELLIDAE) AS REFERENCES FOR THE ELABORATION OF ARTIFICIAL DIETS	I	420	25/08/00	16:30	CC		8	PS	8
Pagliai, A. M.	2276	THE PRESENCE OF THE TRANSPOSABLE ELEMENTS R1 AND R2 IS ASSOCIATED TO MITOTIC CROSSING OVER IN SEVERAL APHID SPECIES	I	574	23/08/00	16:30	CC		12	PS	12
Pagliai, A. M.	1299	RELATIONSHIP BETWEEN EXPRESSION, AMPLIFICATION AND METHYLATION OF FE4 GENE IN MYZUS PERSICAE (HOMOPTERA, APHIDIDAE)	I	328	21/08/00	16:30	CC		7	PS	7
Pagliai, A.M.	987	APHIDS: NOT ONLY A PEST INSECT	I	249	22/08/00	16:30	CC		6	PS	6
Pagnocca Jr, F. C.	2149	ENZYME PRODUCTION BY THE FUNGUS SYMBIOTIC WITH THE ANT MYCETAROTES PARALLELUS	I	542	25/08/00	16:30	CC		11	PS	11
Pagnocca, F. C.	2122	PIPERONYL DERIVATES BASED ON SESAMIN AND THEIR INHIBITION OF THE SYMBIOTIC FUNGUS OF LEAF-CUTTING ANTS	I	535	24/08/00	16:30	CC		11	PS	11
Pagnocca, F. C.	3433	GROWTH INHIBITION OF THE SYMBIOTIC FUNGUS OF ATTA SEXDENS, BY NATURAL PRODUCTS AND SYNTHETIC COMPOUNDS	II	867	23/08/00	11:35	HM	Q	19	4	19
Pagnocca, F. C.	728	POLYSACCHARIDASES IN NESTS OF THE LEAF-CUTTING ANT ATTA SEXDENS	I	184	25/08/00	16:30	CC		4	PS	4
Pagnocca, F. C.	3547	OBSERVATIONS ON BROOD CARE BEHAVIOR OF THE LEAF-CUTTING ANT ATTA SEXDENS (HYMENOPTERA: FORMICIDAE)	II	895	25/08/00	16:30	CC		19	PS	19
Paine, E. O.	4106	BIORATIONAL APPROACH TO SUPRESSING AMERICAN COCKROACHES, PERIPLANETA AMERICANA, IN SEWAGE SYSTEMS	II	1037	25/08/00	16:30	CC		23	PS	23
Paine, T. A.	774	INTERACTIVE IDENTIFICATION USING THE INTERNET	I	195	24/08/00	11:35	Bol	T	5	5	5
Paine, T. D.	1854	MECHANISMS OF RESISTANCE TO WOOD BORERS	I	467	24/08/00	10:50	HB	M	10	5	10
Paine, T. D.	1891	DIFFERENTIAL PARASITISM BY AN EGG PARASITOID, AVETIANELLA LONGOI, OF TWO PHORACANTHA SPP. ATTACKING EUCALYPTUS	I	477	26/08/00	14:50	HB	M	10	10	10
Paine, T. D.	1890	BIOLOGICAL CONTROL OF COLEOPTERAN PESTS OF EUCALYPTUS IN CALIFORNIA	I	476	26/08/00	14:35	HB	M	10	10	10
Pais, M. P.	1886	ARTHROPODS AS BIOINDICATORS IN AN AREA UNDER REFORESTATION IN SÃO PAULO STATE, BRAZIL	I	475	26/08/00	11:50	HB	M	10	9	10
Paiva, C.	3403	PROTECTION OF HISTORICAL MONUMENT FROM TERMITES IN BRAZIL	II	859	21/08/00	15:45	HM	Q	19	1	19
Paiva, D. P. de	473	THE INFLUENCE OF ORGANIC MATTER ON THE DIVERSITY OF SIMULIDAE ON THE MICROBASIN OF LAGEADO DOS FRAGOSOS IN CONCÓRDIA, SANTA CATARINA STATE, BRAZIL	I	120	21/08/00	16:30	CC		3	PS	3
Paiva, E.	3941	EFFECTS OF TROPICAL BACULOVIRUS ISOLATES AGAINST SPODOPTERA FRUGIPERDA (LEPIDOPTERA: NOCTUIDAE) LARVAE	II	995	21/08/00	16:30	CC		22	PS	22
Paiva, E.	3967	ANALYSIS OF SUPERNATANTS FROM CULTURES OF 'B.t.' STRAINS CONTAINING VIP3A-LIKE GENES AND THEIR RELATIVE EFFICIENCY IN THE CONTROL OF TROPICAL FALL ARMYWORM LARVAE	II	1001	23/08/00	16:30	CC		22	PS	22
Paiva, E.	3968	TEMPORAL PATTERN OF PROTEIN SECRETION AND INSECTICIDAL ACTIVITY AGAINST TROPICAL FALL ARMYWORM IN THE SUPERNATANT OF THE 'B.t.' STRAIN 'HD125'	II	1001	23/08/00	16:30	CC		22	PS	22
Paiva, P. E. B.	1616	INTRODUCTION OF THE PARASITOID AGENIASPIS CITRICOLA FOR THE BIOLOGICAL CONTROL OF CITRUS LEAFMINER PHYLLOCNISTIS CITRELLA IN BRAZIL	I	407	24/08/00	16:30	CC		8	PS	8
Paiva, P. E. B.	249	EFFICIENCY OF THE INSECTICIDE ACTARA (THIAMETOXAN) ON CONTROL OF SHARPSHOOTER VECTORS OF XYLELLA FASTIDIOSA ON CITRUS	I	63	22/08/00	16:30	CC		2	PS	2
Paiva, P. E. B.	251	EFFICIENCY OF THE INSECTICIDE WINNER (IMIDACLOPRID) ON CONTROL OF SOME CITRUS PESTS AND SELECTIVITY TO NATURAL ENEMIES	I	64	22/08/00	16:30	CC		2	PS	2
Paiva,E.	2158	EFFECT OF TREATMENT TIMING OF BACULOVIRUS SPODOPTERA AND BACILLUS THURINGIENSIS ON SPODOPTERA FRUGIPERDA	I	544	25/08/00	16:30	CC		11	PS	11
Pajni, H. R.	4055	LABORATORY TRIALS ON THE USE OF THREE SPECIES OF USCANA FOR THE CONTROL OF STORE BRUCHIDS (BRUCHIDAE; COLEOPTERA)	II	1024	24/08/00	14:30	HB	J	23	9	23
Palacio, M. A.	3436	HONEY BEE TOLERANCE AGAINST VARROA JACOBSONI IN ARGENTINA	II	867	24/08/00	9:50	HM	Q	19	5	19

Sub-titles: (HB=Hotel Bourbon) - (HM=Hotel Mabu) - (CC=Convention Center) - (Bol=Foz Boulevard) - (PS=Poster Session) - (PL=Plenary Lecturer)

AUTHOR	Nº	TITLE	Book	Page	Date	Time	Local	Room	Session	Symp	New Session
Palacios, S.	657	ANTIFEEDANT EFFECTS OF ARGENTINE MELIA AZEDARACH FRUIT EXTRACT AND ITS ACTIVE COMPOUND MELIARTENIN	I	166	22/08/00	16:30	CC		4	PS	4
Palacios, S.	1328	INSECTICIDE AND REPELLENT EFFECTS OF MELIA AZEDARACH EXTRACTS AGAINST AEDES AEGYPTI (DIPTERA: CULICIDAE)	I	335	22/08/00	16:30	CC		7	PS	7
Palhares, F. A. B.	2955	LEGAL MEDICINE X FORENSIC ENTOMOLOGY IN BRAZIL	II	746	26/08/00	15:15	Bol	R	15	11	15
Palli, S. R.	1845	BIOLOGICAL CONTROL OF FOREST PESTS USING INSECT SPECIFIC VIRUSES	I	465	23/08/00	14:35	HB	M	10	4	10
Palli, S. R.	3280	MOLECULAR ANALYSIS OF THE OVERWINTERING DIAPAUSE IN THE SPRUCE BUDWORM, CHORISTONEURA FUMIFERANA	II	828	23/08/00	10:20	HB	K	18	4	18
Palli, S. R.	3325	GLUTATHIONE S-TRANSFERASE FROM THE SPRUCE BUDWORM, CHORISTONEURA FUMIFERANA: IDENTIFICATION, CHARACTER-IZATION, LOCALIZATION, CDNA CLONING, DEVELOPMENTAL EXPRESSION AND INDUCTION BY VARIOUS FACTORS	II	840	21/08/00	16:30	CC		18	PS	18
Palli, S. R.	1838	AN OVERVIEW OF BIOTECHNOLOGICAL APPROACHES TO BIOLOGICAL AND BIORATIONAL CONTROL OF FOREST INSECT PESTS	I	463	23/08/00	9:35	HB	M	10	4	10
Palli, S. R.	1320	AN RNA HELICASE OF THE "DEAD BOX" FAMILY CLONED FROM A LEPIDOPTERAN SPECIES, THE SPRUCE BUDWORM (CHORISTONEURA FUMIFERANA)	I	333	22/08/00	16:30	CC		7	PS	7
Palli, S. R.	2382	HORMONAL REGULATION OF CUTICLE FORMATION AND CHITIN SYNTHESIS	II	602	25/08/00	13:35	HB	I	13	9	13
Palli, S. R.	3289	PHOTOAFFINITY LABELED NON-STEROIDAL ECDYSONE AGONIST AS A TOOL TO STUDY LIGAND-ECDYSONE RECEPTOR COMPLEX INTERACTION	II	831	23/08/00	15:35	HB	K	18	5	18
Pallini, A.	707	ODOUR-MEDIATED INDIRECT INTERACTIONS IN FOOD WEBS	I	179	24/08/00	16:30	CC		4	PS	4
Pallini, A.	707	ODOUR-MEDIATED INDIRECT INTERACTIONS IN FOOD WEBS	I	179	24/08/00	16:30	CC		4	PS	4
Pallini, A.	862	BEHAVIOUR AND INDIRECT INTERACTIONS IN FOOD WEBS OF PLANT-INHABITING ARTHROPODS	I	218	25/08/00	14:05	HB	D	6	8	6
Palma, A. Di	3175	SOME HYPOTESIS ON THE REDUCTION OF THE ANTENNAE IN DIASPIS ECHINOCACTI FEMALE (RHYNCHOTA DIASPIDIDAE) DURING ONTOGENESIS	II	801	24/08/00	16:30	CC		16	PS	16
Palma, C. R. V.	2653	INSECTICIDE EVALUATION TO CONTROL AGROTIS IPSILON (LEPIDOPTERA, NOCTUIDAE) IN TOBACCO	II	670	21/08/00	16:30	CC		14	PS	14
Palmieri, N.	1126	THE POLLINATORS OF CHICKLING VETCH (LATHYRUS SATIVUS L., LEGUMINOSAE) IN CENTRAL ITALY.	I	284	24/08/00	16:30	CC		6	PS	6
Pálsson, K.	3003	MOSQUITO REPELLENT PLANTS	II	758	24/08/00	16:30	CC		15	PS	15
Palumbo, J. C.	2557	OVERVIEW OF INSECTICIDAL CONTROL AND RESISTANCE MANAGEMENT	II	646	22/08/00	10:35	HB	B	14	3	14
Palumbo, J. C.	101	ECOLOGICAL CONSIDERATIONS FOR MANAGEMENT OF A MULTIPLE-CROP PEST	I	26	22/08/00	14:00	HB	A	2	4	2
Pan, E. A.	2702	STRATEGY OF SEED TREATMENT FOR RATIONALIZATION OF CHEMICAL CONTROL OF ORYZOPHAGUS ORYZAE ON FLOODED RICE	II	682	22/08/00	16:30	CC		14	PS	14
Pan, E. A.	2744	FOLIAR SPRAY STRATEGY FOR RATIONAL CHEMICAL CONTROL OF ORYZOPHAGUS ORYZAE ON FLOODED RICE	II	693	23/08/00	16:30	CC		14	PS	14
Panagiotaki, E.	3242	APHID POPULATION FLUCTUATION AND SPREAD OF APHID-BORNE VIRUSES IN TOBACCO CROPS IN GREECE	II	818	23/08/00	16:30	CC		17	PS	17
Pang, A. S. D.	3325	GLUTATHIONE S-TRANSFERASE FROM THE SPRUCE BUDWORM, CHORISTONEURA FUMIFERANA: IDENTIFICATION, CHARACTER-IZATION, LOCALIZATION, CDNA CLONING, DEVELOPMENTAL EXPRESSION AND INDUCTION BY VARIOUS FACTORS	II	840	21/08/00	16:30	CC		18	PS	18
Pang, H.	537	THE DIVERSITY OF COCCINELLIDAE IN SOUTHEN CHINA	I	136	24/08/00	16:30	CC		3	PS	3
Pang, X. F.	3996	INTEGRATED MEASURES FOR CONTROLLING THE DIAMONDBACK MOTH (DBM) IN SOUTHERN CHINA	II	1008	25/08/00	16:30	CC		22	PS	22
Pang, X. F.	4001	EFFECTS OF INTEGRATED MEASURES FOR CONTROLLING THE DIAMONBACK MOTH (DBM) ON ARTHROPOD DIVERSITIES IN VEGETABLE PLANTATIONS	II	1010	25/08/00	16:30	CC		22	PS	22
Pang, Y.	2935	MICROBIAL PESTICIDES FOR MOSQUITO CONTROL IN CHINA: CURRENT AND FUTURE CONSIDERATIONS	II	741	25/08/00	15:00	Bol	R	15	10	15
Panizzi, A. R.	406	BRAZILIAN ENTOMOLOGICAL SOCIETIES PRESERVING BIODIVERSITY	I	103	23/08/00	10:35	HB	C	3	3	3
Panizzi, A. R.	538	DEVELOPMENT OF PHYTOPHAGOUS HETEROPTERANS ON DRY ARTIFICIAL DIETS	I	136	24/08/00	16:30	CC		3	PS	3
Panizzi, A. R.	2363	SUBOPTIMAL NUTRITION AND FEEDING BEHAVIOR OF STINK BUGS ON LESS PREFERRED PLANT FOOD SOURCES	II	597	24/08/00	9:35	HB	I	13	6	13
Panizzi, A. R.	2606	LIFE HISTORY STUDIES AND ECOLOGICAL SIGNIFICANCE OF HOST PLANTS OF PENTATOMIDS FOR THEIR MANAGEMENT	II	658	26/08/00	11:05	HB	B	14	9	14
Panizzi, A. R.	214	IMPACT OF CULTIVATION SYSTEMS ON DICHELOPS MELACANTHUS (HEMIPTERA: PENTATOMIDAE) ABUNDANCE AND ITS DAMAGE TO WHEAT IN SOUTHERN BRAZIL	I	55	21/08/00	16:30	CC		2	PS	2
Panizzi, A. R.	304	PERFORMANCE AND FEEDING PREFERENCE OF NYMPHS AND ADULTS OF PIEZODORUS GUILDINII (HEMIPTERA: PENTATOMIDAE) ON SOYBEAN PODS AT DIFFERENT DEVELOPMENTAL STAGES	I	77	21/08/00	16:30	CC		2	PS	2
Panizzi, A. R.	403	LATIN AMERICAN ENTOMOLOGICAL SOCIETIES AT THE DAWN OF A NEW CENTURY—A TIME FOR INVENTORY.	I	102	23/08/00	9:35	HB	C	3	3	3
Panizzi, A. R.	508	ENTOMOLOGICAL SOCIETIES IN LATIN AMERICA	I	129	23/08/00	16:30	CC		3	PS	3
Panizzi, A. R.	1805	OVIPOSITION BEHAVIOR OF NEOMEGALOTOMUS PARVUS	I	455	22/08/00	16:30	CC		9	PS	9
Panizzi, A. R.	1806	FEEDING BEHAVIOR OF NEOMEGALOTOMUS PARVUS	I	455	22/08/00	16:30	CC		9	PS	9
Pannunzio, M. J.	186	MORPHOLOGICAL, BIOLOGICAL ASPECTS AND DAMAGE OF TENTHECORIS BICOLOR DISTINTUS (HETEROPTERA: MIRIDAE): AN AMARILLIDACEAE AND ORQUIDACEAE PEST	I	48	21/08/00	16:30	CC		2	PS	2
Pansera-de-Araújo, M. C. G.	1784	WILL BE CERATITIS CAPITATA COMPETING WITH ANASTREPHA FRATERCULUS?	I	449	23/08/00	16:30	CC		9	PS	9
Pansera-de-Araújo, M. C. G.	2630	THE SOYBEAN'S VARITIES INFLUENCE THE ANTICARSIA GEMMATALIS FITNESS ?	II	664	21/08/00	16:30	CC		14	PS	14
Pantoja, A.	539	SOCIEDAD ENTOMOLÓGICA DE PUERTO RICO	I	136	24/08/00	16:30	CC		3	PS	3
Pantoja, A.	410	SOCIEDAD ENTOMOLÓGICA DE PUERTO RICO PRESERVING BIODIVERSITY	I	104	23/08/00	11:35	HB	C	3	3	3
Panzardi, S.	328	BASIL-TOMATO INTERCROPPING EFFECT ON MACROSIPHUM EUPHORBIAE (HEMIPTERA: APHIDIDAE) ABUNDANCE	I	83	24/08/00	16:30	CC		2	PS	2
Panzetta-Dutari, G.	2310	MITOCHONDRIAL DNA "A+T RICH" REGION AS A GENETIC MARKER IN AEDES AEGYPTI POPULATION STUDIES	I	583	24/08/00	16:30	CC		12	PS	12
Paoletti, M. G.	413	THE USE OF COMBINATIONS OF SPECIES, ECOLOGICAL GUILDS AND SINGLE SPECIES AS BIOINDICATORS TO ASSESS RURAL LANDSCAPES: PROBLEMS AND TOOLS	I	105	23/08/00	14:20	HB	C	3	4	3
Paoletti, M. G.	3985	PLURALITY OF SPECIES, ECOLOGICAL GUILDS, SINGLE SPECIES AS BIOINDICATORS TO ASSESS RURAL LANDSCAPES: PROBLEMS AND TOOLS	II	1006	24/08/00	16:30	CC		22	PS	22
Papa, G.	1377	EFFECT OF A SPECIAL THERMONEBULIZATION FORMICIDE FORMULATION FOR THE CONTROL OF THE LEAF-CUTTING ANT, ATTA CAPIGUARA (HYMENOPTERA:FORMICIDAE)	I	347	24/08/00	16:30	CC		7	PS	7
Papa, G.	1378	EFFECT OF CHEMIGATION THROUGH CENTRAL PIVOT, FOR THE CONTROL OF THE FALL ARMYWORM, SPODOPTERA FRUGIPERDA, (LEPIDOPTERA: NOCTUIDAE), IN CORN	I	348	24/08/00	16:30	CC		7	PS	7
Papa, G.	1379	STRATEGIES FOR THE USE OF THIAMETHOXAM ON THE MANAGEMENT OF THE APHID Aphis gossypii IN COTTON	I	348	24/08/00	16:30	CC		7	PS	7

Sub-titles: (HB=Hotel Bourbon) - (HM=Hotel Mabu) - (CC=Convention Center) - (Bol=Foz Boulevard) - (PS=Poster Session) - (PL=Plenary Lecturer)

AUTHOR	N°	TITLE	Book	Page	Date	Time	Local	Room	Session	Symp	New Session
Papa, G.	1292	EFFECT OF THE MICROENCAPSULATED FORMULATION OF LAMBDA-CYHALOTHRIN FOR THE CONTROL OF THE BLACK CUTWORM, AGROTIS IPSILON (LEPIDOPTERA: NOCTUIDAE), IN CORN	I	326	21/08/00	16:30	CC		7	PS	7
Papa, G.	1400	EFFECT OF A NEW FORMULATION OF LAMBDA-CYHALOTHRIN FOR THE CONTROL OF THE BOLL WEEVIL, ANTHONOMUS GRANDIS (COLEOPTERA: CURCULIONIDAE), IN COTTON	I	353	25/08/00	16:30	CC		7	PS	7
Papa, G.	1407	PERFORMANCE OF THE MICROENCAPSULATED FORMULATION OF LAMBDA-CYHALOTHRIN FOR THE CONTROL OF THE WHITEFLY, BEMISIA TABACI (BIOTYPE B) (HEMIPTERA: ALEYRODIDAE), IN BEANS	I	355	25/08/00	16:30	CC		7	PS	7
Papapanayotou, A.	3227	NEW APHID VECTORS OF ZUCCHINI YELLOW MOSAIC VIRUS AND THEIR ROLE IN THE EPIDEMIOLOGY OF THE VIRUS IN GREECE	II	815	22/08/00	16:30	CC		17	PS	17
Papassideria, I.	3168	THE EGGSHELL OF LEPTINOTARSA DECEMLINEATA: STRUCTURAL AND BIOCHEMICAL ANALYSIS OF THE CRYSTALLINE CHORION LAYER	II	799	24/08/00	16:30	CC		16	PS	16
Papassideria, I.	3042	STAGE SPECIFIC APOPTOTIC PATTERNS DURING DROSOPHILA OOGENESIS	II	768	21/08/00	15:30	HB	G	16	1	16
Papassideria, I.	3190	DIFFERENTIAL SORTING OF THE CONSTITUTIVELY CO-SECRETED VITELLINE MEMBRANE AND YOLK PROTEINS OF DROSOPHILA IN THE VITELLOGENIC OVARIAN FOLLICLE CELLS; A HIGH RESOLUTION IMMUNO-ELECTRON MICROSCOPY STUDY OF THE FOLLICLE CELLS SECRETORY AND OOCYTE ACCUMULATIVE PATHWAYS	II	805	25/08/00	16:30	CC		16	PS	16
Pape, T.	3665	NATIVE NEW WORLD RHINOPHORIDAE (DIPTERA) AND THEIR TRANSANTARCTIC TIES	II	925	24/08/00	11:35	HB	E	21	6	21
Papeschi, A. G.	2307	COMPARATIVE CYTOGENETICS IN ARGENTINE SPECIES OF PENTATOMINAE (PENTATOMIDAE, HETEROPTERA)	I	582	24/08/00	16:30	CC		12	PS	12
Papeschi, A. G.	2309	CYTOGENETIC HETEROGENEITY IN COMMON ARGENTINE HAPLOGINE SPIDERS	I	583	24/08/00	16:30	CC		12	PS	12
Pappu, H. R.	2566	SUCCESSES WITH PEANUT IPM IN THE SOUTHEASTERN UNITED STATES THROUGH INTERDISCIPLINARY APPROACHES	II	648	22/08/00	14:50	HB	B	14	4	14
Paradela, F. A.	3489	ANT ASSEMBLAGES (FORMICIDAE) IN THE PARQUE ESTADUAL XIXOVÁ-JAPUI, SÃO VICENTE-PRAIA GRANDE, SÃO PAULO	II	881	25/08/00	16:30	CC		19	PS	19
Paradell, S.	305	CICADELLIDAE (INSECTA-HOMOPTERA) SPECIES RICHNESS AND ABUNDANCE ON MAIZE IN ARGENTINA	I	77	24/08/00	16:30	CC		2	PS	2
Paradelli, S.	3235	RESOURCE AVAILABILITY AND SPATIAL DISTRIBUTION OF DELPHACODES KUSCHELI (FULGOROMORPHA: DELPHACIDAE)	II	817	23/08/00	16:30	CC		17	PS	17
Parajulee, M. N.	4015	A SIMULATION MODEL FOR LYCTOCORIS CAMPESTRIS, A PREDATOR OF STORED-PRODUCT INSECT PESTS	II	1014	22/08/00	9:45	HB	J	23	3	23
Paranhos, B. A. J.	1617	PARASITISM EFFICIENCY OF THE BRACONIDAE WASPS, DIACHASMIMORPHA LONGICAUDATA, ON LARVAE OF MEDFLY IN GUAVAS	I	408	24/08/00	16:30	CC		8	PS	8
Paranhos, B. A. J.	1618	BIOLOGICAL CONTROL OF MEDFLY IN PEACH USING PARASITOID DIACHASMIMORPHA LONGICAUDATA (HYMENOPTERA: BRACONIDAE) INUNDATIVE RELEASINGS	I	408	24/08/00	16:30	CC		8	PS	8
Pardue, S. G.	2206	HOST CONTROL OF COPIA RETROTRANSPOSITION RATE IN DROSOPHILA MELANOGASTER	I	557	24/08/00	13:35	HB	L	12	8	12
Paré, P. W.	4161	GLANDULAR TRICHOMES IN PLANTS CAN ATTRACT HERBIVORE INSECTS	II	1051	21/08/00	16:30	CC		Erratum	PS	4
Paredes, G. E. D.	1365	INSECTICIDE PROPERTIES OF ETHANOLIC EXTRACT ISOLATED FROM SEEDS OF PIPER TUBERCULATUM SEEDS (PIPERACEAE) ON DIATRAEA SACCHARALIS (LEPIDOPTERA: PYRALIDAE)	I	344	25/08/00	16:30	CC		7	PS	7
Paredes, G.E.D.	703	SUSCEPTIBILITY TESTS OF 4,5-DIDROPIPERLONGUMININA ISOLATED FROM PIPER TUBERCULATUM SEEDS ON VELVETBEAN CATERPILLAR	I	178	24/08/00	16:30	CC		4	PS	4
Parenti, P.	2456	ROLE OF ACTIVATORS OF THE ABSORPTION OF AMINO ACIDS BY THE MIDGUT IN BOMBYX MORI LARVAL NUTRITION	II	620	23/08/00	16:30	CC		13	PS	13
Parenzan, P.	1100	FIRST RECORD OF SETINA IRRORELLA IN SOUTHERN ITALY AND OF SETINA ROSCIDA IN ABRUZZO (CENTRAL ITALY) WITH SOME CONSIDERATIONS ON EUROPEAN SPECIES OF GENUS SETINA (LEPIDOPTERA ARCTIDAE LITHOSIINAE)	I	277	24/08/00	16:30	CC		6	PS	6
Parise-Maltempi, P. P.	2300	SEX CHROMOSOME VARIATION AMONG MUSCOIDEA FLIES	I	580	24/08/00	16:30	CC		12	PS	12
Park, D. S.	2319	BIOCHEMICAL CHARACTERIZATION AND GENOMIC ORGANIZATION OF H. CUNEA LECTIN	I	585	25/08/00	16:30	CC		12	PS	12
Park, H.-Y.	2116	ULTRASTRUCTURAL AND MOLECULAR IDENTIFICATION OF A WOLBACHIA ENDOSYMBIONT IN A SPIDER, NEPHILA CLAVATA	I	534	24/08/00	16:30	CC		11	PS	11
Park, H.-Y.	2319	BIOCHEMICAL CHARACTERIZATION AND GENOMIC ORGANIZATION OF H. CUNEA LECTIN	I	585	25/08/00	16:30	CC		12	PS	12
Park, J. A.	2339	PEPTIDERGIC OUTPUT OF THE CIRCADIAN CLOCK IN DROSOPHILA	II	591	21/08/00	10:10	HB	I	13	1	13
Park, J.-A.	1043	SPATIAL INTERACTION OF PIRATA SUBPIRATICUS (LYCOSIDAE) AND PACHYGNATHA CLERKI (TETRAGNATHIDAE) IN THE RICE FIELDS	I	263	23/08/00	16:30	CC		6	PS	6
Parkes, R. J.	2243	THE IDENTIFICATION OF TRANSPOSABLE ELEMENTS IN THE GENOME OF THE MALARIA VECTOR, ANOPHELES GAMBIAE	I	566	21/08/00	16:30	CC		12	PS	12
Parmentier, M.	2344	DIFFERENTIAL ACTIVATION OF AN INSECT G PROTEIN-COUPLED PEPTIDE RECEPTOR BY INSECTATACHYKININ-LIKE AGONISTS	II	592	21/08/00	14:35	HB	I	13	2	13
Parmentier, M. L.	2342	DROSOPHILA METABOTROPIC GLUTAMATE RECEPTORS: STRUCTURE AND FUNCTIONS	II	592	21/08/00	13:35	HB	I	13	2	13
Parnell, T. G.	3924	INSTABILITY IN PHYTOSANITARY MARKET ACCESS: IDENTIFYING CAUSES AND MANAGING EFFECTS	II	990	26/08/00	9:45	HB	H	22	8	22
Paro, C. M.	1101	BIOLOGY AND ONTOGENY OF ZELUS LEUCOGRAMMUS, (HEMIPTERA: REDUVIIDAE) IN CERRADO-SAVANNA, BRAZIL: THE IMPORTANCE OF CLIMATIC VARIATIONS	I	278	24/08/00	16:30	CC		6	PS	6
Paro, C. M.	1786	THE PREDATORY BEHAVIOR OF ZELUS LEUCOGRAMMUS, (HEMIPTERA: REDUVIIDAE) IN CERRADO-SAVANNA, BRAZIL	I	450	23/08/00	16:30	CC		9	PS	9
Paron, M. J. F. O.	1380	RESISTANCE OF COMMON BEAN GENOTYPES TO DIABROTICA SPECIOSA (COLEOPTERA: CHRYSOMELIDAE) ADULTS	I	348	24/08/00	16:30	CC		7	PS	7
Parra, J. R. P.	3341	THERMAL REQUIREMENTS AND NUMBER OF GENERATIONS OF SELENASPIDUS ARTICULATUS (HEMIPTERA: DIASPIDIDAE) DURING THE YEAR IN THE STATE OF SÃO PAULO, BRAZIL	II	844	22/08/00	16:30	CC		18	PS	18
Parra, J. R. P.	3342	FERTILITY LIFE TABLES OF SELENASPIDUS ARTICULATUS (HEMIPTERA: DIASPIDIDAE) REARED UNDER DIFFERENT TEMPERATURES AND RELATIVE HUMIDITIES	II	844	23/08/00	16:30	CC		18	PS	18
Parra, A. L. G. C.	1502	AGENIASPIS CITRICOLA: INTRODUCTION, LABORATORY REARING AND ADAPTATION IN BRAZIL	I	379	21/08/00	16:30	CC		8	PS	8
Parra, J. R. P.	2763	DETERMINATION OF THE OPTIMAL AND UPPER THRESHOLD OF TEMPERATURE FOR THE DEVELOPMENT OF SELENASPIDUS ARTICULATUS IN CITRUS	II	698	23/08/00	16:30	CC		14	PS	14
Parra, J. R. P.	1428	IN VITRO REARING OF PARASITOIDS IN BRAZIL: AN OVERVIEW	I	360	21/08/00	14:05	HM	O	8	2	8
Parra, J. R. P.	2367	NUTRITION OF PHYTOPHAGOUS INSECTS AND THEIR PRODUCTION ON ARTIFICIAL DIETS	II	598	24/08/00	10:35	HB	I	13	6	13
Parra, J. R. P.	315	RELATIONSHIP BETWEEN THE ARTIFICIAL INFESTATION OF DIATRAEA SACCHARALIS EGGS AND THE DAMAGE IN SUGARCANE STALKS	I	80	24/08/00	16:30	CC		2	PS	2
Parra, J. R. P.	538	DEVELOPMENT OF PHYTOPHAGOUS HETEROPTERANS ON DRY ARTIFICIAL DIETS	I	136	24/08/00	16:30	CC		3	PS	3

Sub-titles: (HB=Hotel Bourbon) - (HM=Hotel Mabu) - (CC=Convention Center) - (Bol=Foz Boulevard) - (PS=Poster Session) - (PL=Plenary Lecturer)

AUTHOR	Nº	TITLE	Book	Page	Date	Time	Local	Room	Session	Symp	New Session
Parra, J. R. P.	889	INFLUENCE OF AGE OF BEAN PLANTS ON THE FECUNDITY AND LEAF CONSUMPTION OF DIABROTICA SPECIOSA (COLEOPTERA: CHRYSOMELIDAE)	I	225	21/08/00	16:30	CC		6	PS	6
Parra, J. R. P.	890	INFLUENCE OF THE HOST PLANT ON THE LEAF CONSUMPTION BY ADULTS OF DIABROTICA SPECIOSA (COLEOPTERA: CHRYSOMELIDAE)	I	225	21/08/00	16:30	CC		6	PS	6
Parra, J. R. P.	1470	EFFECT OF DENSITY OF DIATRAEA SACCHARALIS EGGS IN THE PARASITISM OF TRICHOGRAMMA GALLOI IN SUGARCANE	I	371	26/08/00	10:05	HM	O	8	8	8
Parra, J. R. P.	1512	HOST SELECTION BEHAVIOR OF IN VIVO- AND IN VITRO-REARED TRICHOGRAMMA GALLOI AND T. PRETIOSUM (HYMENOPTERA: TRICHOGRAMMATIDAE)	I	381	21/08/00	16:30	CC		8	PS	8
Parra, J. R. P.	1575	COMPARISON AND DEVELOPMENT OF ARTIFICIAL DIETS FOR BRACON HEBETOR (HYMENOPTERA: BRACONIDAE) REARING	I	397	21/08/00	16:30	CC		8	PS	8
Parra, J. R. P.	1594	BIOLOGY, THERMAL REQUIREMENTS AND PARASITIZATION OF TRICHOGRAMMA PRETIOSUM STRAINS ON HELICOVERPA ZEA EGGS	I	402	23/08/00	16:30	CC		8	PS	8
Parra, J. R. P.	1698	DETERMINATION OF THE THERMAL LIMITS OF TRICHOGRAMMA PRETIOSUM (PIRASSUNUNGA STRAIN), ON THE EGGS OF ANTICARSIA GEMMATALIS	I	428	25/08/00	16:30	CC		8	PS	8
Parra, J. R. P.	4160	SEXUAL BEHAVIOR AND DAILY ACTIVITY OF CITRUS BORER MOTH ECDYTOLOPHA AURANTIANA (LEPIDOPTERA: TORTRICIDAE)	II	1051	21/08/00	16:30	CC		Erratum	PS	4
Parra, J. R. P.	4161	GLANDULAR TRICHOMES IN PLANTS CAN ATTRACT HERBIVORE INSECTS	II	1051	21/08/00	16:30	CC		Erratum	PS	4
Parra, J. R. P.	1489	BEHAVIOR OF TRICHOGRAMMA PRETIOSUM (HYMENOPTERA: TRICHOGRAMMATIDAE) IN SPODOPTERA FRUGIPERDA (LEPIDOPTERA: NOCTUIDAE) EGG-MASSES	I	376	21/08/00	16:30	CC		8	PS	8
Parra, J. R. P.	1588	ARTIFICIAL DIET FOR DIABROTICA SPECIOSA (COLEOPTERA: CHRYSOMELIDAE) REARING	I	400	24/08/00	16:30	CC		8	PS	8
Parra, J. R. P.	1536	DEVELOPMENT OF TRICHOGRAMMA PRETIOSUM (HYMENOPTERA: TRICHOGRAMMATIDAE) IN ARTIFICIAL DIET, FOCUSING ON PROTEIN UTILIZATION	I	387	22/08/00	16:30	CC		8	PS	8
Parra, J. R. P.	1502	AGENIASPIS CITRICOLA: INTRODUCTION, LABORATORY REARING AND ADAPTATION IN BRAZIL	I	379	21/08/00	16:30	CC		8	PS	8
Parra, L. E.	407	CONSERVATION OF THE BIODIVERSITY OF INSECTS IN CHILE	I	103	23/08/00	10:50	HB	C	3	3	3
Parra, L. E.	540	REVISION AND PHYLOGENY OF THE GENERA OF LITHININI OF AUSTRAL SOUTH AMERICA (LEPIDOPTERA: GEOMETRIDAE)	I	137	24/08/00	16:30	CC		3	PS	3
Parra, L. E.	541	THE SOCIEDAD CHILENA DE ENTOMOLOGIA	I	137	24/08/00	16:30	CC		3	PS	3
Parrella, M. P.	1459	SPECIES INTERACTIONS IN MULTI-SPECIES BIOLOGICAL PEST MANAGEMENT SYSTEMS: DO THEY ENHANCE OR DETER BIOLOGICAL CONTROL	I	368	24/08/00	9:35	HM	O	8	7	8
Parrella, M. P.	2776	SPECIES INTERACTIONS IN MULTI-SPECIES BIOLOGICAL PEST MANAGEMENT SYSTEMS: DO THEY ENHANCE OR DETER BIOLOGICAL CONTROL	II	701	24/08/00	16:30	CC		14	PS	14
Paschoalini, E. L.	497	COMPOSITION AND RELATIVE ABUNDANCE OF DIPTERAN FAMILIES (EXCLUDING NEMATOCERA AND ACALYPTRATAE) COLLECTED BY MALAISE TRAPS, WITHIN AND OUTSIDE FOREST FRAGMENTS IN TWO DIFFERENT AREAS	I	126	22/08/00	16:30	CC		3	PS	3
Pascual, A. N. T.	3021	MONITORING OF HEMATOPHAGOUS VECTORS IN THE AREA OF INFLUENCE OF THE YACYRETA DAM	II	762	22/08/00	16:30	CC		15	PS	15
Pasini, A.	306	CHEMICAL CONTROL OF THE BOLLWEEVIL, ANTHONOMUS GRANDIS, WITH PYRETHROIDS	I	78	24/08/00	16:30	CC		2	PS	2
Pasini, A.	307	CHEMICAL CONTROL OF THE VELVETBEAN CATERPILLAR, ANTICARSIA GEMMATALIS WITH PYRETHROIDS	I	78	24/08/00	16:30	CC		2	PS	2
Pasini, A.	308	MACROFAUNA OF THE SOIL IN DIFFERENT TILLAGE SYSTEMS, IN OXYSOL OF PARANÁ, BRAZIL	I	78	24/08/00	16:30	CC		2	PS	2
Pasini, A.	1369	INSECTICIDES FOR PSEUDALETIA SEQUAX CONTROL IN WHEAT TRITICUM AESTIVUM	I	345	24/08/00	16:30	CC		7	PS	7
Pasini, A.	2849	CONTROL OF ASCIA MONUSTE ORSEIS BY PYRETHROID INSECTICIDES IN COLLARD	II	719	25/08/00	16:30	CC		14	PS	14
Pasini, A.	2850	CONTROL OF THRIPS TABACI BY PYRETHROID INSECTICIDES IN ONION	II	719	25/08/00	16:30	CC		14	PS	14
Pasquali, V.	3539	AN AUTOMATIC DEVICE FOR DETECTING LOCOMOTOR ACTIVITY OF SINGLE ANT IN A SOCIAL CONTEXT	II	893	24/08/00	16:30	CC		19	PS	19
Pasquali, V.	3540	CIRCADIAN AND ULTRADIAN RHYTHMS OF LOCOMOTOR ACTIVITY IN WORKERS OF ANT FORMICA PRATENSIS	II	893	24/08/00	16:30	CC		19	PS	19
Pass, G.	3050	ANTENNAL CIRCULATION: VESSELS, HEARTS AND NEUROSECRETION	II	770	22/08/00	14:05	HB	G	16	3	16
Pass, G.	3169	ANTENNAE OF HYDROPHILID BEETLES AND THEIR SIGNIFICANCE IN RESPIRATION	II	799	24/08/00	16:30	CC		16	PS	16
Passell, M.	779	A SOFTWARE ENGINEERING PERSPECTIVE ON DEVELOPING ELECTRONIC FIELD GUIDES: LESSONS FOR BIOINFORMATICS	I	197	24/08/00	15:00	Bol	T	5	5	5
Passell, M.	791	DEVELOPING ELECTRONIC FIELD GUIDES: FIRST RESULTS USING COSTA RICAN BUTTERFLIES AND MASSACHUSETTS AQUATIC MACROINVERTEBRATES	I	200	23/08/00	16:30	CC		5	PS	5
Passos, F. A.	2740	RESISTANCE OF STRAWBERRIES TO TETRANYCHUS URTICAE (ACARI: TETRANYCHIDAE)	II	692	23/08/00	16:30	CC		14	PS	14
Passos, P.	1586	FIRST APPROACH ON THE POTENTIAL ROLE OF SEVERAL SPECIES (NEUROPTERA: CHRYSOPIDAE), AS NATURAL CONTROL AGENT IN PORTUGUESE GREENHOUSES	I	400	23/08/00	16:30	CC		8	PS	8
Passos, P.	1619	FIRST APPROACH ON THE POTENTIAL ROLE OF DICYPHUS CERASTII WAGNER (HEMIPTERA: MIRIDAE), AS NATURAL CONTROL AGENT IN PORTUGUESE GREENHOUSES	I	408	25/08/00	16:30	CC		8	PS	8
Passos-Carvalho, J.	2839	EVALUATION OF TRAPS FOR MONITORING BACTROCERA OLEAE ADULTS, IN INTEGRATED PEST MANAGEMENT	II	717	25/08/00	16:30	CC		14	PS	14
Pasteels, J. M.	4130	CHEMICAL DEFENSE IN NEOTROPICAL LEAF BEETLES	II	1043	25/08/00	14:40	HM	P	24	2	24
Pasteels, J.M.	3536	CONTACT POISONS IN THE ANT GENUS CREMATOGASTER: CHEMICAL DIVERSITY AND BIOLOGICAL FUNCTIONS	II	892	24/08/00	16:30	CC		19	PS	19
Patanita, M. I.	309	PEST IDENTIFICATION AND MONITORING ON A IRRIGATED AGRICULTURAL SYSTEM AT BAIXO ALENTEJO (PORTUGAL)	I	78	24/08/00	16:30	CC		2	PS	2
Patanita, M. I.	3956	A BIOTECNICAL METHOD FOR THE CONTROL OF THE OLIVE FLY IN ORGANIC ORCHARDS	II	998	22/08/00	16:30	CC		22	PS	22
Patanita, M. I.	2777	AN CONTRIBUTION TO IMPROVE THE IPM IN STONE FRUIT ORCHARDS IN PORTUGAL	II	701	25/08/00	16:30	CC		14	PS	14
Patel, N. H.	2244	EXPRESSION OF PAIRED GROUP III GENES AND THE EVOLUTION OF SEGMENTATION.	I	566	21/08/00	16:30	CC		12	PS	12
Patel, N. H.	3291	EVOLUTION OF ANTEROPOSTERIOR AXIS FORMATION IN INSECTS: THE ROLE OF HUNCHBACK AND NANOS IN THE GRASSHOPPER	II	831	24/08/00	9:35	HB	K	18	6	18
Patel, N. H.	3066	EVOLUTION OF ANTEROPOSTERIOR AXIS FORMATION IN INSECTS: THE ROLE OF HUNCHBACK AND NANOS IN THE GRASSHOPPER	II	774	21/08/00	16:30	CC		16	PS	16
Patel, V.	1825	ADVANTAGES AND LIMITATIONS IN THE USE OF PATHOGENS AS BIOCIDES FOR CONTROL OF FOREST PESTS	I	460	22/08/00	10:20	HB	M	10	2	10
Patel, V. S.	1896	THE SPATIAL AND TEMPORAL IMPACT OF ENDEMIC NATURAL ENEMIES ON THE MORTALITY OF CHRYSOMELID BEETLES IN EUCALYPT PLANTATIONS	I	478	26/08/00	16:05	HB	M	10	10	10
Patel, V. S.	2027	THE SPATIAL AND TEMPORAL IMPACT OF ENDEMIC NATURAL ENEMIES ON THE MORTALITY OF CHRYSOMELID BEETLES IN EUCALYPT PLANTATIONS	I	511	21/08/00	16:30	CC		11	PS	11
Patell, J.	1237	CORN ROOT-WORM ACTIVE	I	312	22/08/00	14:05	HM	N	7	4	7
Pathak, S. C.	1102	TRANS-OCEANIC DISPERSAL OF INSECTS OVER BAY OF BENGAL	I	278	24/08/00	16:30	CC		6	PS	6

Sub-titles: (HB=Hotel Bourbon) - (HM=Hotel Mabu) - (CC=Convention Center) - (Bol=Foz Boulevard) - (PS=Poster Session) - (PL=Plenary Lecturer)

AUTHOR	Nº	TITLE	Book	Page	Date	Time	Local	Room	Session	Symp	New Session
Pathak, S. C.	4005	EFFECT OF PHOTOPERIOD AND TEMPERATURE CHANGES ON THE REPRODUCTIVE BEHAVIOR OF MALE BLATTELLA GERMANICA LINN. (BLATTOIDEA : BLATTELLIDAE)	II	1011	21/08/00	11:00	HB	J	23	I	23
Pathirana, S.	3319	OOGENESIS IN DROSOPHILA	II	838	22/08/00	16:30	CC		18	PS	18
Patil, A.	1251	PINK BOLLWORM RESISTANCE TO BT COTTON	I	316	23/08/00	15:05	HM	N	7	6	7
Paton, M.	2999	COMPARISON OF VECTORIAL CAPACITY IN INSECTICIDE RESISTANT AND SUSCEPTIBLE CULEX QUINQUEFASCIATUS FROM FILARIASIS ENDEMIC SRI LANKAN FIELD POPULATIONS	II	757	23/08/00	16:30	CC		15	PS	15
Patricia A. Nuttall	XI	Thick parasite interactions at the host interface	I	L	24/08/00	8:00	HB			PL	
Patricio, F.	1578	PERSPECTIVES IN THE BIOLOGICAL CONTROL OF NEMATUS OLIGOSPILUS FOERSTER (HYMENOPTERA; TENTHREDINIDAE) PEST OF WILLOWS IN ARGENTINA AND CHILE	I	398	23/08/00	16:30	CC		8	PS	8
Pattaro, F. C.	171	AGRONOMIC EFFICIENCY OF INSECTICIDES AT DIFFERENT RATES TO THE CONTROL OF STERNECHUS SUBSIGNATUS IN SOYBEAN	I	44	21/08/00	16:30	CC		2	PS	2
Pattaro, F. C.	172	EFFICIENCY OF DIFFERENT INSECTICIDES IN THE CONTROL OF THRIPS, FRANKLINIELLA SCHULTZEI, IN LETTUCE	I	44	21/08/00	16:30	CC		2	PS	2
Pattaro, F. C.	173	EFFICIENCY OF INSECTICIDES IN THE CONTROL OF PECTINOPHORA GOSSYPIELLA IN COTTON CROP	I	44	22/08/00	16:30	CC		2	PS	2
Pattaro, F. C.	175	SURVEY OF THE ARTHROPODS ASSOCIATED TO MALPIGHIA GLABRA IN ANGULO, PARANA, BRAZIL	I	45	22/08/00	16:30	CC		2	PS	2
Patten, M. A.	1103	DIPTERA COMMUNITY COMPOSITION AND SUCCESSION FOLLOWING HABITAT DISTURBANCE BY WILDFIRE	I	278	21/08/00	16:30	CC		6	PS	6
Patten, M. A.	910	PATTERNS AND PROCESSES OF ARTHROPOD COMMUNITY SUCCESSION AFTER A FIRE	I	230	21/08/00	16:30	CC		6	PS	6
Patti, I.	3722	AN APPROACH TO EVOLUTIVE TAXONOMY OF THE APHID GENUS ANURAPHIS (RHYNCHOTA APHIDIDAE)	II	940	21/08/00	16:30	CC		21	PS	21
Patton, T.	1354	TIMING INSECTICIDE APPLICATIONS FOR DUSKY SAP BEETLE (COLEOPTERA: NITIDULIDAE) CONTROL IN BT SWEET CORN.	I	342	23/08/00	16:30	CC		7	PS	7
Patz, J. A.	2878	THE IMPACT OF DEFORESTATION ON MALARIA: A CASE STUDY FROM THE PERUVIAN AMAZON	II	726	21/08/00	15:05	Bol	R	15	2	15
Paul, A. V. N.	1667	SYNOMONAL EFFECT OF CHICKPEA VARIETIES ON THE EGG PARASITOID TRICHOGRAMMA CHILONIS (TRICHOGRAMMATIDAE: HYMENOPTERA)	I	420	24/08/00	16:30	CC		8	PS	8
Paula, M. C. Z. de	2778	EFFECTS OF AGE AND SEX ON MORTALITY OF TRIBOLIUM CASTANEUM EXPOSED TO WHEAT TREATED WITH DIATOMACEOUS EARTH	II	701	24/08/00	16:30	CC		14	PS	14
Paula, S. V.	3986	DATA BASE OF QUARANTINE PESTS TO BRAZIL	II	1006	24/08/00	16:30	CC		22	PS	22
Paula, S. V.	3982	PEST RISK ASSESSMENT TO MANGO CROP IN BRAZIL	II	1005	24/08/00	16:30	CC		22	PS	22
Paulino, F. A. O.	717	FEMALE SEX PHEROMONE OF CASTNIA LICUS (LEPIDOPTERA:CASTNIIDEA): IDENTIFICATION AND FIELD APPLICATION	I	181	24/08/00	16:30	CC		4	PS	4
Paulino-Simões, Z. L.	3440	VARROA JACOBSONI INFESTATIONS IN THE TRANSITION ZONE BETWEEN AFRICANIZED AND EUROPEAN BEES	II	868	24/08/00	10:50	HM	Q	19	5	19
Paulson, G. S.	2483	THE DESIGN AND APPLICATION OF AN ACTIGRAPH TO STUDY THE CIRCADIAN RHYTHM OF THE DUMP FLY, HYDROTAEA AENESCENS	II	627	24/08/00	16:30	CC		13	PS	13
Paulson, G. S.	2779	THE EFFECT OF A PLANT GROWTH REGULATOR (APOGEE) ON INSECT PESTS OF PEAR AND APPLE	II	702	25/08/00	16:30	CC		14	PS	14
Paulsson, O.	843	GENOTYPIC VARIATION IN PR-PROTEIN ACTIVITY IN WILLOW AND RESISTANCE TO A GALLING INSECT	I	213	23/08/00	15:30	HB	D	6	5	6
Pauron, D.	1304	INVOLVEMENT OF VOLTAGE-DEPENDENT SODIUM CHANNELS IN DELTAMETHRIN RESISTANCE IN A STRAIN OF CYDIA POMONELLA	I	329	21/08/00	16:30	CC		7	PS	7
Pauw, A.	99	HABITAT FRAGMENTATION AND ITS CONSEQUENCES FOR PLANT-POLLINATOR MUTUALISMS IN SOUTH AFRICA	I	26	22/08/00	12:00	HB	A	2	3	2
Pavan, L.	1272	A GLOBAL PERSPECTIVE ON THE BIOLOGY AND FIELD PERFORMANCE OF SPINOSAD	I	321	25/08/00	11:05	HM	N	7	9	7
Pavan, L. A.	2809	ESTABLISHMENT OF A ROTATIONAL PROGRAM WITH TRACER (SPINOSAD) FOR SPODOPTERA FRUGIPERDA (FALL ARMYWORM) CONTROL IN CORN	II	709	24/08/00	16:30	CC		14	PS	14
Pavan, L. A.	1275	RECENT ADVANCES IN PESTICIDE RESISTANCE MANAGEMENT PROGRAMS IN BRAZIL	I	322	25/08/00	13:35	HM	N	7	10	7
Pavis, C.	1649	BEMISIA TABACI BIOTYPE B (HEMIPTERA: ALEYRODIDAE) AND ITS PARASITOIDS: GUADELOUPE ISLAND AS A REPRESENTATIVE SITE OF THE CARIBBEAN	I	416	24/08/00	16:30	CC		8	PS	8
Pawinska, M.	1283	DEVELOPMENT OF A RESISTANCE MANAGEMENT STRATEGY FOR COLORADO BEETLE IN POLAND: A SUCCESSFUL IRAC-SPONSORED PROJECT	I	324	25/08/00	15:50	HM	N	7	10	7
Payne, C. C.	2020	THE ROLE OF FORMULATION ADDITIVES IN INCREASING THE POTENCY OF CYDIA POMONELLA GRANULOVIRUS FOR CODLING MOTH LARVAE	I	510	24/08/00	11:05	HM	P	11	7	11
Peakall, R.	725	POLLINATOR ATTRACTION BY PHEROMONE-MIMICKING VOLATILES IN AUSTRALIAN AND EUROPEAN ORCHIDS	I	183	25/08/00	16:30	CC		4	PS	4
Pearson, D. L.	389	SPATIAL PATTERNS OF SPECIES RICHNESS: TIGER BEETLES OF NORTHWESTERN SOUTH AMERICA (COLEOPTERA: CICINDELIDAE)	I	99	22/08/00	10:50	HB	C	3	2	3
Pearson, D. L.	411	NATURAL HISTORY, CULTURE AND STATISTICS: CRITERIA FOR SELECTING BIOINDICATORS FOR MONITORING AND INVENTORY	I	104	23/08/00	13:35	HB	C	3	4	3
Peck, D.	78	SCARAB LARVAE - A WORLDWIDE PEST PROBLEM	I	21	21/08/00	9:35	HB	A	2	I	2
Peck, D. C.	2780	NEW PERSPECTIVES FOR MANAGING GRASSLAND SPITTLEBUGS	II	702	24/08/00	16:30	CC		14	PS	14
Peck, R. W.	1931	CHEMOTAXIS OF SOME SCOLYTIDS AND THEIR PREDATORS TO 4-ALLYLANISOLE AND ETHANOL IN CENTRAL OREGON PINE FORESTS	I	487	22/08/00	16:30	CC		10	PS	10
Peck, S. B.	3774	PHYLOGENY AND EVOLUTION OF LEIODIDAE (COLEOPTERA) - INTRODUCTION TO THE SYMPOSIUM	II	953	23/08/00	16:30	CC		21	PS	21
Pedersen, B. V.	3570	MITOCHONDRIAL DNA SEQUENCE VARIATION OF THE WATER STRIDER AQUARIUS REMIGIS (HETEROPTERA, GERRIDAE)	II	901	23/08/00	10:35	Bol	U	20	I	20
Pedersen, J. S.	3430	MATING SYSTEM EVOLUTION IN ATTINE FUNGUS GROWING ANTS	II	866	23/08/00	10:50	HM	Q	19	4	19
Pedreros, F. H.	2123	FUNGI ASSOCIATED TO SCOLYTIDAE BEETLES IN PUERTO RICO	I	535	24/08/00	16:30	CC		11	PS	11
Pedro Neto, M.	1633	EFFECT OF THE PREY DENSITY ON THE FUNCTIONAL AND NUMERICAL RESPONSE OF TWO SPECIES OF PREDACEOUS MITES	I	412	24/08/00	16:30	CC		8	PS	8
Pedrosa-Macedo, J. H.	912	BIOLOGY OF THE LEAF GALL MAKER NEOTRIOZA TAVARESI IN STRAWBERRY GUAVA TREE	I	230	21/08/00	16:30	CC		6	PS	6
Pedrosa-Macedo, J. H.	913	PREFERENCES OF LEAF GALL MAKER NEOTRIOZA TAVARESI IN DIFFERENT SHOOTING STAGES OF THE STRAWBERRY GUAVA TREE	I	231	21/08/00	16:30	CC		6	PS	6
Peixoto, A. A.	2297	GENETIC VARIABILITY OF CACOPHONY GENE IN LUTZOMYIA LONGIPALPIS POPULATIONS	I	580	24/08/00	16:30	CC		12	PS	12
Peixoto, C. A.	2396	CELLULAR IMMUNE RESPONSE OF THE MOSQUITO CULEX QUINQUEFASCIATUS (DIPTERA-CULICIDAE) TO CANDIDA ALBICANS INFECTION.	II	605	21/08/00	16:30	CC		13	PS	13
Peixoto, E. B. M. I.	3170	A COMPARATIVE STUDY OF THE CARDIAC VALVE AND CARDIA IN CORBICULATED BEES (HYMENOPTERA, APINAE)	II	800	23/08/00	16:30	CC		16	PS	16
Pelicano, A. E.	1391	EXTRACTS OF CHRYSANTHEMUM CINERARIAEFOLIUM AND QUASSIA AMARA: EVALUATION OF EFFICIENCE AND EFFECT ON SITOPHILUS ORYZAE (COLEOPTERA:CURCULIONIDAE)	I	351	25/08/00	16:30	CC		7	PS	7
Pelicano, A.	1905	WATER STRESS EFFECT ON WORKER CUTTING-ANTS OF ACROMYRMEX HISPIDUS ON THREE ORIGINS OF EUCALYPTUS GLOBULUS GLOBULUS	I	480	21/08/00	16:30	CC		10	PS	10
Pelicano, A. E.	1135	USE OF NATURAL EXTRACTS OF BASIL, DILL AND FENNEL LIKE ALTERNATIVE MEASURE OF CONTROL OF MACROSIPHUM EUPHORBIAE (HEMIPTERA: APHIDIDAE)	I	286	24/08/00	16:30	CC		6	PS	6

Sub-titles: (HB=Hotel Bourbon) - (HM=Hotel Mabu) - (CC=Convention Center) - (Bol=Foz Boulevard) - (PS=Poster Session) - (PL=Plenary Lecturer)

AUTHOR	N°	TITLE	Book	Page	Date	Time	Local	Room	Session	Symp	New Session
Pell, J. K.	2164	COPING WITH CROWDS: THE EVOLUTION OF DENSITY-DEPENDENT RESISTANCE TO PATHOGENS	I	546	25/08/00	16:30	CC		11	PS	11
Pels, B.	9	PREDATOR DISPERSAL AND PREY-EXPLOITATION STRATEGIES	I	3	22/08/00	10:20	Bol	U	1	2	1
Pemberton, R. W.	1620	PREDICTABLE RISK TO NATIVE PLANTS IN WEED BIOLOGICAL CONTROL	I	408	24/08/00	16:30	CC		8	PS	8
Pena, J. E.	1450	FOREIGN EXPLORATION FOR NATURAL ENEMIES OF THE WEEVIL DIAPREPES ABBREVIATUS (COLEOPTERA: CURCULIONIDAE) A SERIOUS PEST OF CITRUS IN FLORIDA	I	366	23/08/00	10:15	HM	O	8	5	8
Pendleton, M. W.	3045	ULTRASTRUCTURAL ANALYSIS OF NEUROSECRETORY CELLS IN THE ANTENNAE OF THE MOSQUITO, CULEX SALINARIUS (DIPTERA: CULICIDAE)	II	768	22/08/00	10:05	HB	G	16	2	16
Pener, M. P.	3306	A MALE VIEW ON REPRODUCTIVE DIAPAUSE, OR COADAPTATION OF MALE REPRODUCTIVE STRATEGIES TO DIAPAUSE IN FEMALE INSECTS	II	835	25/08/00	9:35	HB	K	18	8	18
Penev, L.	418	CARABID BEETLES (COLEOPTERA, CARABIDAE) ACROSS URBAN-RURAL GRADIENTS IN BULGARIA, CANADA AND FINLAND: AN INTERNATIONAL COLLABORATIVE EFFORT	I	106	23/08/00	15:35	HB	C	3	4	3
Peng, T. X.	310	LITCHI INSECT PESTS RESEARCH AND CONTROL	I	79	24/08/00	16:30	CC		2	PS	2
Peng, X. J.	3821	TWO NEW SPECIES OF THE GENUS THOMISUS FROM CHINA (ARANEAE : THOMISIDAE)	II	964	24/08/00	16:30	CC		21	PS	21
Peng, X. J.	3822	ONE NEW SPECIES OF THE GENUS XYSTICUS FROM CHINA (ARANEAE: THOMISIDAE)	II	965	24/08/00	16:30	CC		21	PS	21
Penilla, P.	3012	A THREE-YEAR FIELD EVALUATION OF THE IMPACT OF ROTATIONS AND MOSAIC AS RESISTANCE MANAGEMENT STRATEGIES IN ANOPHELES ALBIMANUS IN SOUTHERN MEXICO	II	760	24/08/00	16:30	CC		15	PS	15
Penilla, R. P.	1381	RESISTANCE MECHANISMS IN ANOPHELES ALBIMANUS DURING A LARGE-SCALE FIELD TRIAL USING A SINGLE INSECTICIDE, ROTATION AND MOSAIC STRATEGIES IN MEXICO	I	348	24/08/00	16:30	CC		7	PS	7
Penilla, R. P.	1281	INSECTICIDE RESISTANCE MANAGEMENT APPLICATION TO THE CONTROL OF MALARIA VECTORS	I	323	25/08/00	15:20	HM	N	7	10	7
Pennacchio, F.	1920	DISTRIBUTION AND ABUNDANCE OF MONOCHAMUS SPECIES ON PINES IN ITALY	I	484	22/08/00	16:30	CC		10	PS	10
Pennacchio, F.	1427	REARING HYMENOPTEROUS LARVAL PARASITOIDS OF APHIDS ON ARTIFICIAL DIETS	I	360	21/08/00	13:50	HM	O	8	2	8
Pennacchio, F.	1451	HOST SELECTION STRATEGIES BY THE APHID PARASITOID APHIDIUS ERVI	I	366	23/08/00	13:35	HM	O	8	6	8
Pennacchio, F.	2364	PHYSIOLOGICAL AND NUTRITIONAL INTERACTIONS BETWEEN THE PEA APHID AND THE ENDOPHAGOUS BRACONID APHIDIUS ERVI	II	597	24/08/00	9:50	HB	I	13	6	13
Pennacchio, F.	2372	EXPRESSION OF CARDIOCHILES NIGRICEPS POLYDNAVIRUS IN PARASITIZED HELIOTHIS VIRESCENS LARVAE AND INDUCED HOST FUNCTIONAL ALTERATIONS	II	599	24/08/00	14:05	HB	I	13	7	13
Pennacchio, F.	1421	APHID-INDUCED PLANT VOLATILES INFLUENCING PARASITOID BEHAVIOUR	I	359	21/08/00	10:35	HM	O	8	1	8
Pennacchio, F.	1426	ARTIFICIAL DIETS FOR REARING PREDATORS AND PARASITOIDS OF GREENHOUSE PEST INSECTS	I	360	21/08/00	13:35	HM	O	8	2	8
Pennington, P. M.	2895	BACTERIAL SYMBIONTS AND THE CONTROL OF CHAGAS DISEASE	II	731	23/08/00	9:35	Bol	R	15	5	15
Penny, N. D.	3614	A SYNOPSIS OF THE NEOTROPICAL NOGODINIDAE (HEMIPTERA: FULGOROMORPHA)	II	913	21/08/00	10:50	HB	E	21	1	21
Pensel, S. M.	2240	SEXUAL SELECTION ON MORPHOMETRIC AND CHROMOSOME VARIABLES IN LEPTYSMA ARGENTINA (ORTHOPTERA)	I	565	21/08/00	16:30	CC		12	PS	12
Penteado, C. H. S.	2457	RELATION BETWEEN WEIGHT AND VOLUME OF CORNOPS AQUATICUM (ORTHOPTERA: ACRIDIDAE) IN THE SURROUNDINGS OF RIO CLARO, BRAZIL	II	621	23/08/00	16:30	CC		13	PS	13
Penteado, C. H. S.	2458	RESPIROMETRIC STUDIES OF CORNOPS AQUATICUM (ORTHOPTERA: ACRIDIDAE) IN THE SURROUNDINGS OF RIO CLARO, BRAZIL	II	621	23/08/00	16:30	CC		13	PS	13
Penteado, S. R. C.	1823	INTRODUCTION AND RELEASE OF RHISSINES TO CONTROL SIREX NOCTILIO IN BRAZIL	I	460	22/08/00	9:35	HB	M	10	2	10
Penteado, S. R. C.	1881	SIREX NOCTILIO IN SOUTH AMERICA: DISTRIBUTION, MONITORING AND CONTROL	I	474	26/08/00	9:35	HB	M	10	9	10
Penz, C.	3081	BEHAVIORAL ADAPTATIONS TO POLLEN-FEEDING IN HELICONIUS BUTTERFLIES	II	777	25/08/00	10:45	HB	G	16	7	16
Penz, C. M.	3641	COMBINING DATA IN SYSTEMATICS: WHAT DO WE WANT TO ACHIEVE?	II	919	22/08/00	15:15	HB	E	21	4	21
Pepper, D. A.	1367	PRO-ACTIVE MANAGEMENT OF BEET ARMYWORM (SPODOPTERA EXIGUA) RESISTANCE TO THE IGRS, TEBUFENOZIDE AND METHOXYFENOZIDE	I	345	24/08/00	16:30	CC		7	PS	7
Pepper, N.	1662	THE COMMON EARWIG FORFICULA AURICULARIA: BENEFICIAL OR PEST IN ORCHARDS?	I	419	25/08/00	16:30	CC		8	PS	8
Perales-Segovia, C.	2781	NATURAL CONTROL OF GUAVA WEEVIL CONOTRACHELLUS SP. (COLEOPTERA: CURCULIONIDAE) IN AGUASCALIENTES, MEXICO	II	702	24/08/00	16:30	CC		14	PS	14
Peralta, R. C. G.	3533	INFESTATION OF TERMITES IN EUCALYPTUS SP. AT THE "UNIVERSIDADE FEDERAL RURAL DO RIO DE JANEIRO"	II	891	25/08/00	16:30	CC		19	PS	19
Perdikis, D. CH.	1621	THERMAL REQUIREMENTS FOR DEVELOPMENT OF THE PREDATOR mACROLOPHUS PYGMAEUS (HEMIPTERA:MIRIDAE)	I	409	24/08/00	16:30	CC		8	PS	8
Peredo, H.	1832	CERTIFICATION OF EXPORTED CHILEAN FOREST PRODUCTS. ADVANCES IN THE MANAGEMENT OF ENTOMOLOGICAL RISKS	I	462	22/08/00	13:35	HB	M	10	3	10
Peredo, H.	373	EFFECTIVENESS OF METHYL BROMIDE ALTERNATIVES AGAINST POTENTIAL PESTS TO BE IMPORTED TO THE UNITED STATES FROM CHILE	I	94	25/08/00	16:30	CC		2	PS	2
Peredo, H.	2856	AN IPM APPROACH TO PREVENTION OF POTENTIAL PESTS THAT MIGHT BE IMPORTED TO THE UNITED STATES ON CHILEAN LOGS: PART I, EFFECTIVENESS OF METHYL BROMIDE ALTERNATIVES	II	721	24/08/00	16:30	CC		14	PS	14
Pereira, R. M.	2114	DEVELOPMENTAL CYCLES OF THE ENTOMOPATHOGENIC FUNGI BEAUVERIA BASSIANA AND METARHIZIUM ANISOPLIAE ON THE TERMITE CORNITERMES CUMULANS AS DETERMINED FROM SCANNING ELECTRON MICROSCOPE (SEM) STUDY	I	533	23/08/00	16:30	CC		11	PS	11
Pereira, C. J.	689	SCREENING GENOTYPES OF SESAME (SESAMUM INDICUM) FOR RESISTANCE TO WHITEFLY (BEMISIA TABACI)	I	174	23/08/00	16:30	CC		4	PS	4
Pereira, C. J.	1004	SPATIAL DISTRIBUTION OF INMATURE STAGES OF THE SWEETPOTATO WHITEFLY (BEMISIA TABACI) IN SESAME (SESAMUM INDICUM)	I	253	22/08/00	16:30	CC		6	PS	6
Pereira, E. J. G.	1398	PATTERNS OF ANSWER OF THE ENTOMOFAUNA OF THE CANOPY OF THE BEAN PLANT TO THE IMIDACLOPRID APPLICATION	I	353	25/08/00	16:30	CC		7	PS	7
Pereira, E. S.	2059	OCCURRENCE OF CULICIDAE (DIPTERA) LARVAE IN WATER HELD IN AQUASCYPHA HYDROPHORA (FUNGUS:STEREACEAE) IN CENTRAL AMAZON, BRAZIL	I	519	23/08/00	16:30	CC		11	PS	11
Pereira, G. D.	1207	COMPETITION BETWEEN TWO ARMORED SCALES FOR CITRUS LEAVES COLONIZATION	I	304	23/08/00	16:30	CC		6	PS	6
Pereira, J. A.	1488	DATA ON THE NATURAL CONTROL OF THE OLIVE MOTH, PRAYS OLEAE , BY PARASITOIDS IN TRÁS-OS-MONTES REGION (NORTHEASTERN PORTUGAL)	I	375	21/08/00	16:30	CC		8	PS	8
Pereira, J. M. M.	1816	ENVIRONMENTAL DIVERSITY IN A EUCALYPTUS PLANTATION AFFECTS NUMBERS OF SARSINA VIOLASCENS (LEPIDOPTERA: LYMANTRIIDAE) ADULTS?	I	458	21/08/00	11:50	HB	M	10	1	10
Pereira, J. M. M.	1950	MONITORING OF LEPIDOPTERA DEFOLIATORS OF EUCALYPTUS IN NIQUELÂNDIA, STATE OF GOIÁS, BRAZIL	I	491	23/08/00	16:30	CC		10	PS	10
Pereira, J. M. M.	1887	USE OF STRIPS OF NATIVE VEGETATION WITHIN EUCALYPTUS PLANTATIONS AS A STRATEGY TO REDUCE LEPIDOPTERA PEST POPULATIONS	I	476	26/08/00	13:35	HB	M	10	10	10

Sub-titles: (HB=Hotel Bourbon) - (HM=Hotel Mabu) - (CC=Convention Center) - (Bol=Foz Boulevard) - (PS=Poster Session) - (PL=Plenary Lecturer)

AUTHOR	N°	TITLE	Book	Page	Date	Time	Local	Room	Session	Symp	New Session
Pereira, J. M. M.	2865	EFFICIENCY OF MIREX-S MAX (SULFLURAMID 0.3%) BAIT AGAINST ATTA SEXDENS RUBROPILOSA AND ACROMYRMEX OCTOSPINOSUS (HYMENOPTERA: FORMICIDAE)	II	723	24/08/00	16:30	CC		14	PS	14
Pereira, L. A.	1967	COMPOSITION OF SCOLYTIDAE (COLEOPTERA) IN THREE FOREST MACROHABITATS OF SEROPÉDICA, RJ, BRASIL	I	496	24/08/00	16:30	CC		10	PS	10
Pereira, M. C.	2985	IXODID TICKS COLLECTED FROM ARMADILLO EUPHRACTUS SEXCINCTUS AND ANTEATER MYMERCOPHAGA TRIDACTYLA AT EMAS NATIONAL PARK, STATE OF GOIÁS, BRAZIL.	II	753	22/08/00	16:30	CC		15	PS	15
Pereira, M. F. A.	2782	PROTECTION PERIODS OF BEMISIA TABACI BIOTYPE B (HEMIPTERA: ALEYRODIDAE) ATTACK, ON BEAN CROP (PHASEOLUS VULGARIS), IN THREE SOWING DATE	II	702	24/08/00	16:30	CC		14	PS	14
Pereira, M. F. A.	2783	MACROSIPHUM EUPHORBIAE (HEMIPTERA: APHIDIDAE) CONTROL AND FRANKLINIELLA SCHULZEI (THYSANOPTERA: THRIPIDAE) WITH DIFFERENT INSECTICIDES ON TOMATO CROP (LYCOPERSICUM ESCULENTUM)	II	703	24/08/00	16:30	CC		14	PS	14
Pereira, M. F. R.	2844	FRUIT FLIES AND FRUGIVOROUS LONCHAEIDAE (DIPTERA: TEPHRITOIDEA) ON URBAN HOSTS IN TWO CITIES OF THE STATE OF MATO GROSSO DO SUL, BRAZIL	II	718	25/08/00	16:30	CC		14	PS	14
Pereira, M. G.	1382	RESISTANCE TO THE TOMATO PINWORM, TUTA ABSOLUTA, BY INTERSPECIFIC GENETIC CROSSES OF TOMATO PLANTS	I	349	24/08/00	16:30	CC		7	PS	7
Pereira, M. J. B.	1622	BIOLOGICAL DATA OF SOME NATURAL ENEMIES OF THE SOURSOP BORER CERCONOTA ANONELLA (LEPIDOPTERA: OECOPHORIDAE) IN PLANALTINA, FEDERAL DISCTRICT, BRAZIL	I	409	24/08/00	16:30	CC		8	PS	8
Pereira, M. M.	60	FIELD EVALUATION OF SPIDER MITES (ACARI: TETRANYCHIDAE) POPULATION ON CORN AT BAIXO ALENTEJO (PORTUGAL)	I	15	24/08/00	16:30	CC		1	PS	1
Pereira, M. M.	309	PEST IDENTIFICATION AND MONITORING ON A IRRIGATED AGRICULTURAL SYSTEM AT BAIXO ALENTEJO (PORTUGAL)	I	78	24/08/00	16:30	CC		2	PS	2
Pereira, N. E.	1382	RESISTANCE TO THE TOMATO PINWORM, TUTA ABSOLUTA, BY INTERSPECIFIC GENETIC CROSSES OF TOMATO PLANTS	I	349	24/08/00	16:30	CC		7	PS	7
Pereira, P. R. V. S.	1327	EVALUATION OF IMIDACLOPRID, THIACLOPRID AND METHIOCARB TO CONTROL MYZUS PERSICAE (HOMOPTERA: APHIDIDADE) IN POTATO	I	335	22/08/00	16:30	CC		7	PS	7
Pereira, P. R. V. S.	4034	EFFICACY OF PHOSPHINE TO CONTROL SITOPHILUS ORYZAE, S. ZEAMAIS (COLEOPTERA: CURCULIONIDAE), RHYZOPERTHA DOMINICA (COL: BOSTRICHIDAE) AND ORYZAEPHILUS SURINAMENSIS (COL: SILVANIDAE) IN THE FUMIGATION OF STORED SOY BRAN	II	1019	23/08/00	11:15	HB	J	23	6	23
Pereira, P. R. V. S.	4011	THE USE OF DIATOMACEOUS EARTH TO CONTROL INSECTS IN CORN STORED IN THE COB	II	1013	21/08/00	15:00	HB	J	23	2	23
Pereira, P. R. V. S.	4098	MONITORING INSECTS (COLEOPTERA) OUTSIDE GRAIN STORAGE FACILITIES	II	1035	24/08/00	16:30	CC		23	PS	23
Pereira, P. R. V. S.	4074	EVALUATION OF INSECTICIDES TO CONTROL SITOPHILUS ORYZAE (COLEOPTERA: CURCULIONIDAE) AND RHYZOPERTHA DOMINICA IN STORED BARLEY	II	1029	22/08/00	16:30	CC		23	PS	23
Pereira, R. A. A.	1641	POS-INTRODUCTION OF THE NATURAL ENEMY AGENIAPIS CITRICOLA IN CITRUS GROVES IN JAGUARIÚNA AND AGUAÍ REGIONS, SÃO PAULO STATE, BRAZIL: PRELIMINARY RESULTS	I	414	24/08/00	16:30	CC		8	PS	8
Pereira, R. A. S.	1787	SEX RATIO VS. FOUNDRESS NUMBER IN POLLINATING FIG WASP, PEGOSCAPUS CF. TONDUZI (HYMENOPTERA: AGAONIDAE), IN FICUS EXIMIA (MORACEAE)	I	450	24/08/00	16:30	CC		9	PS	9
Pereira, R. A. S.	1788	MALE AGGRESSION IN POLLINATING (PEGOSCAPUS CF. TONDUZI) AND NON-POLLINATING (IDARNES SPP.) FIG WASPS (HYMENOPTERA: AGAONIDAE), ASSOCIATED TO FICUS EXIMIA (MORACEAE)	I	450	24/08/00	16:30	CC		9	PS	9
Pereira, R. C.	708	INFLUENCE OF PRE- AND POST- IMAGINAL EXPERIENCE ON HOST-FINDING BEHAVIOR OF HYPOTHENEMUS HAMPEI	I	179	24/08/00	16:30	CC		4	PS	4
Pereira, R. C.	2124	MICROBIAL CONTROL OF THE COFFEE BERRY BORER HYPOTHENEMUS HAMPEI	I	536	25/08/00	16:30	CC		11	PS	11
Pereira, R. J. G.	2985	IXODID TICKS COLLECTED FROM ARMADILLO EUPHRACTUS SEXCINCTUS AND ANTEATER MYMERCOPHAGA TRIDACTYLA AT EMAS NATIONAL PARK, STATE OF GOIÁS, BRAZIL.	II	753	22/08/00	16:30	CC		15	PS	15
Pereira, V. de J.	3987	USE OF GAMMA RADIATION AS QUARENTENARY TREATMENT TO CONTROL THE MOTH OPOGONA SACCHARI (BOJER, 1856) (LEPIDOPTERA :TINEIDAE) IN BANANA (MUSA SP.) AND DRACAENA FRAGANS	II	1006	24/08/00	16:30	CC		22	PS	22
Perera, M. R.	1383	TOWARDS APHID RESISTANCE IN TRANSGENIC LUPINS	I	349	24/08/00	16:30	CC		7	PS	7
Peres, W. A. A.	1477	MULTIPLICATION OF TELENOMUS PODISI AND TRISSOLCUS BASALIS (HYMENOPTERA: SCELIONIDAE) ON EUSCHISTUS HEROS (HEMIPTERA: PENTATOMIDAE) EGGS FOR SOYBEAN STINK BUGS CONTROL	I	373	26/08/00	11:50	HM	O	8	8	8
Peres, W. A. A.	1623	REARING OF BROWN STINK BUG EUSCHISTUS HEROS AND GREEN STINK BUG NEZARA VIRIDULA AS HOSTS IN THE MULTIPLICATION OF EGG PARASITOIDS	I	409	21/08/00	16:30	CC		8	PS	8
Peresan, L.	4086	ANALYSIS OF VARIATION OF SPECIFIC CHARACTERS OF CULEX (CULEX) IN TWO ENVIROMENTS AND DETECTION OF NEW SPECIES IN THE CITY OF BUENOS AIRES	II	1032	23/08/00	16:30	CC		23	PS	23
Peretti, A. V.	3057	SCORPION GENITALIA: WHICH THEORY CAN BEST EXPLAIN THE DIVERSITY?	II	771	23/08/00	11:05	HB	G	16	4	16
Peretti, A. V.	3171	MORPHOLOGY OF THE MALE REPRODUCTIVE SYSTEM IN BUTHIDAE AND BOTHRIURIDAE SPECIES (ARACHNIDA, SCORPIONES)	II	800	24/08/00	16:30	CC		16	PS	16
Peretto, A.	2652	PESTICIDE EVALUATION TO CONTROL GYROPSYLLA SPEGAZZINIANA (HEMIPTERA, PSYLLIDAE) IN PARAGUAY-TEA ORCHARD	II	670	22/08/00	16:30	CC		14	PS	14
Peretto, A.	3222	PESTICIDE EVALUATION TO CONTROL VECTORS INSECTS OF TOBACCO VIRUS DISEASES	II	813	22/08/00	16:30	CC		17	PS	17
Peretto, A. J.	2846	EFFECT OF INSECTICIDES ON NYMPHS OF BEMISIA TABACI B BIOTYPE	II	718	25/08/00	16:30	CC		14	PS	14
Pereyra, P.	311	EVALUATION OF POSSIBLE PLANT ASSOCIATIONS WITH STRAWBERRY: EFFECT ON THE TWO-SPOTTED MITE IN THE LABORATORY	I	79	24/08/00	16:30	CC		2	PS	2
Pereyra, P.	312	TOMATO LEAF SIZE AND CONSPECIFIC INTERACTION EFFECTS ON TUTA ABSOLUTA (MEYRICK) (LEPIDOPTERA: GELECHIIDAE)	I	79	24/08/00	16:30	CC		2	PS	2
Pereyra-Alférez, B.	2077	A PAECILOMYCES FUMOSOROSEUS MUTANT OVERPRODUCING CHITINASE DISPLAYS HIGH VIRULENCE AGAINST BEMISIA TABACI	I	524	22/08/00	16:30	CC		11	PS	11
Pereyra-Alférez, B.	2125	GENETIC VARIABILITY AMONG BEAUVERIA BASSIANA AND PAECILOMYCES FUMOSOROSEUS	I	536	24/08/00	16:30	CC		11	PS	11
Perez Goodwyn, P. J.	3172	MUSCLE REGRESSION IN BELOSTOMATID BUGS (HETEROPTERA: BELOSTOMATIDAE)	II	800	24/08/00	16:30	CC		16	PS	16
Pérez, A.	3606	EFFECT OF INTERCROP WITH CHINESE BEET (BRASSICA JUNCEA) ON THE ABUNDANCE OF BREVICORYNE BRASSICAE AND THE QUALITY OF CABBAGE (BRASSICA OLERACEA VAR. CAPITATA)	II	910	24/08/00	16:30	CC		20	PS	20
Perez, J.	4020	NEAR-INFRARED SPECTROSCOPY APPLIED TO DETECTING PARASITOIDS AND HIDDEN INSECT LARVAE, IDENTIFYING COLEOPTERA, AND CHRONOLOGICAL AGE-GRADING	II	1015	22/08/00	11:00	HB	J	23	3	23
Pérez, M.	2484	EVIDENCE FOR A CATECHOL-γ-ALANYL LIGASE IN INSECTS	II	627	24/08/00	16:30	CC		13	PS	13
Pérez, M. M.	2386	β-ALANYL DERIVATIVES IN CUTICLE AND NEURAL TISSUE	II	603	25/08/00	15:50	HB	I	13	9	13
Perez, S.	1981	PRELIMINAR OBSERVATIONS OF CULICIDS (DIPTERA:CULICIDAE) ASSOCIATED TO PHYTOTELMATA IN A VERY HYMUD TROPICAL FOREST (bmh-T) IN CHOCO COLOMBIA	I	499	21/08/00	16:30	CC		10	PS	10
Pérez, T. M.	37	LIFE TABLES OF THE RED MITE, EOTETRANYCHUS LEWISI (ACARI: TETRANYCHIDAE)	I	10	22/08/00	16:30	CC		1	PS	1
Perez-Camargo, G.	1702	EXPLORATION IN ARGENTINA FOR POTENTIAL BIOLOGICAL CONTROL AGENTS OF HELIOTROPIUM AMPLEXICAULE AN INVASIVE WEED IN EASTERN AUSTRALIA	I	429	25/08/00	16:30	CC		8	PS	8

Sub-titles: (HB=Hotel Bourbon) - (HM=Hotel Mabu) - (CC=Convention Center) - (Bol=Foz Boulevard) - (PS=Poster Session) - (PL=Plenary Lecturer)

AUTHOR	Nº	TITLE	Book	Page	Date	Time	Local	Room	Session	Symp	New Session
Pérez-Maluf, R.	1645	PARASITISM OF APHIDIUS COLEMANI (HYMENOPTERA: APHIDIIDAE) IN DIFFERENT DENSITIES OF MYZUS PERSICAE (HEMIPTERA: APHIDIDAE)	I	415	24/08/00	16:30	CC		8	PS	8
Pérez-Santiago, G.	1384	RELATION DOSE-LETHALITY OF THREE PESTICIDES ON VARROA JACOBSONI (GAMASIDA: VARROIDAE) AND APIS MELLIFERA (HYMENOPTERA: APIDAE): COMPARISON OF TWO ADMINISTRATION METHODS	I	349	24/08/00	16:30	CC		7	PS	7
Peri, E.	653	CONTACT CHEMICAL CUES RELEASED BY ADULTS OF NEZARA VIRIDULA HAVE A KAIROMONAL EFFECT ON THE EGG PARASITOID TRISSOLCUS BASALIS: A CHROMATOGRAPHIC INVESTIGATION	I	165	22/08/00	16:30	CC		4	PS	4
Perich, M. J.	2934	MALARIA CONTROL: SIMPLE - ENVIRONMENTALLY SOUND- EFFICACIOUS AND SUSTAINABLE	II	740	25/08/00	14:45	Bol	R	15	10	15
Perich, M. J.	3006	THE IMPORTANCE OF DEVELOPING NOVEL STRATEGIES FOR PESTICIDE USE IN CONTROLLING VECTOR-BORNE DISEASES	II	758	24/08/00	16:30	CC		15	PS	15
Perich, M. J.	3016	USE OF A GEOGRAPHICAL INFORMATION SYSTEM TO EVALUATE THE EFFICACY OF A LETHAL OVITRAP FOR THE CONTROL OF THE MOSQUITO VECTORS OF DENGUE IN THAILAND	II	761	25/08/00	16:30	CC		15	PS	15
Perioto, N. W.	2794	USE OF THIAMETHOXAM IN THE BEMISIA SPP (HOMOPTERA: ALEYRODIDAE) CONTROL IN CULTIVATION OF VEGETABLES AND COTTON, IN MONITORED AREAS	II	705	25/08/00	16:30	CC		14	PS	14
Permana, A. D.	313	POPULATION DYNAMIC OF SCARLET MITE, BREVIPALPUS PHOENICIS AND ITS PREDATOR IN TEA AREA WHICH TREATED AND NON TREATED BY PESTICIDES	I	79	24/08/00	16:30	CC		2	PS	2
Permana, A. D.	709	LABORATORY AND FIELD TEST OF SEX PHEROMONE OF SPODOPTERA EXIGUA (LEPIDOPTERA: NOCTUIDAE)	I	179	25/08/00	16:30	CC		4	PS	4
Permana, A. D.	2485	QUANTIFICATION AND UTILISATION OF INSECT GROWTH IN BIOASSAY OF INSECT GROWTH INHIBITOR	II	628	23/08/00	16:30	CC		13	PS	13
Permana, A. D.	1624	THE EFFECT OF THE ADDITION OF AMINO ACIDS TO THE TOXICITY OF BACILLUS THRUINGIENSIS AGAINST PLUTELLA XYLOSTELLA LARAVE	I	409	22/08/00	16:30	CC		8	PS	8
Permaul, D.	2833	THE EFFICACY OF NEEM SEED EXTRACTS AND COMMERCIAL NEEM PRODUCTS IN CONTROLLING THE SMALL RICE STINK BUG	II	715	25/08/00	16:30	CC		14	PS	14
Perondini, A. L. P.	3043	DEVELOPMENTAL RESTRICTIONS AND UNUSUAL MECHANISMS IN THE EMBRYOGENESIS OF THE FRUIT FLY ANASTREPHA	II	768	21/08/00	16:00	HB	G	16	1	16
Perondini, A. L. P.	3177	EARLY EMBRYOLOGY AND SEGMENTATION GENES EXPRESSION IN THE TEPHRITID FLY ANASTREPHA SP. 2 (DIPTERA; TEPHRITIDAE)	II	801	24/08/00	16:30	CC		16	PS	16
Peronti, A. L. B. G.	255	FIRST RECORD OF OCCURRENCE OF APHIS SPIRAECOLA (HEMIPTERA: APHIDIDAE) ON IXORA COCCINEA AND I. COCCINEA VAR. COMPACTA (RUBIACEAE)	I	65	23/08/00	16:30	CC		2	PS	2
Perreau, M.	1104	COLEOPTERA LIVING IN SUBTERRANEAN NESTS OF AVES ALCIDAE AND SPHENISCIDAE IN THE SUBTARCTIC AND SUBANTARCTIC REGIONS	I	278	24/08/00	16:30	CC		6	PS	6
Perreau, M.	3703	THE STRANGE GENUS BARYODIRUS AND THE PHYLOGENY OF PTOMAPHAGINI	II	935	26/08/00	14:35	HB	E	21	10	21
Perring, T.M.	2556	THE BEMISIA SPECIES COMPLEX: A CHALLENGING SYSTEMATIC ISSUE	II	646	22/08/00	10:05	HB	B	14	3	14
Perry, J. N.	372	SPATIAL RELATIONSHIPS BETWEEN A PREDATOR AND PEST INFESTATION IN WINTER RAPE AND RELEVANCE TO INTEGRATED PEST MANAGEMENT STRATEGIES	I	94	25/08/00	16:30	CC		2	PS	2
Pershing, J.	1326	EFFECTS OF TRANSGENIC HYBRID MAIZE ON ADULT WESTERN CORN ROOTWORM EMERGENCE AND ROOT RATINGS	I	335	22/08/00	16:30	CC		7	PS	7
Persijn, S. T.	3086	ACTOGRAPHIC RESPIROMETRY REVEALS THE STRATEGIES OF SPIRACULAR CONTROL OF GAS EXCHANGE IN INSECTS	II	779	25/08/00	14:05	HB	G	16	8	16
Personeni, C.	1228	MOLECULAR STUDIES OF INSECT ACETYLCHOLINESTERASE: IS THERE NEW LIFE IN AN OLD TARGET?	I	310	21/08/00	14:05	HM	N	7	2	7
Pesquero, M. A.	496	GEOGRAPHIC RANGES AND PATTERNS OF DIVERSITY FOR PSEUDACTEON FLIES, PARASITOIDS OF SOLENOPSIS ANTS, FROM ARGENTINA AND BRAZIL	I	126	22/08/00	16:30	CC		3	PS	3
Pessanha, R. P.	2132	CARACTERIZATION OF NEW STRAINS OF BACILLUS THURINGIENSIS TOXIC AGAINST BOLL WEVILL, ANTHONOMUS GRANDIS	I	538	24/08/00	16:30	CC		11	PS	11
Pessanha, R. P.	2103	PATHOGENICITY OF NEW ISOLATES OF BACILLUS THURINGIENSIS AGAINST LEPIDOPTERAN AND DIPTERAN PESTS	I	530	23/08/00	16:30	CC		11	PS	11
Pessanha, R. P.	2102	A CULTURE COLLECTION OF BACILLUS THURINGIENSIS AND BACILLUS SPHAERICUS PATHOGENIC TO INSECTS	I	530	23/08/00	16:30	CC		11	PS	11
Petacci, F.	1309	METANOLIC EXTRACTS FROM DIMORPHANDRA MOLLIS (BARBATIMÃO) AND THEIR ACTIVITY IN WORKERS OF APIS MELLIFERA	I	330	21/08/00	16:30	CC		7	PS	7
Peters, B. A.	2784	FIELD STUDY TO COMPARE AN INTEGRATED FLEA CONTROL TREATMENT OF CAPSTAR AND PROGRAM TO ADVANTAGE USED ALONE AGAINST THE CAT FLEA (SIPHONAPTERA: PULICIDAE)	II	703	24/08/00	16:30	CC		14	PS	14
Peters, D.	3217	A WAY TO DIFFERENTIATE VECTOR SPECIFICITY BY THRIPS IN TOMATO SPOTTED WILT VIRUS TRANSMISSION	II	812	22/08/00	16:30	Bol	U	17	2	17
Peters, D.	3221	THE MEDIAN ACQUISITION AND INOCULATION ACCESS PERIOD OF THRIPS TABACI LINDEMAN MALES AND FEMALES IN THE TRANSMISSION OF TOMATO SPOTTED WILT TOSPOVIRUS	II	813	21/08/00	16:30	CC		17	PS	17
Peters, M.	2786	USE AND IMPACT OF MATING DISRUPTION IN COMMERCIAL PEACH INTEGRATED CROP MANAGEMENT PROGRAMS IN NEW JERSEY, USA	II	703	24/08/00	16:30	CC		14	PS	14
Petersen, C. L.	2925	A LONGITUDINAL PAIRED TRIAL OF TWO SENSING DEVICES FOR DETECTING PERIDOMESTIC POPULATIONS OF TRIATOMA INFESTANS (HEMIPTERA: REDUVIIDAE) IN RURAL NORTHWESTERN ARGENTINA	II	738	25/08/00	10:50	Bol	R	15	9	15
Petitpierre, E.	2301	MOLECULAR PHYLOGENY, CHROMOSOMES, AND HOST PLANT AFFILIATION IN CHRYSOLINA AND OREINA (COLEOPTERA, CHRYSOMELIDAE)	I	581	24/08/00	16:30	CC		12	PS	12
Petitpierre, E.	4133	MOLECULAR PHILOGENY OF THE GENUS CYRTONUS (COLEOPTERA: CHRYSOMELIDAE)	II	1044	25/08/00	16:00	HM	P	24	2	24
Petitpierre, E.	3769	MOLECULAR PHILOGENY OF THE GENUS CYRTONUS (COLEOPTERA: CHRYSOMELIDAE)	II	951					21		21
Petrarca, V.	2279	ODYSSEUS, A NOVEL TRANSPOSON INVOLVED IN THE GENERATION OF CHROMOSOMAL INVERSIONS IN THE MALARIA MOSQUITO ANOPHELES ARABIENSIS	I	575	23/08/00	16:30	CC		12	PS	12
Petrie, N.	2451	EFFECTS OF ONTOGENY ON THE OXYGEN SENSITIVITY OF JUMPING PERFORMANCE IN THE AMERICAN LOCUST (SCHISTOCERCA AMERICANA)	II	619	23/08/00	16:30	CC		13	PS	13
Petrov, P.	1105	THE SUCCESSION OF A FRESHWATER POND AFFECTING THE FAUNA OF WATER BEETLES (COLEOPTERA: HYDRADEPHAGA) IN WESTERN SIBERIA	I	279	24/08/00	16:30	CC		6	PS	6
Petrulevicius, J. F.	4139	FIRST RECORD OF BELOSTOMATIDAE AS INTERMEDIATE HOSTS OF DIGENETIC TREMATODES	II	1045	21/08/00	16:30	CC		24	PS	24
Petrulevicius, J. F.	3823	FIRST SOUTH AMERICAN RECORD OF FOSSIL LYGAEOIDEA (HETEROPTERA)	II	965	24/08/00	16:30	CC		21	PS	21
Pettit, W.	1702	EXPLORATION IN ARGENTINA FOR POTENTIAL BIOLOGICAL CONTROL AGENTS OF HELIOTROPIUM AMPLEXICAULE, AN INVASIVE WEED IN EASTERN AUSTRALIA	I	429	25/08/00	16:30	CC		8	PS	8
Pfeiffer, D. G.	3871	THE ROLE OF LEPIDOPTERAN MATING DISRUPTION IN FRUIT PEST MANAGEMENT SYSTEMS AND BARRIERS TO ITS ADOPTION IN THE EASTERN U.S.	II	977	21/08/00	10:35	HB	H	22	1	22
Pham, T.	3289	PHOTOAFFINITY LABELED NON-STEROIDAL ECDYSONE AGONIST AS A TOOL TO STUDY LIGAND-ECDYSONE RECEPTOR COMPLEX INTERACTION	II	831	23/08/00	15:35	HB	K	18	5	18
Pham, T.	314	IDENTIFICATION OF PROTEOLYTIC ACTIVITY IN BEMISIA TABACI B TYPE (HOMOPTERA: ALEYRODIDAE)	I	80	24/08/00	16:30	CC		2	PS	2

Sub-titles: (HB=Hotel Bourbon) - (HM=Hotel Mabu) - (CC=Convention Center) - (Bol=Foz Boulevard) - (PS=Poster Session) - (PL=Plenary Lecturer)

AUTHOR	Nº	TITLE	Book	Page	Date	Time	Local	Room	Session	Symp	New Session
Pham-Delègue, M. H.	1557	SUBLETHAL EFFECTS OF INSECTICIDES ON THE BEHAVIOUR OF TWO PARASITOIDS : INFLUENCE OF INDIVIDUAL EXPERIENCE AND GENETIC VARIABILITY	I	393	22/08/00	16:30	CC		8	PS	8
Phillips, J.	2380	NEUROPEPTIDE CONTROL OF INSECT HINDGUT REABSORPTION: RECENT MOLECULAR ADVANCES	II	601	25/08/00	11:05	HB	I	13	8	13
Phillips, P.	3224	TRANSMISSION OF CITRUS PATHOGENS FOREIGN TO THE U.S. BY ARTHROPODS ENDEMIC TO THE U.S. CONDUCTED UNDER HIGH QUARANTINE CONTAINMENT	II	814	22/08/00	16:30	CC		17	PS	17
Phillips, P. A.	1106	FIELD BIOLOGY OF THE GLASSY-WINGED SHARPSHOOTER IN SOUTHERN CALIFORNIA	I	279	24/08/00	16:30	CC		6	PS	6
Phillips, P. A.	1106	FIELD BIOLOGY OF THE GLASSY-WINGED SHARPSHOOTER IN SOUTHERN CALIFORNIA	I	279	24/08/00	16:30	CC		6	PS	6
Phillips, P. A.	1438	MYMARID PARASITOIDS OF THE GLASSY-WINGED SHARPSHOOTER IN SOUTHERN CALIFORNIA CITRUS	I	363	22/08/00	11:05	HM	O	8	3	8
Phillips, T. W.	4015	A SIMULATION MODEL FOR LYCTOCORIS CAMPESTRIS, A PREDATOR OF STORED-PRODUCT INSECT PESTS	II	1014	22/08/00	9:45	HB	J	23	3	23
Piau, O.	3671	HOPLIINI OF THE IBERIAN PENINSULA SCARABAEOIDEA, MELOLONTHIDAE): A BIOGEOGRAPHICAL AND TAXONOMIC STUDY	II	927	24/08/00	14:35	HB	E	21	7	21
Picanço, M.	710	CONVENTIONAL SAMPLING PLAN FOR VECTORIAL INSECTS OF VIROSES, PREDATORS AND PARASITOIDS IN TOMATO	I	179	24/08/00	16:30	CC		4	PS	4
Picanço, M.	636	INTENSITY OF LOSSES IN MAIZE CULTIVATED UNDER MINERAL AND ORGANIC FERTILIZATION SYSTEMS.	I	161	21/08/00	16:30	CC		4	PS	4
Picanço, M.	673	ECONOMIC INJURY LEVEL AND SEQUENCIAL SAMPLING FOR BEMISIA TABACI IN TOMATO	I	170	23/08/00	16:30	CC		4	PS	4
Picanço, M.	732	LIFE TABLES OF THE CULTURES APPLIED TO PESTS OF MAIZE UNDER INTERCROPPED CULTIVATION	I	185	25/08/00	16:30	CC		4	PS	4
Picanço, M.	998	EFFECT OF CATERPILLARS AND DEFOLIATION IN OVIPOSICION OF PLUTELLA XYLOSTELLA	I	252	22/08/00	16:30	CC		6	PS	6
Picanço, M.	1045	EFFECTS OF TRICHOMES AND CRISTALIFEROUS IDIOBLASTS DENSITIES, CONCENTRATIONS OF MINERALS AND WEATHER ON THE BEMISIA ARGENTIFOLII IN TOMATO	I	264	23/08/00	16:30	CC		6	PS	6
Picanço, M.	1398	PATTERNS OF ANSWER OF THE ENTOMOFAUNA OF THE CANOPY OF THE BEAN PLANT TO THE IMIDACLOPRID APPLICATION	I	353	25/08/00	16:30	CC		7	PS	7
Picanço, M.	1232	RESISTANCE AND SYNERGISM TO ORGANOSPHOSPHATE INSECTICIDES IN POPULATIONS OF LEUCOPTERA COFFEELLA (LEPIDOPTERA: LYONETIIDAE)	I	311	21/08/00	16:05	HM	N	7	2	7
Picanço, M.	1401	CARTAP RESISTANCE AND SYNERGISM IN POPULATIONS OF TUTA ABSOLUTA (LEPIDOPTERA: GELECHIIDAE)	I	353	25/08/00	16:30	CC		7	PS	7
Picanço, M.	1402	INSECTICIDE RESISTANCE IN POPULATIONS OF TUTA ABSOLUTA (LEPIDOPTERA: GELECHIIDAE)	I	354	25/08/00	16:30	CC		7	PS	7
Piccirillo, G. A.	3438	THE INFLUENCE OF COMB CELL SIZE ON THE WEIGHT OF EMERGING HONEY BEES (APIS MELLIFERA) AND ON INFESTATION WITH THE MITE VARROA JACOBSONI	II	868	24/08/00	10:20	HM	Q	19	5	19
Picumbon, J.-F.	658	PHYSIOLOGICAL REGULATION OF PHEROMONE PRODUCTION AND IT'S INHIBITION FOLLOWING MATING IN CHORISTONEURA FUMIFERANA AND C. ROSACEANA (LEPIDOPTERA:TORTRICIDAE)	I	166	22/08/00	16:30	CC		4	PS	4
Picinato, N. C.	2743	EVALUATION OF INDOXACARB FOR LEPIDOPTEROUS PESTS CONTROL ON VEGETABLES	II	693	22/08/00	16:30	CC		14	PS	14
Pickett, C.	3959	REVIEWING A MULTI-AGENCY BIOLOGICAL CONTROL PROGRAM FOR BEMISIA ARGENTIFOLII IN THE SOUTHWEST UNITED STATES: ESTABLISHING, CONSERVING & AUGMENTING NEW PARASITOIDS & EVALUATING THEIR IMPACT	II	999	22/08/00	16:30	CC		22	PS	22
Pickett, C.	3960	REVIEWING A MULTI-AGENCY BIOLOGICAL CONTROL PROGRAM FOR BEMISIA ARGENTIFOLII IN THE SOUTHWEST UNITED STATES: FOREIGN EXPLORATION, MASS CULTURE & EVALUATIONS	II	999	22/08/00	16:30	CC		22	PS	22
Pickett, J.	194	STEM BORER HABITAT MANAGEMENT IN EAST AND SOUTHERN AFRICA	I	50	21/08/00	16:30	CC		2	PS	2
Pickett, J. A.	592	PROSPECTING WITH INSECT CHEMOSENSORS FOR BIOACTIVES IN PLANT AND ANIMAL STRESS	I	150	22/08/00	13:35	Bol	S	4	3	4
Picollo, M. I.	4092	OVICIDAL EFFECT AND EMBRYO RESISTANCE TO INSECTICIDES IN PEDICULUS CAPITIS (PHTHIRAPTERA, PEDICULIDAE)	II	1033	23/08/00	16:30	CC		23	PS	23
Picollo, M. I.	4099	SYNERGIZED PYRETHROIDS FOR THE CONTROL OF PERMETHRIN RESISTANT HEAD LICE PEDICULUS CAPITIS (PHTHIRAPETRA, PEDICULIDAE)	II	1035	21/08/00	16:30	CC		23	PS	23
Picollo, M. I.	4100	REVERSION OF PERMETHRIN RESISTANCE BY INSECTICIDE SYNERGISTS IN THE HEADLICE PEDICULUS CAPITIS (PHTHIRAPTERA, PEDICULIDAE).	II	1035	21/08/00	16:30	CC		23	PS	23
Picollo, M. I.	1385	DETECTION AND MONITORING OF INSECTICIDE RESISTANCE IN TRIATOMA INFESTANS AND RHODNIUS PROLIXUS	I	349	24/08/00	16:30	CC		7	PS	7
Picollo, M. I.	2622	INSECT DEVELOPMENT DELAY PRODUCED BY WITHANOLIDES FROM SOLANACEAE	II	662	22/08/00	16:30	CC		14	PS	14
Pierobom, C. R.	2091	GROWTH OF FUNGI CULTIVATED BY CUTTING ANTS ON MURASHIGE & SKOOG NUTRIENT SOLUTION IN DIFFERENT pH	I	527	24/08/00	16:30	CC		11	PS	11
Pierobom, C. R.	2092	EFFICIENCY OF DIFFERENT CULTURE MEDIA IN THE IN VITRO GROWTH OF FUNGI CULTIVATED BY DIFFERENT LEAF CUTTING ANT SPECIES	I	528	24/08/00	16:30	CC		11	PS	11
Pieman, J.	2891	DYNAMIC CHANGES IN LYME DISEASE SPIROCHETE POPULATIONS DURING TRANSMISSION BY NYMPHAL TICKS	II	730	22/08/00	15:20	Bol	R	15	4	15
Pietrantonio, P. V.	2443	CLONING AND DEVELOPMENTAL EXPRESSION OF A LYMNOKININ-LIKE RECEPTOR FROM THE CATTLE FEVER TICK, Boophilus microplus (ACARI: IXODIDAE)	II	617	22/08/00	16:30	CC		13	PS	13
Pietrantonio, P. V.	2486	CLONING AND LOCALIZATION OF AQUAPORIN AND G PROTEIN-COUPLED RECEPTORS FROM THE MOSQUITO Aedes aegypti (DIPTERA) MALPIGHIAN TUBULE	II	628	24/08/00	16:30	CC		13	PS	13
Pietrobon, T. A. O.	3173	ULTRAMORPHOLOGY OF THE ECTAL MANDIBULAR GLAND OF POLISTES VERSICOLOR (HYMENOPTERA: VESPIDAE)	II	800	24/08/00	16:30	CC		16	PS	16
Pietrobon, T. A. O.	3174	ULTRAMORPHOLOGY OF THE ECTAL MANDIBULAR GLAND OF POLISTES VERSICOLOR (HYMENOPTERA: VESPIDAE)	II	801	24/08/00	16:30	CC		16	PS	16
Pietsch, C.	3607	EXTRAORDINARY NEST SITE OF AUGOCHLOROPSIS CAERULANS (HYMENOPTERA; HALICTINAE) IN A WET PASTURE HOLLOW	II	910	25/08/00	16:30	CC		20	PS	20
Pik, A. J.	483	BIOTRACK: CONCEPTUAL AND INFORMATION TECHNOLOGY SOLUTIONS FOR UNDERSTANDING MORE OF BIODIVERSITY	I	122	22/08/00	16:30	CC		3	PS	3
Pike, A.	17	HOUSE DUST MITE (DERMATOPHAGOIDES PTERONYSSINUS) MORTALITY IN OCCUPIED BEDS AND HEATED AND UNHEATED CARPET	I	5	21/08/00	16:30	CC		1	PS	1
Pike, N.	1107	THE ROLE OF PREDATORS IN THE POPULATION AND BEHAVIOURAL ECOLOGY OF THE SOLDIER-PRODUCING APHID SPECIES, PEMPHIGUS SPYROTHECAE	I	279	24/08/00	16:30	CC		6	PS	6
Pimenta, H. R.	1162	BIOLOGY OF ISODONTIA FUSCIPENNIS COMPLEX IN TRAP-NESTS (HYMENOPTERA: SPHECIDAE)	I	293	25/08/00	16:30	CC		6	PS	6
Pimenta, L. P. S.	4101	INSECTICIDE ACTION OF ETHANOLIC EXTRACT FROM ANNONA CRASSIFLORA SEEDS AGAINST SPODOPTERA FRUGIPERDA	II	1035	24/08/00	16:30	CC		23	PS	23
Pimentel, E. R.	3375	SECRETION OF SEXUAL ACCESSORY GLANDS OF FEMALE FLIES: SOME BIOCHEMICAL CHARACTERISTICS AND ANTIBACTERIAL ACTIVITY (DIPTERA, CALLIPHORIDAE, MUSCIDAE)	II	852	25/08/00	16:30	CC		18	PS	18
Pitent, S. M. J.	542	THYSANOPTERA DIVERSITY AT PARQUE ESTADUAL DE ITAPUÃ, VIAMÃO, RS, BRAZIL	I	137	24/08/00	16:30	CC		3	PS	3

Sub-titles: (HB=Hotel Bourbon) - (HM=Hotel Mabu) - (CC=Convention Center) - (Bol=Foz Boulevard) - (PS=Poster Session) - (PL=Plenary Lecturer)

AUTHOR	Nº	TITLE	Book	Page	Date	Time	Local	Room	Session	Symp	New Session
Pinger, R. R.	3004	SPREAD OF IXODES SCAPULARIS AND AMBLYOMMA AMERICANUM (ACARI: IXODIDAE) IN INDIANA AND OTHER MIDWESTERN STATES HAS PRECIPITATED INCREASES IN TICK-BORNE DISEASES	II	758	24/08/00	16:30	CC		15	PS	15
Pinheiro, F.	951	PATTERNS OF INSECT ABUNDANCE IN THE CERRADO OF BRASÍLIA AND THE EFFECT OF CLIMATE	I	240	22/08/00	16:30	CC		6	PS	6
Pinheiro, F.	3986	DATA BASE OF QUARANTINE PESTS TO BRAZIL	II	1006	24/08/00	16:30	CC		22	PS	22
Pinheiro, V. C. S.	3005	DENGUE CONTROL IN MANAUS: LARVAL DENSITY AND PREFERRED CONTAINERS FOR AEDES AEGYPTI	II	758	24/08/00	16:30	CC		15	PS	15
Piñon, N.	4088	INVASION OF AEDES AEGYPTI (DIPTERA: CULICIDAE) IN URUGUAY	II	1032	23/08/00	16:30	CC		23	PS	23
Pinto Jr., A. R.	4074	EVALUATION OF INSECTICIDES TO CONTROL SITOPHILUS ORYZAE (COLEOPTERA: CURCULIONIDAE) AND RHYZOPERTHA DOMINICA IN STORED BARLEY	II	1029	22/08/00	16:30	CC		23	PS	23
Pinto Jr., A. R.	4034	EFFICACY OF PHOSPHINE TO CONTROL SITOPHILUS ORYZAE, S. ZEAMAIS (COLEOPTERA: CURCULIONIDAE), RHYZOPERTHA DOMINICA (COL: BOSTRICHIDAE) AND ORYZAEPHILUS SURINAMENSIS (COL: SILVANIDAE) IN THE FUMIGATION OF STORED SOY BRAN	II	1019	23/08/00	11:15	HB	J	23	6	23
Pinto Jr., A. R.	1327	EVALUATION OF IMIDACLOPRID, THIACLOPRID AND METHIOCARB TO CONTROL MYZUS PERSICAE (HOMOPTERA: APHIDIDADE) IN POTATO	I	335	22/08/00	16:30	CC		7	PS	7
Pinto, A. de S.	315	RELATIONSHIP BETWEEN THE ARTIFICIAL INFESTATION OF DIATRAEA SACCHARALIS EGGS AND THE DAMAGE IN SUGARCANE STALKS	I	80	24/08/00	16:30	CC		2	PS	2
Pinto, A. de S.	1470	EFFECT OF DENSITY OF DIATRAEA SACCHARALIS EGGS IN THE PARASITISM OF TRICHOGRAMMA GALLOI IN SUGARCANE	I	371	26/08/00	10:05	HM	O	8	8	8
Pinto, J. M.	1108	NITROGEN AND POTASSIUM FERTILIZATION WERE INFLUENCING THE WHITEFLIES POPULATIONS IN CITRIC PLANTS	I	279	24/08/00	16:30	CC		6	PS	6
Pinto, J. M.	1109	INFLUENCE OF DIFFERENT LEVELS OF NITROGEN AND POTASSIUM FERTILIZATION ON THE SCALES POPULATIONS ASSOCIATED WITH CITRIC PLANTS	I	280	24/08/00	16:30	CC		6	PS	6
Pinto, J. M.	1625	OCCURRENCE OF SCALES, WHITEFLIES AND NATURAL ENEMIES IN CITRIC PLANTS IN THE MUNICIPAL DISTRICT OF CÁCERES, MT, BRASIL	I	410	25/08/00	16:30	CC		8	PS	8
Pinto, J. M.	3359	BIOLOGY OF URBANUS ACAWOIOS (LEPIDOPTERA, HESPERIIDAE) IN LABORATORY	II	848	23/08/00	16:30	CC		18	PS	18
Pinto, M.	1907	OCCURRENCE AND DAMAGES CAUSED FOR ONCIDERES SAGA (COLEOPTERA: CERAMBYCIDAE) IN ARBORIZATION	I	481	21/08/00	16:30	CC		10	PS	10
Pinto, J. M.	1964	OCCURRENCE OF WOOD BORING BEETLES IN THE NATIONAL FOREST MÁRIO XAVIER, RJ, BRASIL	I	495	21/08/00	16:30	CC		10	PS	10
Pinto, J. M.	2055	EVALUATION OF THE EFFICIENCY OF BACILLUS THURINGIENSIS IN THE CONTROL OF URBANUS ACAWOIOS (LEPIDOPTERA: HESPERIIDAE)	I	518	21/08/00	16:30	CC		11	PS	11
Pinto, J. of M.	1049	DETERMINATION OF THE INFLUENCE OF THE MATURITY OF THE LEAVES OF CLITORIA FAIRCHILDIANA IN THE DEVELOPMENT OF URBANUS ACAWOIOS (LEPIDOPTERA: HESPERIIDAE)	I	265	23/08/00	16:30	CC		6	PS	6
Pinto, L.	2959	ANOPHELES GAMBIAE MIDGUT MICROVILLI: EFFECTS OF INDUCED IMMUNITY ON LONGEVITY, FERTILITY AND TRANSMISSION OF MALARIA	II	747	21/08/00	16:30	CC		15	PS	15
Pinto, M.A.	4177	SPATIAL AND TEMPORAL PATTERNS OF MITOCHONDRIAL DNA IN FERAL HONEY BEES: IMPACT OF AFRICANIZATION	II	1055	21/08/00	16:30	CC		Erratum	PS	12
Pinto, R.	1962	INFLUENCE OF STRIPS OF NATIVE VEGETATION IN PLANTATIONS OF EUCALYPTUS CLOËZIANA ON POPULATION OF OXYDIA VESULIA.	I	494	24/08/00	16:30	CC		10	PS	10
Pintureau, B.	1540	STABILITY OF THE WOLBACHIA TRANSFER FROM TRICHOGRAMMA PRETIOSUM TO T. DENDROLIMI	I	388	22/08/00	16:30	CC		8	PS	8
Pintureau, B.	1626	COEXISTENCE IN ONE FIELD OF DIFFERENT TRICHOGRAMMA SPECIES SHOWING DIFFERENT MODES OF REPRODUCTION AND DIFFERENT LEVELS OF WOLBACHIA INFECTION	I	410	24/08/00	16:30	CC		8	PS	8
Pinzauti, M.	965	THE AGONY OF A HONEYBEE COLONY PARASITIZED BY THE SARCOPHAGID FLY SENOTAINIA TRICUSPIS (MEIGEN): TEMPERATURE AND HUMIDITY VARIATIONS	I	244	22/08/00	16:30	CC		6	PS	6
Pinzauti, M.	2423	PRELIMINARY INVESTIGATION ON INDIVIDUAL RESPIRATION OF ADULTS AND PUPAE OF OSMIA CORNUTA DURING DIAPAUSE BY MEANS OF A CO2 ANALYZER BASED ON AN INFRARED TUNABLE DIODE LASER	II	612	22/08/00	16:30	CC		13	PS	13
Piotte, C.	1665	FOOD AND CARCASS ANALYSES OF THE PREDATORY BUG HARMONIA AXYRIDIS (COLEOPTERA: COCCINELLIDAE) AS REFERENCES FOR THE ELABORATION OF ARTIFICIAL DIETS	I	420	25/08/00	16:30	CC		8	PS	8
Pipernos, A.	3230	HYTOPLASMA-BEARING LEAFHOPPERS/PLANTHOPPERS, SUSPECTED TO BE VECTORS, IN VINEYARDS IN THE GOLAN HEIGHTS, ISRAEL	II	815	23/08/00	16:30	CC		17	PS	17
Pires, C. S. S.	1110	DRY-SEASON EMBRIONIC DORMANCY IN DEOIS FLAVOPICTA (HOMOPTERA: CERCOPIDAE): ROLES OF TEMPERATURE AND MOISTURE IN NATURE	I	280	24/08/00	16:30	CC		6	PS	6
Pires, C. S. S.	1111	FEEDING BEHAVIOR OF THE SPITTLEBUG DEOIS FLAVOPICTA (HOMOPTERA: CERCOPIDAE) ON WILD AND CULTIVATED HOST PLANT	I	280	24/08/00	16:30	CC		6	PS	6
Pires, C. S. S.	1112	PATTERNS OF HOST PLANT GROWTH AND ATTACK AND ESTABLISHMENT OF GALL-INDUCING WASP, ANDRICUS SP. (HYMENOPTERA: CYNIPIDAE)	I	280	24/08/00	16:30	CC		6	PS	6
Pires, C. S. S.	3373	EFFECT OF FOOD QUALITY ON THE FECUNDITY OF SPITTLEBUG	II	852	22/08/00	16:30	CC		18	PS	18
Pires, C. S. S.	977	PHENOTYPIC PLASTICITY IN DEOIS FLAVOPICTA - VARIATION IN THE DRY SEASON DORMANCY AMONG FAMILIES AND AMONG GEOGRAPHICALLY ISOLATED POPULATIONS	I	247	22/08/00	16:30	CC		6	PS	6
Pirez, N.	3534	NECTAR COLLECTING IN HONEY BEES: HOW DO CHANGES IN THE RELATIVE FOOD SOURCE PROFITABILITY EXPLOITED BY INDIVIDUAL BEES AFFECT THE SOCIAL FORAGING ACTIVITY?	II	892	24/08/00	16:30	CC		19	PS	19
Pistillo, D.	3077	THE DEVELOPMENT AND EVOLUTION OF BRISTLE PATTERNS IN DIPTERA	II	776	24/08/00	16:00	HB	G	16	6	16
Pitara, E.	2111	EFFICACY OF SPINOSAD NATURALYTE INSECT CONTROL AGAINST LOBESIA BOTRANA (LEPIDOPTERA: TORTRICIDAE) ON GREEK VINEYARDS	I	532	23/08/00	16:30	CC		11	PS	11
Pitelli, R. A.	1580	CLASSICAL BIOLOGICAL CONTROL OF SOLANUM VIARUM (SOLANACEAE) IN THE USA	I	398	23/08/00	16:30	CC		8	PS	8
Pitre, H. N.	2562	INTEGRATED PEST MANAGEMENT PROGRAMS FOR CORN AND SORGHUM	II	647	22/08/00	13:50	HB	B	14	4	14
Pitts, K. M.	1113	MORTALITY RATE, REPRODUCTIVE OUTPUT, AND TRAP RESPONSE BIAS IN POPULATIONS OF THE BLOWFLY LUCILIA SERICATA	I	281	24/08/00	16:30	CC		6	PS	6
Piubelli, G. C.	711	ROLE OF NEZARA VIRIDULA (HEMIPTERA:PENTATOMIDAE) ON INDUCING THE PRODUCTION OF FLAVONOID IN SOYBEAN GENOTYPES	I	180	21/08/00	16:30	CC		4	PS	4
Piubelli, G. C.	1114	BIOLOGICAL AND NUTRITIONAL ASPECTS OF NEZARA VIRIDULA (HEMIPTERA:PENTATOMIDAE) ON SOYBEAN GENOTYPES	I	281	22/08/00	16:30	CC		6	PS	6
Pinlachs, M. D.	3302	MOLECULAR ASPECTS OF JUVENILE HORMONE ACTION UPON VITELLOGENIN PRODUCTION IN INSECTS	II	834	25/08/00	14:35	HB	K	18	7	18
Pizzio, R.	3487	DEMOGRAPHY OF CAMPONOTUS PUNCTULATUS ANTS ALONG A GRADIENT OF AGRICULTURAL DISTURBANCE AND THROUGH TIME	II	880	24/08/00	16:30	CC		19	PS	19
Plattman, N.	4130	CHEMICAL DEFENSE IN NEOTROPICAL LEAF BEETLES	II	1043	25/08/00	14:40	HM	P	24	2	24
Plato, J. C.	611	THE USE OF ATTRACT AND CONTROL TECHNOLOGIES IN THE CONTROL, PREVENTION, SUPPRESSION AND ERADICATION OF THE COTTON BOLL WEEVIL	I	155	24/08/00	10:35	Bol	S	4	6	4
Plato, J. C.	2785	NEW AND IMPROVED COTTON BOLL WEEVIL TRAP FOR USE IN IPM, PREVENTION, SUPRESSION AND ERADICATION PROGRAMS	II	703	24/08/00	16:30	CC		14	PS	14
Plato, J. S.	611	THE USE OF ATTRACT AND CONTROL TECHNOLOGIES IN THE CONTROL, PREVENTION, SUPPRESSION AND ERADICATION OF THE COTTON BOLL WEEVIL	I	155	24/08/00	10:35	Bol	S	4	6	4

Sub-titles: (HB=Hotel Bourbon) - (HM=Hotel Mabu) - (CC=Convention Center) - (Bol=Foz Boulevard) - (PS=Poster Session) - (PL=Plenary Lecturer)

AUTHOR	Nº	TITLE	Book	Page	Date	Time	Local	Room	Session	Symp	New Session
Plato, J. S.	2785	NEW AND IMPROVED COTTON BOLL WEEVIL TRAP FOR USE IN IPM, PREVENTION, SUPRESSION AND ERADICATION PROGRAMS	II	703	24/08/00	16:30	CC		14	PS	14
Plato, S. E.	2785	NEW AND IMPROVED COTTON BOLL WEEVIL TRAP FOR USE IN IPM, PREVENTION, SUPRESSION AND ERADICATION PROGRAMS	II	703	24/08/00	16:30	CC		14	PS	14
Plato, S. E.	611	THE USE OF ATTRACT AND CONTROL TECHNOLOGIES IN THE CONTROL, PREVENTION, SUPPRESSION AND ERADICATION OF THE COTTON BOLL WEEVIL	I	155	24/08/00	10:35	Bol	S	4	6	4
Plato, T. A.	611	THE USE OF ATTRACT AND CONTROL TECHNOLOGIES IN THE CONTROL, PREVENTION, SUPPRESSION AND ERADICATION OF THE COTTON BOLL WEEVIL	I	155	24/08/00	10:35	Bol	S	4	6	4
Plato, T. A.	2785	NEW AND IMPROVED COTTON BOLL WEEVIL TRAP FOR USE IN IPM, PREVENTION, SUPRESSION AND ERADICATION PROGRAMS	II	703	24/08/00	16:30	CC		14	PS	14
Platt, K. B.	3006	THE IMPORTANCE OF DEVELOPING NOVEL STRATEGIES FOR PESTICIDE USE IN CONTROLLING VECTOR-BORNE DISEASES	II	758	24/08/00	16:30	CC		15	PS	15
Plazas, M. C.	316	SAMPLING DISTRIBUTION PATTERNS OF RACHIPLUSIA NU (LEPIDOPTERA: NOCTUIDAE) AND DESIGN OF SAMPLE PLANS	I	80	24/08/00	16:30	CC		2	PS	2
Plepys, D.	712	BEHAVIOURAL AND ELECTROPHYSIOLOGICAL RESPONSES OF SILVER Y MOTH, AUTOGRAPHA GAMMA (LEPIDOPTERA: NOCTUIDAE), TO FLORAL VOLATILES	I	180	24/08/00	16:30	CC		4	PS	4
Plessis, H. du	317	MASS REARING AND RESISTANCE SCREENING TECHNIQUES FOR HE BEAN STEM MAGGOT (OPHIOMYIA SPP.)	I	80	24/08/00	16:30	CC		2	PS	2
Plessis, H. du	318	NYSIUS NATALENSIS (HETEROPTERA: LYGAEIDAE) – A NEW PEST OF SUNFLOWER (HELIANTHUS ANNUUS) IN SOUTH AFRICA	I	81	24/08/00	16:30	CC		2	PS	2
Plessis, U. du	317	MASS REARING AND RESISTANCE SCREENING TECHNIQUES FOR HE BEAN STEM MAGGOT (OPHIOMYIA SPP.)	I	80	24/08/00	16:30	CC		2	PS	2
Ploski, J.	1447	DEVELOPMENT AND IMPLEMENTATION OF AN AUTOMATED SYSTEM FOR MASS REARING PINK BOLLWORM (PECTINOPHORA GOSSYPIELLA)	I	365	22/08/00	15:20	HM	O	8	4	8
Pluciennik, Z.	2021	CODLING MOTH (CYDIA POMONELLA) CONTROL WITH BACTERIAL AND VIRAL PREPARATIONS UNDER POLISH WEATHER CONDITIONS	I	510	24/08/00	11:35	HM	P	11	7	11
Plue, P.	2042	LESSONS LEARNED DURING THE DESIGN OF AN ARTHROPOD AND PATHOGEN QUARANTINE FACILITY	I	515	21/08/00	16:30	CC		11	PS	11
Plunkett, J. L.	1030	MIGRATORY SPECIES, INDIVIDUAL VARIATION IN MIGRATORY TENDENCY: CORRELATIONS WITH RESOURCE STORAGE AND MOBILIZATION	I	260	23/08/00	16:30	CC		6	PS	6
Pluot-Sigwalt, D.	2961	TRIATOMINES SPECIES (HEMIPTERA, REDUVIIDAE, TRIATOMINAE) AND TRYPANOSOMA CRUZI IN FRENCH GUYANA	II	747	21/08/00	16:30	CC		15	PS	15
Poehling, H. M.	988	INTRAGUILD PREDATION BETWEEN APHIDOPHAGOUS PREDATORS AND ERIGONID SPIDERS IN CEREALS	I	249	22/08/00	16:30	CC		6	PS	6
Poels, J.	2344	DIFFERENTIAL ACTIVATION OF AN INSECT G PROTEIN-COUPLED PEPTIDE RECEPTOR BY INSECTATACHYKININ-LIKE AGONISTS	II	592	21/08/00	14:35	HB	I	13	2	13
Poels, J.	2528	INSECT G PROTEIN-COUPLED RECEPTORS AND SIGNAL TRANSDUCTION	II	638	25/08/00	16:30	CC		13	PS	13
Poels, J.	2529	INSECT G PROTEIN-COUPLED RECEPTORS AND SIGNAL TRANSDUCTION	II	639	25/08/00	16:30	CC		13	PS	13
Pohl, J.	2402	IDENTIFICATION OF TWO NEW BRAIN/MIDGUT PEPTIDES IN A MOSQUITO	II	607	21/08/00	16:30	CC		13	PS	13
Poland, T. M.	1833	THE UNITED STATES RESPONSE TO TWO RECENT INTRODUCTIONS: ANOPLOPHORA GLABRIPENNIS (CERAMBYCIDAE) AND TOMICUS PINIPERDA (SCOLYTIDAE)	I	462	22/08/00	14:05	HB	M	10	3	10
Polavarapu, S.	3873	DISRUPTION OF MATING IN SPARGANOTHIS FRUITWORM (TORTRICIDAE) IN CRANBERRIES	II	978	21/08/00	13:30	HB	H	22	1	22
Poleo, N. C.	61	DAMAGE AND POPULATION DISTRIBUTION OF BREVIPALPUS PHOENICIS ON GUAVA FRUIT, PSIDIUM GUAJAVA	I	16	24/08/00	16:30	CC		1	PS	1
Polesney, F.	2126	CODLING MOTH (CYDIA POMONELLA) AND THE USE OF GRANULOVIRUS IN ORGANIC AND INTEGRATED CONTROL	I	536	24/08/00	16:30	CC		11	PS	11
Polesny, F.	2023	CODLING MOTH (CYDIA POMONELLA) AND THE USE OF GRANULOVIRUS IN ORGANIC AND INTEGRATED CONTROL	I	510	24/08/00	14:00	HM	P	11	7	11
Poletti, M.	4149	RESISTANCE OF POTATO GENOTYPES (SOLANUM SPP.) TO DIABROTICA SPECIOSA AND THE MECHANISMS ENVOLVED	II	1048	21/08/00	16:30	CC		Erratum	PS	2
Poletto, C. F.	297	THE EFFECT OF SOME PHYSIOLOGICAL INSECTICIDES OVER THE SHARPSHOOTERS VETORS OF CVC IN CITRUS	I	75	24/08/00	16:30	CC		2	PS	2
Polhemus, D. A.	3572	PACIFIC HYDROMETRIDAE - INSULAR EVOLUTION IN GEOGRAPHIC AND PHYLOGENETIC ISOLATION	II	901	23/08/00	11:35	Bol	U	20	1	20
Polhemus, D. A.	1923	ARBOREAL ARTHROPOD COMMUNITY STRUCTURE ACROSS FOUR MILLION YEARS OF ECOSYSTEM DEVELOPMENT IN HAWAII	I	485	22/08/00	16:30	CC		10	PS	10
Polhemus, D. A.	3628	A REVIEW OF THE FAMILY LEVEL PHYLOGENY OF THE NEPOMORPHA (HETEROPTERA)	II	916	22/08/00	9:50	HB	E	21	3	21
Polhemus, J. T.	3628	A REVIEW OF THE FAMILY LEVEL PHYLOGENY OF THE NEPOMORPHA (HETEROPTERA)	II	916	22/08/00	9:50	HB	E	21	3	21
Polhemus, J. T.	3572	PACIFIC HYDROMETRIDAE - INSULAR EVOLUTION IN GEOGRAPHIC AND PHYLOGENETIC ISOLATION	II	901	23/08/00	11:35	Bol	U	20	1	20
Poliakov, D.	907	COMMUNITIES OF SOIL COLLEMBOLA ON THE NORTH AND SOUTH FACING SLOPES OF A MEDITERRANEAN VALLEY	I	229	23/08/00	16:30	CC		6	PS	6
Polk, D. F.	2786	USE AND IMPACT OF MATING DISRUPTION IN COMMERCIAL PEACH INTEGRATED CROP MANAGEMENT PROGRAMS IN NEW JERSEY, USA	II	703	24/08/00	16:30	CC		14	PS	14
Pollack, G. S.	1725	NEUROPHYSIOLOGICAL ANALYSIS OF ACOUSTIC SIGNALS IN CRICKETS: TEMPORAL PATTERN AND SOUND LOCALIZATION	I	435	22/08/00	14:00	HB	F	9	3	9
Pollet, M.	1912	BEETLES, SPIDERS AND FLIES AS BIO-INDICATORS IN FORESTS: A LARGE SCALE RESEARCH PROJECT IN FLANDERS (BELGIUM)	I	482	21/08/00	16:30	CC		10	PS	10
Polsa, N.	2924	PREVENTION OF SPOROGONY OF PLASMODIUM VIVAX IN ANOPHELES DIRUS MOSQUITOES BY TRANSMISSION-BLOCKING ANTIMALARIALS	II	738	25/08/00	10:35	Bol	R	15	9	15
Polukonova, N. V.	2302	CHROMOSOMAL AND MORPHOLOGICAL DIVERGENCE SPECIES OF A GENUS CHIRONOMUS MEIG. (CHIRONOMIDAE, DIPTERA)	I	581	24/08/00	16:30	CC		12	PS	12
Polukonova, N. V.	2303	THE ECOLOGO-KARYOTYPICAL APPROACH TO THE ANALYSIS OF SIBLING-SPECIES GENUS CHIRONOMUS MEIG. (CHIRONOMIDAE, DIPTERA)	I	581	24/08/00	16:30	CC		12	PS	12
Polwart, A.	2990	MALARIA AND MOSQUITOES: PARASITE-INDUCED APOPTOSIS REDUCES VECTOR REPRODUCTIVE FITNESS AND MAY ENHANCE TRANSMISSION	II	754	23/08/00	16:30	CC		15	PS	15
Pompolo, S. G.	2320	CYTOGENETICS OF SOME SPECIES OF PARASITIC WASPS OF THE FAMILIES PTEROMALIDAE AND EULOPHIDAE	I	585	25/08/00	16:30	CC		12	PS	12
Ponce, G.	1526	SUBLETHAL EFFECTS OF BACILLUS THURINGIENSIS VAR. ISRAELENSIS (VECTOBAC G & AS) ON LIFE PARAMETERS OF AEDES AEGYPTI	I	385	22/08/00	16:30	CC		8	PS	8
Ponnamma, K. N.	3824	BIOCONTROL AGENTS ASSOCIATED WITH PROUTISTA MOESTA, A VECTOR OF PHYTOPLASMA DISEASES OF PALMS, WITH PARTICULAR REFERENCE TO HALICTOPHAGUS PALMI	II	965	25/08/00	16:30	CC		21	PS	21
Pontes, A. R. de M.	2040	ANTICARSIA GEMMATALIS NUCLEOPOLYHEDROVIRUS INFECTIVITY IN SEVEN INSECT CELL LINES	I	515	21/08/00	16:30	CC		11	PS	11
Ponti, L.	3178	MOUTH PARTS AND THE FEEDING HABITS OF COCCINELLIDS (COLEOPTERA)	II	802	24/08/00	16:30	CC		16	PS	16
Ponti, L.	319	THE ECOLOGICAL ROLE OF NATURAL HEDGES ON LEAFHOPPERS POPULATIONS IN VINEYARDS OF CENTRAL ITALY	I	81	24/08/00	16:30	CC		2	PS	2
Popov, C.	2627	PROTECTION OF WINTER WHEAT AND BARLEY CROPS AGAINST DISEASES AND PESTS BY AN INTEGRATED CONTROL SYSTEM	II	664	22/08/00	16:30	CC		14	PS	14
Popov, C.	713	RESEARCH DIRECTIONS OF USING THE SYNTHETIC SEXUAL PHEROMONES ON FIELD CROPS IN ROMANIA	I	180	24/08/00	16:30	CC		4	PS	4
Popov, C.	1115	FAT-BODY, A DECISIVE FACTOR OF SUNN PEST POPULATIONS LEVEL OF EURYGASTER GENUS	I	281	25/08/00	16:30	CC		6	PS	6

Sub-titles: (HB=Hotel Bourbon) - (HM=Hotel Mabu) - (CC=Convention Center) - (Bol=Foz Boulevard) - (PS=Poster Session) - (PL=Plenary Lecturer)

AUTHOR	Nº	TITLE	Book	Page	Date	Time	Local	Room	Session	Symp	New Session
Popov, C.	2747	INTEGRATED CONTROL MANAGEMENT AGAINST THE PEST COMPLEX OF LUCERNE CROPS	II	694	23/08/00	16:30	CC		14	PS	14
Popov, C.	2787	SUNN PEST (EURYGASTER INTEGRICEPS) MANAGEMENT IN ROMANIA	II	704	23/08/00	16:30	CC		14	PS	14
Popov, C.	2788	STUDY OF FACTORS INVOLVED IN REDUCING POPULATION LEVEL OF HAPLODIPLOSIS MARGINATA	II	704	24/08/00	16:30	CC		14	PS	14
Popov, C.	548	ZOOGEOGRAPHICAL ANALYSIS OF THE FAUNA OF TERRESTRIAL HETEROPTERA FROM ROMANIA	I	139	24/08/00	16:30	CC		3	PS	3
Popov, S.Ya.	3360	OVIPOSITION BEHAVIOUR OF THE STRAWBERRY BLOSSOM WEEVIL ANTHONOMUS RUBI (COLEOPTERA: CURCULIONIDAE)	II	848	24/08/00	16:30	CC		18	PS	18
Popp, B.	1226	PYMETROZINE, A SELECTIVE FEEDING INHIBITOR FOR SUCKING INSECTS, ACTS THROUGH A NOVEL MECHANISM	I	310	21/08/00	11:35	HM	N	7	1	7
Poppy, G.	1451	HOST SELECTION STRATEGIES BY THE APHID PARASITOID APHIDIUS ERVI	I	366	23/08/00	13:35	HM	O	8	6	8
Poppy, G. M.	1421	APHID-INDUCED PLANT VOLATILES INFLUENCING PARASITOID BEHAVIOUR	I	359	21/08/00	10:35	HM	O	8	1	8
Poppy, G. M.	1243	INTERACTIONS BETWEEN TRANSGENIC OILSEED RAPE AND PARASITOIDS	I	314	23/08/00	10:20	HM	N	7	5	7
Porcel, E.	3124	MORPHOMETRICS VARIATIONS IN SOLDIERS OF TERMES SALTANS (ISOPTERA, TERMITIDAE, TERMITINAE)	II	788	22/08/00	16:30	CC		16	PS	16
Porcelli, F.	3175	SOME HYPOTESIS ON THE REDUCTION OF THE ANTENNAE IN DIASPIS ECHINOCACTI FEMALE (RHYNCHOTA DIASPIDIDAE) DURING ONTOGENESIS	II	801	24/08/00	16:30	CC		16	PS	16
Porrini, C.	3492	THE USE OF HONEYBEES (APIS MELLIFERA) AS INDICATORS FOR THE PRESENCE OF THE PHYTOPATHOGEN BACTERIUM ERWINIA AMYLOVORA IN THE ENVIRONMENT	II	881	22/08/00	16:30	CC		19	PS	19
Porta, N. C. La	185	BIOLOGICAL ASPECTS AND VITAL STATISTICS OF EDESSA MEDITABUNDA (HEMIPTERA, PENTATOMIDAE) UNDER CONTROLLED CONDITIONS	I	47	21/08/00	16:30	CC		2	PS	2
Porta, N. C. La	346	BIOLOGY AND REPRODUCTIVE ASPECTS OF PIEZODORUS GUILDINII (HEMIPTERA: PENTATOMIDAE) UNDER LABORATORY CONDITIONS	I	88	25/08/00	16:30	CC		2	PS	2
Porter, C.	1981	PRELIMINAR OBSERVATIONS OF CULICIDS (DIPTERA:CULICIDAE) ASSOCIATED TO PHYTOTELMATA IN A VERY HYMUD TROPICAL FOREST (bmh-T) IN CHOCO-COLOMBIA	I	499	21/08/00	16:30	CC		10	PS	10
Porter, S. D.	1596	CLASSICAL BIOLOGICAL CONTROL OF IMPORTED FIRE ANTS BY PARASITOID FLIES.	I	402	23/08/00	16:30	CC		8	PS	8
Porter, S. D.	496	GEOGRAPHIC RANGES AND PATTERNS OF DIVERSITY FOR PSEUDACTEON FLIES, PARASITOIDS OF SOLENOPSIS ANTS, FROM ARGENTINA AND BRAZIL	I	126	22/08/00	16:30	CC		3	PS	3
Portugal, C. B.	3804	A NEW SPECIES OF THE NEMOBIINAE CRICKET ZUCCHIELLA	II	960	21/08/00	16:30	CC		21	PS	21
Posadas, P.	3825	TAXONOMIC DISTINCTNESS, ENDEMICITY, AND COMPLEMENTARITY: NEW CLUES TO DEFINE PRIORITIES FOR CONSERVATION IN SOUTHERN SOUTH AMERICA	II	965	24/08/00	16:30	CC		21	PS	21
Posadas, P.	489	HISTORICAL BIOGEOGRAPHY OF THE SOUTH AMERICAN RHYTIRRHININI (COLEOPTERA; CURCULIONIDAE)	I	124	22/08/00	16:30	CC		3	PS	3
Posadas, P.	526	A COMPARISON BETWEEN RECONCILIATED TREES, DISPERSE-VICARIANCE AND PARALOGY FREE BIOGEOGRAPHIC SCHEMES	I	133	23/08/00	16:30	CC		3	PS	3
Posey, D. A.	399	SOCIAL INSECTS AND THE KAYAPÓ INDIANS OF THE BRAZILIAN AMAZON: INDIGENOUS APPRECIATION AND NOMENCLATURE OF BIODIVERSITY	I	101	22/08/00	15:35	HB	C	3	2	3
Pospischil, R.	320	STATUS OF PEST CONTROL IN CENTRAL EUROPE	I	81	24/08/00	16:30	CC		2	PS	2
Pospischil, R.	4004	STATUS OF PEST CONTROL IN CENTRAL EUROPE	II	1011	21/08/00	10:30	HB	J	23	1	23
Pospischil, R.	4006	FLEAS (SIPHONAPTERA) – BIOLOGY AND CONTROL	II	1012	21/08/00	11:15	HB	J	23	1	23
Posthumus, M. A.	727	CHARACTERIZATION OF TRICHOGRAMMA FEMALE VOLATILES LIKELY INVOLVED IN COURTSHIP BEHAVIOUR AND THEIR POTENTIAL USE IN TAXONOMY	I	184	25/08/00	16:30	CC		4	PS	4
Potapina, N. W.	2455	EXPERIMENTAL STUDY OF HAEMOCYTES AND HEMOPOIETIC TISSUE OF ADULT OF NAUPHOETA CINEREA	II	620	23/08/00	16:30	CC		13	PS	13
Potenza, M. R.	3449	FIELD EVALUATION OF A 0,5% HEXAFLUMURON BAIT (RECRUIT® II) FOR COLONY ELIMINATION OF THE SUBTERRANEAN TERMITE COPTOTERMES HAVILANDI (ISOPTERA : RHINOTERMITIDAE)	II	871	21/08/00	16:30	CC		19	PS	19
Potenza, M. R.	3535	USE OF ABOVE GROUND 0.5% HEXAFLUMURON BAITS (RECRUIT® AG) IN THE CONTROL OF COPTOTERMES HAVILANDI (ISOPTERA: RHINOTERMITIDAE) IN CONSTRUCTIONS LOCATED IN SÃO PAULO, SP, BRAZIL	II	892	24/08/00	16:30	CC		19	PS	19
Potenza, M. R.	3987	USE OF GAMMA RADIATION AS QUARENTENARY TREATMENT TO CONTROL THE MOTH OPOGONA SACCHARI (BOJER, 1856) (LEPIDOPTERA : TINEIDAE) IN BANANA (MUSA SP.) AND DRACAENA FRAGANS	II	1006	24/08/00	16:30	CC		22	PS	22
Potenza, M. R.	3506	FORAGING POPULATION AND TERRITORY OF THE SUBTERRANEAN TERMITE COPTOTERMES HAVILANDI (ISOPTERA : RHINOTERMITIDAE) BY THE TRIPLE MARKED RECAPTURE METHOD IN AN URBAN AREA	II	885	23/08/00	16:30	CC		19	PS	19
Potenza, M. R.	3507	FORAGING POPULATION AND TERRITORY OF THE SUBTERRANEAN TERMITE HETEROTERMES TENUIS (ISOPTERA : RHINOTERMITIDAE) BY THE TRIPLE MARKED RECAPTURE METHOD IN AN URBAN AREA	II	885	23/08/00	16:30	CC		19	PS	19
Potenza, M. R.	3022	EFFICACY OF DIFFERENT INSECTICIDES ON THE CONTROL OF THE ADULT MUSCA DOMESTICA IN LABORATORY CONDITIONS	II	762	25/08/00	16:30	CC		15	PS	15
Potenza, M.R.	4165	FIELD EVALUATION OF A 0,5% HEXAFLUMURON BAIT (RECRUIT® II) FOR COLONY ELIMINATION OF SUBTERRANEAN TERMITE HETEROTERMES TENUIS (ISOPTERA : RHINOTERMITIDAE).	II	1052	21/08/00	16:30	CC		Erratum	PS	19
Potenza, M.R.	4165	FIELD EVALUATION OF A 0,5% HEXAFLUMURON BAIT (RECRUIT® II) FOR COLONY ELIMINATION OF SUBTERRANEAN TERMITE HETEROTERMES TENUIS (ISOPTERA : RHINOTERMITIDAE).	II	1052	21/08/00	16:30	CC		Erratum	PS	19
Potter, D. A.	714	HABITUATION OF JAPANESE BEETLES (COLEOPTERA: SCARABAEIDAE) TO AZADIRACHTIN APPLIED AS A FEEDING DETERRENT	I	180	24/08/00	16:30	CC		4	PS	4
Potting, R. P. J.	1243	INTERACTIONS BETWEEN TRANSGENIC OILSEED RAPE AND PARASITOIDS	I	314	23/08/00	10:20	HM	N	7	5	7
Poulsom, T.	1501	HOST SPECIFICITY TESTING OF RODOLIA CARDINALIS, A CENTURY LATER	I	379	21/08/00	16:30	CC		8	PS	8
Póvoa, M. M.	2977	EMERGENCE OF A NEW NEOTROPICAL MALARIA VECTOR FACILITATED BY HUMAN MIGRATION AND CHANGES IN LAND USE	II	751	22/08/00	16:30	CC		15	PS	15
Powel, W.	1451	HOST SELECTION STRATEGIES BY THE APHID PARASITOID APHIDIUS ERVI	I	366	23/08/00	13:35	HM	O	8	6	8
Powell, W.	1421	APHID-INDUCED PLANT VOLATILES INFLUENCING PARASITOID BEHAVIOUR	I	359	21/08/00	10:35	HM	O	8	1	8
Powell, G.	748	VIDEO ANALYSIS OF APHID FLIGHT BEHAVIOUR.	I	189	21/08/00	11:35	Bol	T	5	1	5
Powell, J . E.	2100	RESPONSE OF COPTOTERMES FORMOSANUS SHIRAKI TO ISOLATES OF METARHIZIUM ANISOPLIAE IN THE UNITED STATES: VIRULENCE AND REPELLENCY	I	530	23/08/00	16:30	CC		11	PS	11
Powell, J. R.	2250	MITOCHONDRIAL DNA SEQUENCES OF TRIATOMINAE (HEMIPTERA: REDUVIIDAE): PHYLOGENETIC RELATIONSHIPS	I	568	22/08/00	16:30	CC		12	PS	12
Powell, W.	818	MOVEMENT OF APHID PARASITOIDS OVER DIFFERENT SPATIAL SCALES STUDIED USING MOLECULAR MARKERS	I	207	22/08/00	11:35	HB	D	6	3	6
Power, C.	3491	THE EFFECTS OF ELECTRICAL FIELDS ON THE BEHAVIOUR OF ANTS	II	881	22/08/00	16:30	CC		19	PS	19
Pozzan, M.	2592	MANAGEMENT STRATEGIES FOR CITRUS VARIEGATED CHLOROSIS	II	655	24/08/00	15:35	HB	B	14	7	14
Pozzan, Marcos	3210	MANAGEMENT STRATEGIES FOR CITRUS VARIEGATED CHLOROSIS	II	810	21/08/00	16:30	CC		17	PS	17
Prabhaker, N.	2557	OVERVIEW OF INSECTICIDAL CONTROL AND RESISTANCE MANAGEMENT	II	646	22/08/00	10:35	HB	B	14	3	14
Prado, A. P.	1787	SEX RATIO VS. FOUNDRESS NUMBER IN POLLINATING FIG WASP, PEGOSCAPUS CF. TONDUZI (HYMENOPTERA: AGAONIDAE), IN FICUS EXIMIA (MORACEAE)	I	450	24/08/00	16:30	CC		9	PS	9
Prado, A. P.	1788	MALE AGGRESSION IN POLLINATING (PEGOSCAPUS CF. TONDUZI) AND NON-POLLINATING (IDARNES SPP.) FIG WASPS (HYMENOPTERA: AGAONIDAE), ASSOCIATED TO FICUS EXIMIA (MORACEAE)	I	450	24/08/00	16:30	CC		9	PS	9

Sub-titles: (HB=Hotel Bourbon) - (HM=Hotel Mabu) - (CC=Convention Center) - (Bol=Foz Boulevard) - (PS=Poster Session) - (PL=Plenary Lecturer)

AUTHOR	Nº	TITLE	Book	Page	Date	Time	Local	Room	Session	Symp	New Session
Prado, A. P. do	1482	INFLUENCE OF HOST DENSITY ON ATTACK RATES OF TACHINAEPHAGUS ZEALANDICUS ASHMEAD (HYMENOPTERA: ENCYRTIDAE) ON MUSCA DOMESTICA (DIPTERA: MUSCIDAE) AND CHRYSOMYA PUTORIA (DIPTERA: CALLIPHORIDAE	I	374	21/08/00	16:30	CC		8	PS	8
Prado, E.	116	PARTICLE FILM TECHNOLOGY DEVELOPMENT IN CHILE	I	30	23/08/00	14:35	HB	A	2	6	2
Prado, E.	1001	PLANT PATCH SHAPE AND SURROUNDING VEGETATION AFFECT THE POPULATION DYNAMICS OF PREDATORY AND HERBIVOROUS INSECTS	I	253	22/08/00	16:30	CC		6	PS	6
Prager, S.	3025	VARIABLE TIMING OF EGG HATCH AND ITS RELATION TO ANNUAL PRECIPITATION IN POPULATIONS OF AEDES TRISERIATUS	II	763	25/08/00	16:30	CC		15	PS	15
Prakash, A.	2597	INTEGRATED MANAGEMENT OF KEY INDIAN RICE INSECT PESTS	II	656	25/08/00	11:05	HB	B	14	8	14
Prakash, A.	2789	INTEGRATED MANAGEMENT OF KEY INDIAN RICE INSECT PESTS	II	704	24/08/00	16:30	CC		14	PS	14
Prando, H. F.	1116	BIOLOGICAL ASPECTS OF ORYZOPHAGUS ORYZAE (COLEOPTERA: CURCULIONIDAE) IN WATER-SEEDED RICE	I	281	24/08/00	16:30	CC		6	PS	6
Prando, H. F.	1789	ETOLOGICAL ASPECTS OF ORYZOPHAGUS ORYZAE (COLEOPTERA: CURCULIONIDAE) IN WATER- SEEDED RICE	I	451	25/08/00	16:30	CC		9	PS	9
Prando, H. F.	2127	CONTROL ASPECTS OF ORYZOPHAGUS ORYZAE WITH BEAUVERIA BASSIANA, METARHIZIUM ANISOPLIAE AND FIPRONIL IN WATER-SEEDED RICE	I	536	23/08/00	16:30	CC		11	PS	11
Prates, H. T.	4060	PLANT EXTRACTS AS POTENTIAL INSECTICIDE TO CONTROL STORED GRAIN PESTS	II	1025	25/08/00	11:35	HB	J	23	10	23
Prates, H. T.	4101	INSECTICIDE ACTION OF ETHANOLIC EXTRACT FROM ANNONA CRASSIFLORA SEEDS AGAINST SPODOPTERA FRUGIPERDA	II	1035	24/08/00	16:30	CC		23	PS	23
Prates, H. T.	1412	THE EFFECT OF AQUEOUS EXTRACT OF AZADIRACHTA INDICA LEAVES ON THE CONTROL OF SPODOPTERA FRUGIPERDA FED WITH CORN LEAVES	I	356	25/08/00	16:30	CC		7	PS	7
Prates-Jr., P. H.	1117	COMPARATIVE STUDY OF NYMPHS AND ADULTS OF NUBITIIIA GRISESCENS (HEMIPTERA, FULGOROIDEA, ISSIDAE)	I	282	24/08/00	16:30	CC		6	PS	6
Pratiknyo, H.	313	POPULATION DYNAMIC OF SCARLET MITE, BREVIPALPUS PHOENICIS AND ITS PREDATOR IN TEA AREA WHICH TREATED AND NON TREATED BY PESTICIDES	I	79	24/08/00	16:30	CC		2	PS	2
Pratissoli, D.	1627	COLLECTS AND IDENTIFICATION OF RACES OF TRICHOGRAMMA IN COMMERCIAL FIELDS OF TOMATO, IN DIFFERENT ALTITUDE	I	410	24/08/00	16:30	CC		8	PS	8
Pratissoli, D.	1474	PARASITISM RATE AND VIABILITY OF TRICHOGRAMMA MAXACALII (HYM.: TRICHOGRAMMATIDAE) ON EGGS OF THE EUCALYPTUS DEFOLIATOR EUSELASIA APISAON (LEP.: RIODINIDAE)	I	372	26/08/00	11:05	HM	O	8	8	8
Pratissoli, D.	1938	SPATIAL DISTRIBUTION OF NESTS OF THE LEAF CUTTING ANT ATTA SEXDENS RUBROPILOSA (HYMENOPTERA: FORMICIDAE) IN PLANTATIONS OF EUCALYPTUS UROPHYLLA IN BRAZIL	I	488	23/08/00	16:30	CC		10	PS	10
Prawirosukarto, S.	716	EFFECT OF ORYCTES RHINOCEROS PHEROMONE (ETHYL 4-METHYLOCTANOATE) DIFFUSION RATE ON THE SIZE OF PEST CATCHES	I	181	24/08/00	16:30	CC		4	PS	4
Preciado, D. P. R.	2487	PARTIAL CHARACTERIZATION OF DIGESTIVE PROTEINASES FROM COFFEE BERRY BORER ADULTS (HYPOTHENEMUS HAMPEI)	II	628	24/08/00	16:30	CC		13	PS	13
Predel, R.	2488	MASS SPECTROMETRIC MORPHOLOGY - DISTRIBUTION OF FXPRLAMIDES IN NERVES AND NEUROHAEMAL ORGANS OF THE AMERICAN COCKROACH	II	628	24/08/00	16:30	CC		13	PS	13
Predel, R.	3257	TOPOCHEMICAL LOCALIZATION OF PERIVISCEROKININS AND PYROKININS IN THE CEPHALIC NERVOUS SYSTEM OF THE AMERICAN COCKROACH	II	823	21/08/00	14:30	HB	K	18	1	18
Premuzic, Z.	3606	EFFECT OF INTERCROP WITH CHINESE BEET (BRASSICA JUNCEA) ON THE ABUNDANCE OF BREVICORYNE BRASSICAE AND THE QUALITY OF CABBAGE (BRASSICA OLERACEA VAR. CAPITATA)	II	910	24/08/00	16:30	CC		20	PS	20
Prentice, T. R.	1103	DIPTERA COMMUNITY COMPOSITION AND SUCCESSION FOLLOWING HABITAT DISTURBANCE BY WILDFIRE	I	278	21/08/00	16:30	CC		6	PS	6
Prestes, D. A. O.	1167	HOST PLANTS OF ZAPRIONUS INDIANUS IN THE STATE OF SÃO PAULO, BRAZIL	I	294	25/08/00	16:30	CC		6	PS	6
Pretto, D. R.	4156	FOOD PRODUCTION SEASONALLY ADJUSTED FOR THE BROOD REARING IN THE LEAF-CUTTING ANT, ACROMYRMEX BALZANI	II	1050	21/08/00	16:30	CC		Erratum	PS	2
Pribyl, L. J.	1144	AN AQUATIC INSECT FAUNA FROM THE SUNDANCE FORMATION (LATE JURASSIC), NORTHERN WYOMING AND SOUTHERN MONTANA, U.S.A.	I	288	24/08/00	16:30	CC		6	PS	6
Price, J. F.	2790	TETRANYCHUS URTICAE RESISTANCE TO ABAMECTIN IN FLORIDA STRAWBERRY AND THE IMPACT ON ADOPTION OF BIOLOGICAL CONTROL BY PHYTOSEIULUS PERSIMILIS	II	704	24/08/00	16:30	CC		14	PS	14
Price, L. D.	1151	HOST RECOGNITION IN XIPHYDRIID WOODWASPS.	I	290	24/08/00	16:30	CC		6	PS	6
Price, P. W.	854	LONG-TERM, RESOURCE-BASED LIMITATION OF GALL-INDUCING SAWFLY POPULATIONS EXEMPLIFYING A COMMON PATTERN	I	216	25/08/00	9:50	HB	D	6	7	6
Price, P. W.	1040	LARVAL FOOD AND FEEDING HABIT CONTRIBUTE TO PERIODICITY AND MAGNITUDE OF DENSITY FLUCTUATIONS IN SUBARCTIC FOREST MOTHS	I	262	23/08/00	16:30	CC		6	PS	6
Price, P.W.	1111	FEEDING BEHAVIOR OF THE SPITTLEBUG DEOIS FLAVOPICTA (HOMOPTERA: CERCOPIDAE) ON WILD AND CULTIVATED HOST PLANT	I	280	24/08/00	16:30	CC		6	PS	6
Price, P.W.	1112	PATTERNS OF HOST PLANT GROWTH AND ATTACK AND ESTABLISHMENT OF GALL-INDUCING WASP, ANDRICUS SP. (HYMENOPTERA: CYNIPIDAE)	I	280	24/08/00	16:30	CC		6	PS	6
Price, R.	869	THE BROWN LOCUST IN SOUTH AFRICA, NAMIBIA, AND BOTSWANA	I	220	26/08/00	10:05	HB	D	6	9	6
Prieto, D.	543	LITTER MICROARTHROPOD COMMUNITY IN AN URBAN FOREST STAND OF SÃO JOSÉ DO RIO PRETO, STATE OF SÃO PAULO, BRAZIL	I	137	24/08/00	16:30	CC		3	PS	3
Primavera, M.	2382	HORMONAL REGULATION OF CUTICLE FORMATION AND CHITIN SYNTHESIS	II	602	25/08/00	13:35	HB	I	13	9	13
Primavera, M.	1320	AN RNA HELICASE OF THE "DEAD BOX" FAMILY CLONED FROM A LEPIDOPTERAN SPECIES, THE SPRUCE BUDWORM (CHORISTONEURA FUMIFERANA)	I	333	22/08/00	16:30	CC		7	PS	7
Primavera, M.	1845	BIOLOGICAL CONTROL OF FOREST PESTS USING INSECT SPECIFIC VIRUSES	I	465	23/08/00	14:35	HB	M	10	4	10
Primavera, M.	3280	MOLECULAR ANALYSIS OF THE OVERWINTERING DIAPAUSE IN THE SPRUCE BUDWORM, CHORISTONEURA FUMIFERANA	II	828	23/08/00	10:20	HB	K	18	4	18
Primavera, M.	3325	GLUTATHIONE S-TRANSFERASE FROM THE SPRUCE BUDWORM, CHORISTONEURA FUMIFERANA: IDENTIFICATION, CHARACTER-IZATION, LOCALIZATION, CDNA CLONING, DEVELOPMENTAL EXPRESSION AND INDUCTION BY VARIOUS FACTORS	II	840	21/08/00	16:30	CC		18	PS	18
Primiano, E. L. V.	715	AZADIRACTA INDICA AND BOUGAINVILLEA SPECTABILIS EXTRACTS TO CONTROL VELVETBEAN CATERPILLAR	I	181	24/08/00	16:30	CC		4	PS	4
Principato, M	2969	OBSERVATIONS ON SOME COLEOPTERA DERMESTIDAE SPECIES OF ZOOTECHNICAL INTEREST IN UMBRIA,CENTRAL ITALY	II	749	21/08/00	16:30	CC		15	PS	15
Principato, M	2982	EXPERIMENTAL OBSERVATIONS ON THE OUTBREAK OF INFESTATION BY KNEMIDOKOPTES PILAE (ACARINA: KNEMIDOKOPTIDAE) IN PARROTS (MELOPSITTACUS UNDULATUS)	II	752	22/08/00	16:30	CC		15	PS	15
Principato, M.	934	EXPERIMENTAL OBSERVATIONS ON THE OUTBREAK OF INFESTATION BY KNEMIDOKOPTES PILAE (ACARINA: KNEMIDOKOPTIDAE) IN PARROTS (MELOPSITTACUS UNDULATUS)	I	236	21/08/00	16:30	CC		6	PS	6
Prior, C.	2029	VOLATILITY COMPARISONS OF DIFFERENT FORMULATIONS USED TO APPLY MYCOINSECTICIDES	I	512	21/08/00	16:30	CC		11	PS	11
Prior, C.	2030	EVALUATION OF APPLICATION TECHNIQUES OF AN EMULSIFIABLE ADJUVANT OIL FUNGAL FORMULATION	I	512	21/08/00	16:30	CC		11	PS	11
Proença, S. J. R.	2304	PATTERNS OF rDNA LOCALIZATION IN TIGER BEETLES (COLEOPTERA: CICINDELIDAE)	I	581	24/08/00	16:30	CC		12	PS	12
Progar, R. A.	1951	MANAGEMENT OF HEADWATER FOREST STREAMS: ISSUES OF INSECT DIVERSITY AND BIOMASS PRODUCTION FOR VERTEBRATE PREDATORS	I	492	23/08/00	16:30	CC		10	PS	10

Sub-titles: (HB=Hotel Bourbon) - (HM=Hotel Mabu) - (CC=Convention Center) - (Bol=Foz Boulevard) - (PS=Poster Session) - (PL=Plenary Lecturer)

AUTHOR	Nº	TITLE	Book	Page	Date	Time	Local	Room	Session	Symp	New Session
Prokopy, R. J.	609	ATTRACTION OF PLUM CURCULIOS TO INTERACTING, HOST ODOR, PHEROMONAL AND VISUAL STIMULI	I	154	24/08/00	9:35	Bol	S	4	6	4
Prokopy, R. J.	2572	ARTHROPOD BEHAVIOR AND IPM	II	650	23/08/00	10:30	HB	B	14	5	14
Prola, M. J.	321	EGG DEVELOPMENT IN DIATRAEA SACCHARALIS (LEPIDOPTERA: PYRALIDAE) UNDER DIFFERENT TEMPERATURE REGIMES	I	81	24/08/00	16:30	CC		2	PS	2
Prüll, W.	3169	ANTENNAE OF HYDROPHILID BEETLES AND THEIR SIGNIFICANCE IN RESPIRATION	II	799	24/08/00	16:30	CC		16	PS	16
Protas, J.F.S.	686	USE OF MICROENCAPSULATED PHEROMONE OF THE ORIENTAL FRUIT MOTH FOR MATING DISRUPTION IN BRAZIL	I	173	23/08/00	16:30	CC		4	PS	4
Protas, J.F.S.	2728	TECHNICAL AND ECONOMICAL FEASIBILITY OF ERADICATING THE CODLING MOTH FROM THE BRAZILIAN APPLE GROWING AREA	II	689	24/08/00	16:30	CC		14	PS	14
Prpic, N.	3076	PROXIMAL-DISTAL PATTERNING IN TRIBOLIUM CASTANEUM, AN INSECT WITH EMBRYONIC LIMB FORMATION	II	776	24/08/00	15:30	HB	G	16	6	16
Prusinkiewicz, P. W.	750	SIMULATION OF INSECT MOVEMENT WITH RESPECT TO PLANT ARCHITECTURE AND MORPHOGENESIS	I	189	21/08/00	13:50	Bol	T	5	1	5
Przybysz - Szczesna, A.	1283	DEVELOPMENT OF A RESISTANCE MANAGEMENT STRATEGY FOR COLORADO BEETLE IN POLAND: A SUCCESSFUL IRAC-SPONSORED PROJECT	I	324	25/08/00	15:50	HM	N	7	10	7
Przybysz, M.	3110	INCIDENCE AND MORPHOLOGIC ASPECTS OF LONOMIA OBLIQUA (LEPIDOPTERA: SATURNIIDAE).	II	785	21/08/00	16:30	CC		16	PS	16
Pucci, P. S. B.	67	POLIPHAGOTARSONEMUS LATUS (ACARI: TARSONEMIDAE) DAMAGES IN "ERVA-MATE" SEEDLINGS	I	17	25/08/00	16:30	CC		1	PS	1
Puccia, A. R.	3379	EFFECT OF MORPHOGENETIC HORMONES ON THE PROTEIN PROFILE OF TESTES, MUCUS GLANDS AND SEMINAL VESICLES OF APIS MELLIFERA DRONES	II	853	25/08/00	16:30	CC		18	PS	18
Pugh, P. J. A.	51	MORPHOLOGICAL DIFFERENCES IN AQUATIC AND TERRESTRIAL SUBANTARCTIC ALGOPHAGUS SPECIES (ACARI: ASTIGMATA)	I	13	23/08/00	16:30	CC		1	PS	1
Pujade-Villar, J.	488	BIODIVERSITY OF CYNIPOIDEA FROM BRAZIL (HYMENOPTERA).	I	124	22/08/00	16:30	CC		3	PS	3
Pujol-Luz, J. R.	4075	DISPERSION OF AEDES AEGYPTI AND AEDES ALBOPICTUS AND THEIR RELATIONSHIP TO DENGUE TRANSMISSION IN THE STATE OF RIO DE JANEIRO, BRAZIL, 1986•1997	II	1029	22/08/00	16:30	CC		23	PS	23
Pullin, A. S.	432	LANDSCAPE MANAGEMENT FOR THE LARGE COPPER BUTTERFLY, LYCAENA DISPAR BATAVUS	I	110	24/08/00	15:35	HB	C	3	6	3
Pullin, A. S.	430	CONSERVATION OF GRASSLAND BUTTERFLIES IN AN URBAN LANDSCAPE IN THE UK	I	109	24/08/00	14:35	HB	C	3	6	3
Pullin, A. S.	431	CONSERVATION GENETICS OF A THREATENED EUROPEAN BUTTERFLY EURODRYAS AURINIA IN THE FRAGMENTED AGRICULTURAL LANDSCAPE OF THE UK	I	109	24/08/00	15:05	HB	C	3	6	3
Pultar, *	2128	POINT CONTAMINATION OF GYPSY MOTHS POPULATION BY LdNPV BY MEANS OF PHEROMONE TRAPS	I	537	24/08/00	16:30	CC		11	PS	11
Pultar, O.	2024	CONTROL OF THE CODLING MOTH WITH CpGV DISSEMINATED BY MEANS OF PHEROMONE STATIONS: 5 YEARS OF FIELD TRIALS	I	511	24/08/00	14:30	HM	P	11	7	11
Pultz, M. A.	3070	ZYGOTIC ANTERO-POSTERIOR PATTERNING GENE FUNCTIONS IN THE PARASITOID WASP NASONIA	II	775	24/08/00	11:15	HB	G	16	6	16
Pultz, M. A.	3152	ANALYSIS OF HUNCHBACK IN NASONIA VITRIPENNIS	II	795	23/08/00	16:30	CC		16	PS	16
Purba, R.	716	EFFECT OF ORYCTES RHINOCEROS PHEROMONE (ETHYL 4-METHYLOCTANOATE) DIFFUSION RATE ON THE SIZE OF PEST CATCHES	I	181	24/08/00	16:30	CC		4	PS	4
Purcell, A. H.	2579	INTEGRATED METHODS FOR CONTROL OF PIERCE'S DISEASE: INSECTICIDES TO VEGETATION MANAGEMENT	II	652	24/08/00	9:35	HB	B	14	6	14
Purcell, A. H.	3204	MECHANISMS OF INSECT VECTOR TRANSMISSION OF XYLELLA FASTIDIOSA AND IMPLICATIONS FOR CONTROL	II	809	21/08/00	14:05	Bol	U	17	1	17
Purcell, M.	3839	MOLECULAR SYSTEMATICS OF FERGUSONINA SPP. (DIPTERA: FERGUSONINIDAE): HOST SPECIFICITY, HOST-USE EVOLUTION, AND IMPLICATIONS FOR BIOCONTROL OF MELALEUCA QUINQUENERVA IN THE FLORIDA EVERGLADES	II	969	25/08/00	16:30	CC		21	PS	21
Puterka, G.	115	BENEFICIAL PHOTOSYNTHETIC AND HORTICULTURAL EFFECTS OF PARTICLE FILM APPLICATIONS ON PLANTS: DESTROYING THE DOGMA OF THE NEGATIVE EFFECTS OF DUSTS ON PLANTS	I	30	23/08/00	14:15	HB	A	2	6	2
Puterka, G. J.	114	PARTICLE FILM TECHNOLOGY FOR CONTROL OF ARTHROPOD PESTS AND DISEASES IN PLANTS	I	30	23/08/00	13:55	HB	A	2	6	2
Puterka, G. J.	117	EFFICACY OF PARTICLE FILMS TO CONTROL TRIBOLIUM SPP. IN MILLS AND FOOD STORAGE FACILITIES.	I	30	23/08/00	14:55	HB	A	2	6	2
Puterka, G. J.	121	EVALUATION OF SEASONAL PARTICLE FILM SPRAY PROGRAMS IN A WESTERN APPLE ORCHARD	I	31	23/08/00	16:05	HB	A	2	6	2
Putten, W. H. van der	1118	LINKING MULTITROPHIC INTERACTIONS ABOVE-BELOWGROUND	I	282	24/08/00	16:30	CC		6	PS	6
Putter, T.	767	HYPERTEXT WRITING COMES OF AGE: ECOLOGY KNOWLEDGE PROCESSING AT THE DAWN OF THE MILLENIUM	I	194	23/08/00	14:30	Bol	T	5	4	5
Putter, T.	93	TOWARDS AN INTERNATIONAL PROGRAMME ON POLLINATORS AND THEIR ROLE IN ECOSYSTEM RESILIENCE	I	24	22/08/00	10:00	HB	A	2	3	2
Pyrcz, T. W.	544	MEASURING DIVERSITY OF CLOUD FOREST BUTTERFLIES ALONG ELEVATIONAL TRANSECTS - THE NEOTROPICAL TRIDE PRONOPHILINI (LEPIDOPTERA, NYMPHALIDAE, SATYRINAE)	I	138	24/08/00	16:30	CC		3	PS	3
Pyrcz, T. W.	1952	VERTICAL DISTRIBUTION OF CLOUD FOREST PRONOPHILINAE BUTTERFLIES IN MONTE ZERPA, CORDILLERA DE MERIDA, VENEZUELA	I	492	24/08/00	16:30	CC		10	PS	10
Pyza, E.	2489	CELLULAR CIRCADIAN RHYTHMS IN THE FLY'S VISUAL SYSTEM	II	629	24/08/00	16:30	CC		13	PS	13
Pyza, E.	3271	CELLULAR CIRCADIAN RHYTHMS IN THE FLY'S VISUAL SYSTEM	II	826	23/08/00	14:20	HB	K	18	3	18
Qiao, C. L.	1267	INSECTICIDE RESISTANCE GENES IN CULEX PIPIENS COMPLEX MOSQUITOES FROM CHINA	I	320	24/08/00	15:50	HM	N	7	8	7
Qin, Q. L.	2436	TWO COLLAGENASES BEING SECRETED BY TERATOCYTES FROM MICROPLITIS MEDIATOR (HYMENOPTERA: BRACONIDAE) CULTURED IN VITRO*	II	615	22/08/00	16:30	CC		13	PS	13
Quan, G. X.	2305	CHARACTERIZATION OF GENOMIC GENE ENCODING KYNURENINE 3-MONOOXYGENASE IN THE SILKWORM BOMBYX MORI	I	582	24/08/00	16:30	CC		12	PS	12
Quan, Z.	3265	RECENT PROGRESS IN THE TRANSGENESIS OF SILKWORM, BOMBYX MORI AND APPLICATION TO THE GENOME PROJECT	II	825	22/08/00	10:35	HB	K	18	2	18
Queirós, M. R.	2129	WHITEFLIES AND THEIR PARASITOIDS' STATEMENTS IN HORTICULTURAL PROTECTED CROPS IN PORTUGAL	I	537	24/08/00	16:30	CC		11	PS	11
Queiroz, J. M.	807	ANT-WHITEFLY INTERACTION IN A NEOTROPICAL FOREST: ANT ATTENDANCE REDUCES FUNGAL AND PARASITOID ATTACK	I	204	24/08/00	14:35	HB	F	6	2	6
Queiroz, J. M.	1119	DISTRIBUTION WITHIN PLANT, SURVIVORSHIP AND MORTALITY SOURCES OF IMMATURE STAGES OF A TROPICAL LEAFMINER	I	282	24/08/00	16:30	CC		6	PS	6
Queiroz, M. E. L. R.	4079	EFFECT OF THE SPRAYING TEMPERATURE ON THE DEGRADATION AND BIOLOGICAL EFFECTIVENESS OF PIRIMIPHOS-METHYL ON STORED GRAINS	II	1030	22/08/00	16:30	CC		23	PS	23
Querino, R. B.	796	TOWARDS A DATABASE FOR THE TRICHOGRAMMA SPECIES, THEIR HOSTS AND PLANT ASSOCIATIONS IN THE SOUTH AMERICA	I	201	24/08/00	16:30	CC		5	PS	5
Querino, R. B.	2238	IDENTIFICATION OF TRICHOGRAMMA BASED ON THE SEQUENCE OF THE ITS2 REGION OF THE rDNA, WITH A NEW RECORD FROM BRAZIL	I	565	22/08/00	16:30	CC		12	PS	12
Querino, R. B.	1628	THE USE OF SUCTION TRAP TO COLLECT TRICHOGRAMMA SPECIES	I	410	22/08/00	16:30	CC		8	PS	8
Querino, R. B.	1629	CHARACTERIZATION OF THREE SPECIES OF THE GENUS TRICHOGRAMMA	I	411	22/08/00	16:30	CC		8	PS	8
Quesada-Allué, L. A.	2386	ß-ALANYL DERIVATIVES IN CUTICLE AND NEURAL TISSUE	II	603	25/08/00	15:50	HB	I	13	9	13
Quesada-Allué, L. A.	2484	EVIDENCE FOR A CATECHOL-•-ALANYL LIGASE IN INSECTS	II	627	24/08/00	16:30	CC		13	PS	13

Sub-titles: (HB=Hotel Bourbon) - (HM=Hotel Mabu) - (CC=Convention Center) - (Bol=Foz Boulevard) - (PS=Poster Session) - (PL=Plenary Lecturer)

AUTHOR	Nº	TITLE	Book	Page	Date	Time	Local	Room	Session	Symp	New Session
Quesada-Allué, L. A.	2519	METABOLISM OF GLYCOGEN DURING THE METAMORPHOSIS OF THE MEDFLY, CERATITIS CAPITATA	II	636	25/08/00	16:30	CC		13	PS	13
Quesada-Allué, L. A.	2397	EFFECT OF PHLOXIN "B" INGESTION IN IMMATURE STAGES OF THE MEDFLY, CERATITIS CAPITATA	II	606	21/08/00	16:30	CC		13	PS	13
Quicke, D.	383	APPROACHES TO MEGADIVERSITY GROUPS: LESSONS FROM PARASITOIDA	I	97	21/08/00	14:00	HB	C	3	I	3
Quicke, D. L.	2335	EVOLUTIONARY TRENDS ON MALE GENITAL STRUCTURES OF CHALCOSHNAE (LEPIDOPTERA: ZYGAENIDAE)	I	589	25/08/00	16:30	CC		12	PS	12
Quicke, D. L. J.	545	TRADITIONAL AND MOLECULAR APPROACHES TO GLOBAL HYMENOPTERA TAXONOMY	I	138	24/08/00	16:30	CC		3	PS	3
Quicke, D. L. J.	2180	HYMENOPTERA DNA TELLS ALL, WELL, ALMOST ALL	I	550	22/08/00	11:05	HB	L	12	3	12
Quicke, D. L. J.	3101	WASPS ET AL. (HYMENOPTERA) AND THEIR SPERM: THERE ARE PHYLOGENETIC CHARACTERS AFTER ALL	II	782	26/08/00	15:15	HB	G	16	9	16
Quicke, D. L. J.	1807	HOST LOCATION AND OVIPOSITION IN THE ORUSSIDAE (HYMENOPTERA), A BASAL PARASITIC WASP FAMILY	I	455	25/08/00	16:30	CC		9	PS	9
Quilici, S.	1437	PARASITOIDS OF CITRUS PESTS IN REUNION ISLAND (INDIAN OCEAN)	I	363	22/08/00	10:05	HM	O	8	3	8
Quilici, S.	1630	PARASITOIDS OF CITRUS PESTS IN REUNION ISLAND (INDIAN OCEAN)	I	411	24/08/00	16:30	CC		8	PS	8
Quillien, L.	2490	APHIDS AND APHID PROTEASES AS NON-CONVENTIONAL TARGETS FOR PROTEASE INHIBITOR TRANSGENES USED FOR CONTROLLING PHLOEM-FDEEDING INSECTS	II	629	24/08/00	16:30	CC		13	PS	13
Quinet, Y.	3536	CONTACT POISONS IN THE ANT GENUS CREMATOGASTERY: CHEMICAL DIVERSITY AND BIOLOGICAL FUNCTIONS	II	892	24/08/00	16:30	CC		19	PS	19
Quinn, J.	754	THE INTER-AMERICAN BIODIVERSITY INFORMATION NETWORK - ITS DEVELOPMENT AND ENTOMOLOGICAL FUTURE	I	190	22/08/00	10:35	Bol	T	5	2	5
Quintana, D. A.	2062	CONTROL OF PINE SHOOTS MOOTH IN MONTERREY PINE WITH ENTOMOPATHOGENIC FUNGI	I	520	22/08/00	16:30	CC		11	PS	11
Quintela, E. D.	1120	RELATIONSHIP BETWEEN BEMISIA SPP. DENSITY AND DAMAGE IN DRY BEAN (PHASEOLUS VULGARIS)	I	282	24/08/00	16:30	CC		6	PS	6
Quintela, E. D.	1121	BIOLOGY OF BEMISIA ARGENTIFOLII ON DRY BEAN (PHASEOLUS VULGARIS)	I	283	24/08/00	16:30	CC		6	PS	6
Quintela, E. D.	2609	MANAGING HETEROPTERAN PESTS OF BEANS (COWPEA, PIGEONPEA AND COMMOM BEAN) IN THE TROPICS	II	659	26/08/00	14:00	HB	B	14	9	14
Quirán, E.	1570	NEOTROPICAL MYRMECOPHILIC DIAPRIID WASPS ASSOCIATED WITH MYRMICINAE AND FORMICINAE ANTS (HYMENOPTERA, PROCTOTRUPOIDEA, DIAPRIIDAE)	I	396	23/08/00	16:30	CC		8	PS	8
Quirós-González, M. J.	61	DAMAGE AND POPULATION DISTRIBUTION OF BREVIPALPUS PHOENICIS ON GUAVA FRUIT, PSIDIUM GUAJAVA	I	16	24/08/00	16:30	CC		1	PS	1
Quiroz, C.	3964	EVALUATION OF RESISTANT CLONES OF POTATO WITH AND WITHOUT CHEMICAL PROTECTION, AGAINST THE POTATO TUBER MOTH	II	1000	22/08/00	16:30	CC		22	PS	22
Quisenberry, S. S.	2311	GENETIC VARIATION OF EUROPEAN CORN BORER (OSTRINIA NUBILALIS) POPULATIONS IN NEBRASKA DETECTED BY RANDOM AMPLIFIED POLYMORPHIC DNA (RAPD)	I	583	24/08/00	16:30	CC		12	PS	12
Quisenberry, S. S.	2442	CHARACTERIZATION OF PROTEIN CHANGES IN BUFFALOGRASSES CHALLENGED BY CHINCH BUG FEEDING	II	617	22/08/00	16:30	CC		13	PS	13
R. J. Dillon	XII	Reassessment of the role of the gut microflora in insects	I	LI	24/08/00	8:00	HM			PL	
Raab, R. T.	3984	ACCELERATING ADOPTION OF AGRICULTURAL RECOMMENDATIONS THROUGH PARTNERSHIPS BETWEEN GOs, NGOs, And Pos	II	1005	24/08/00	16:30	CC		22	PS	22
Rabelo, K. C. C.	1523	ECOLOGICAL ASPECTS AND DAMAGE EVALUATION OF FUIT FLIES IN CAGAITA IN THE SAVANNAS OF GOIAS STATE, BRAZIL.	I	384	21/08/00	16:30	CC		8	PS	8
Rabindra, R. J.	2066	FIELD TRIALS ON THE EFFICACY AND PERSISTENCE OF IMPROVED FORMULATIONS OF NUCLEAR POLYHEDROSIS VIRUS AGAINST HELICOVERPA ARMIGERA ON CHICKPEA	I	521	22/08/00	16:30	CC		11	PS	11
Rabindra, R. J.	2067	FIELD EVALUATION OF IMPROVED FORMULATIONS OF NUCLEAR POLYHEDROSIS VIRUS AGAINST HELICOVERPA ARMIGERA ON COTTON	I	521	22/08/00	16:30	CC		11	PS	11
Rabindran, R.	2830	PEST AND DISEASE MANAGEMANT IN HYBRID RICE	II	714	22/08/00	16:30	CC		14	PS	14
Rabossi, A.	2519	METABOLISM OF GLYCOGEN DURING THE METAMORPHOSIS OF THE MEDFLY, CERATITIS CAPITATA	II	636	25/08/00	16:30	CC		13	PS	13
Rabossi, A.	2397	EFFECT OF PHLOXIN "B" INGESTION IN IMMATURE STAGES OF THE MEDFLY, CERATITIS CAPITATA	II	606	21/08/00	16:30	CC		13	PS	13
Raccah, B.	2075	DIFFERENTIAL TRANSMISSION OF ZUCCHINI YELLOW MOSAIC VIRUS AND TURNIP MOSAIC MOSAIC VIRUS BY MYZUS PERISCAE AND BREVICORYNE BRASSICAE	I	523	22/08/00	16:30	CC		11	PS	11
Racette, G.	1300	EFFECTS OF SEVERAL FUNGICIDES ON THE PREDACIOUS MITE AMBLYSEIUS FALLACIS (ACARI: PHYTOSEIIDAE) IN QUEBEC APPLE ORCHARDS	I	328	21/08/00	16:30	CC		7	PS	7
Rachadi, T.	1042	DEFORESTATION, DROUGHT AND EXCEPTIONAL OUTBREAKS OF THE ORIENTAL MIGRATORY LOCUST, LOCUSTA MIGRATORIA MANILENSIS (MEYEN 1835) IN INDONESIA	I	263	23/08/00	16:30	CC		6	PS	6
Rachadi, T.	892	RAINFALL AND RECENT OUTBREAKS OF THE AFRICAN MIGRATORY LOCUST IN THE LAKE CHAD BASIN	I	225	21/08/00	16:30	CC		6	PS	6
Radcliffe, E. B.	3240	APHID ALERT: RESEARCH/OUTREACH ADDRESSING POTATO VIRUS PROBLEMS IN THE NORTH CENTRAL U.S.	II	818	24/08/00	16:30	CC		17	PS	17
Radomyska, E.	215	EFFECT OF THE GRAIN APHID FEEDING ON POLYSACCHARIDE CONTENT IN EARS OF WINTER TRITICALE CULTIVARS	I	55	22/08/00	16:30	CC		2	PS	2
Raetano, C. G.	322	DIFFERENT PESTICIDE APPLICATION METHODS IN CONTROL OF WHITEFLY AND LEAFMINER ON TOMATO PLANTS UNDER VINYL HOUSE	I	82	24/08/00	16:30	CC		2	PS	2
Raetano, C. G.	323	INFLUENCE OF DIFFERENT APPLICATION METHODS AND DOSAGES OF THIAMETHOXAM IN THRIPS CONTROL	I	82	24/08/00	16:30	CC		2	PS	2
Raetano, C. G.	369	EFFICIENCY AND RESIDUAL OF DIFFERENT ACEPHATE FORMULATIONS IN CONTROL OF GREEN-PEACH APHIDS ON PEPPER'S CROP	I	93	25/08/00	16:30	CC		2	PS	2
Raetano, C. G.	370	EFFICIENCY OF FENPROPATHRIN AND CHLORFLUAZURON IN CONTROL OF NEOLEUCINODES ELEGANTALIS (LEPIDOPTERA: PYRALIDAE) ON TOMATO'S CROP	I	94	25/08/00	16:30	CC		2	PS	2
Rafael, J. A.	969	DAILY AND SEASONAL ACTIVITY OF HORSE FLIES (DIPTERA:TABANIDAE) ATTACKING REPTILES: CAIMAN CROCODILUS (ALLIGATORIDAE) AND EUNECTES MURINUS (BOIDAE), IN AN ANTHROPOGENIC CLEARING IN CENTRAL AMAZON, BRAZIL	I	245	22/08/00	16:30	CC		6	PS	6
Rafael, J. A.	400	THE AMAZONIAN TABANIDAE AND PIPUNCULIDAE (DIPTERA)	I	102	22/08/00	15:50	HB	C	3	2	3
Rafalimanana, H.	1557	SUBLETHAL EFFECTS OF INSECTICIDES ON THE BEHAVIOUR OF TWO PARASITOIDS : INFLUENCE OF INDIVIDUAL EXPERIENCE AND GENETIC VARIABILITY	I	393	22/08/00	16:30	CC		8	PS	8
Raffaini, G. B.	1095	DIURNAL AND NOCTURNAL DRIFT OF AQUATIC INSECTS	I	276	24/08/00	16:30	CC		6	PS	6
Raffo, M. D.	2791	INTEGRATED PEST MANAGEMENT OF NECTARINES IN THE RIO NEGRO VALLEY OF ARGENTINA	II	705	24/08/00	16:30	CC		14	PS	14
Raga, , A.	1156	DISTRIBUTION OF SCAPTOCORIS CASTANEA (HEMIPTERA: CYDNIDAE) POPULATION IN THE SOIL IN FLORÍNEA COUNTY, STATE OF SÃO PAULO, BRAZIL	I	291	22/08/00	16:30	CC		6	PS	6
Raga, , A.	2148	EPIZOOTY OF NOMURAEA RILEYI IN SPODOPTERA FRUGIPERDA LARVAE IN THE CORN CROP, ZEA MAYS	I	542	25/08/00	16:30	CC		11	PS	11
Raga, A.	1386	THIAMETHOXAM TO CONTROL CITRUS LEAFMINER IN TANGOR MURCOTT	I	350	24/08/00	16:30	CC		7	PS	7

Sub-titles: (HB=Hotel Bourbon) - (HM=Hotel Mabu) - (CC=Convention Center) - (Bol=Foz Boulevard) - (PS=Poster Session) - (PL=Plenary Lecturer)

AUTHOR	Nº	TITLE	Book	Page	Date	Time	Local	Room	Session	Symp	New Session
Raga, A.	1122	SURVEYS ON BEMISIA ARGENTIFOLII WITH STICK TRAPS IN COTTON CULTIVATIONS IN MIGUELÓPOLIS - S.P - BRAZIL	I	283	24/08/00	16:30	CC		6	PS	6
Raga, A.	1167	HOST PLANTS OF ZAPRIONUS INDIANUS IN THE STATE OF SÃO PAULO, BRAZIL	I	294	25/08/00	16:30	CC		6	PS	6
Raga, A.	3955	ANASTREPHA FRATERCULUS (DIP.: TEPHRITIDAE) INFESTATION IN STRAWBERRIES IN THE STATE OF SÃO PAULO, BRAZIL	II	998	22/08/00	16:30	CC		22	PS	22
Ragsdale, D. W.	3240	APHID ALERT: RESEARCH/OUTREACH ADDRESSING POTATO VIRUS PROBLEMS IN THE NORTH CENTRAL U.S.	II	818	24/08/00	16:30	CC		17	PS	17
Raguraman, S.	2792	COMPATIBILITY OF NEEM PESTICIDES WITH PARASITOIDS -- A REALISTIC APPROACH IN IPM	II	705	24/08/00	16:30	CC		14	PS	14
Raguraman, S.	2793	MANAGEMENT OF SUCKING INSECT PESTS IN COTTON ECOSYSTEM WITH A NEW SYSTEMIC MOLECULE, ACETAMIPRID	II	705	24/08/00	16:30	CC		14	PS	14
Raguraman, S.	363	SPINOSAD - A NEW BIOMOLECULE FOR MANAGEMENT OF BOLL WORM IN COTTON ECOSYSTEM	I	92	25/08/00	16:30	CC		2	PS	2
Raguraman, S.	2654	AMELIORATIVE EFFECT OF NEEM AND OTHER BOTANICALS ON THE RESURGENCE OF RICE BROWN PLANTHOPPER, NILAPARVATA LUGENS AND ITS SYMBIONTS	II	670	21/08/00	16:30	CC		14	PS	14
Ragusa, S.	62	LABORATORY STUDIES ON THE LIFE HISTORY, POST-EMBRYONIC SURVIVAL AND OVIPOSITION OF THE PREDACEOUS MITE CYDNODROMUS SP. [ACARINA: PHYTOSEIIDAE] ON DIFFERENT KINDS OF FOOD SUBSTANCES	I	16	24/08/00	16:30	CC		1	PS	1
Raguso, R. A.	575	CHEMISTRY OF OLFACTORY LANDSCAPES; ODOR SIGNAL COMPLEXITY, EVOLUTIONARY CONVERGENCE AND DECEPTION	I	146	21/08/00	9:15	Bol	S	4	1	4
Raguso, R. A.	607	PLASTICITY OF OLFACTORY AND BEHAVIORAL RESPONSES OF HAWKMOTHS TO FLORAL FRAGRANCE	I	154	23/08/00	15:05	Bol	S	4	5	4
Rahavard, M.	2306	CLONING FULL-LENGTH cDNAs ENCODING TWO NOVEL INSECT HYPERACTIVE ANTIFREEZE PROTEIN ISOFORMS FROM SPRUCE BUDWORM	I	582	24/08/00	16:30	CC		12	PS	12
Rahbé, Y.	2490	APHIDS AND APHID PROTEASES AS NON-CONVENTIONAL TARGETS FOR PROTEASE INHIBITOR TRANSGENES USED FOR CONTROLLING PHLOEM-FDEEDING INSECTS	II	629	24/08/00	16:30	CC		13	PS	13
Rahbé, Y.	1404	INSECTICIDAL ACTIVITY AND MOLECULAR TARGETS OF LEGUME LECTINS ON THE PEA APHID, ACYRTHOSIPHON PISUM	I	354	25/08/00	16:30	CC		7	PS	7
Rahbé, Y.	2364	PHYSIOLOGICAL AND NUTRITIONAL INTERACTIONS BETWEEN THE PEA APHID AND THE ENDOPHAGOUS BRACONID APHIDIUS ERVI	II	597	24/08/00	9:50	HB	I	13	6	13
Rahbé, Y.	3952	EXAMINATION OF PROTEINASE AND PROTEINASE INHIBITOR ACTIVITIES IN THE APHID APHIS GOSSYPII	II	997	22/08/00	16:30	CC		22	PS	22
Raikhel, A	2358	GENOMIC STRUCTURE AND ECDYSONE REGULATION OF THE PROPHENOLOXIDASE 1 GENE IN THE MALARIA VECTOR ANOPHELES GAMBIAE	II	596	23/08/00	14:20	HB	I	13	5	13
Raikhel, A. S.	2491	OOCYTE RECEPTORS FOR THE SPECIFIC ACCUMULATION OF YOLK PROTEINS	II	629	24/08/00	16:30	CC		13	PS	13
Raikhel, A. S.	2917	ENGINEERING BLOOD MEAL-ACTIVATED SYSTEMIC IMMUNITY USING FAT BODY-SPECIFIC GENES IN THE MOSQUITO VECTOR	II	736	24/08/00	15:05	Bol	R	15	8	15
Raikhel, A. S.	3305	OOCYTE RECEPTORS FOR THE SPECIFIC ACCUMULATION OF YOLK PROTEINS	II	835	25/08/00	16:05	HB	K	18	7	18
Raikhel, A. S.	3301	ECDYSTEROID-TRIGGERED REGULATORY HIERARCHIES IN INSECT REPRODUCTION	II	834	25/08/00	14:05	HB	K	18	7	18
Raimundo, R.	973	MAPPING, SURVEYING AND MODELLING INSECTS USING GIS TOOLS. CASE STUDY: CERAMBYX CERDO AND CERAMBYX VELUTINUS (COLEOPTERA: CERAMBYCIDAE) IN ALQUEVA DAM- PORTUGAL	I	246	22/08/00	16:30	CC		6	PS	6
Rajagopal, D.	3391	ECONOMICALLY IMPORTANT TERMITE SPECIES IN INDIA	II	856	21/08/00	11:05	HM	Q	19	1	19
Raje, S.	3537	UTILIZATION OF WILD SILKWORMS AS A TOOL FOR RURAL DEVELOPMENT	II	892	24/08/00	16:30	CC		19	PS	19
Raju, A. J. S.	97	THE STATUS OF POLLINATORS AND BIODIVERSITY IN ASIA: AN OVERVIEW	I	25	22/08/00	11:30	HB	A	2	3	2
Rajyashri, K. R.	3980	MAPPING, TAGGING, MARKER-ASSISTED SELECTION AND MAP-BASED GENE CLONING OF GALL MIDGE RESISTANCE GENES IN RICE	II	1004	24/08/00	16:30	CC		22	PS	22
Ram, P.	1345	STATUS OF INSECTICIDE RESISTANCE IN HELICOVERPA ARMIGERA POPULATIONS FROM AREAS WITH DIFFERENT INSECTICIDE-USE REGIMES	I	339	23/08/00	16:30	CC		7	PS	7
Ram, P.	1346	SUSCEPTIBILITY OF HELICOVERPA ARMIGERA EGGS TO SOME COMMONLY USED INSECTICIDES	I	340	23/08/00	16:30	CC		7	PS	7
Ramaekers, A.	2342	DROSOPHILA METABOTROPIC GLUTAMATE RECEPTORS: STRUCTURE AND FUNCTIONS	II	592	21/08/00	13:35	HB	I	13	2	13
Ramalho, F. S.	1984	EFFECT OF FEEDING ON THREE EUCALYPTUS SPECIES ON THE DEVELOPMENT OF BRONTOCORIS TABIDUS (HET.: PENTATOMIDAE) FED WITH TENEBRIO MOLITOR (COL.: TENEBRIONIDAE)	I	500	25/08/00	16:30	CC		10	PS	10
Ramaswamy, S. B.	3361	MODULATORS OF EGG MATURATION AND LONGEVITY IN HELIOTHIS VIRESCENS	II	849	24/08/00	16:30	CC		18	PS	18
Ramaswamy, S. B.	254	SOYBEAN STEM BORER IN KANSAS: LIFE HISTORY, SAMPLING, AND SEVERITY OF RECENT INFESTATIONS	I	65	23/08/00	16:30	CC		2	PS	2
Ramaswamy, S. B.	911	DISPERSAL OF EUROPEAN AND SOUTHWESTERN CORN BORER MOTHS WITHIN AND BETWEEN CORNFIELDS	I	230	21/08/00	16:30	CC		6	PS	6
Ramil, F.	555	PRELIMINARY CHECK LIST OF ISOPODA (ARTHROPODA: CRUSTACEA) IN RÍA DE VIGO (NO ESPAÑA)	I	140	22/08/00	16:30	CC		3	PS	3
Ramírez G., M. E.	1384	RELATION DOSE-LETHALITY OF THREE PESTICIDES ON VARROA JACOBSONI (GAMASIDA: VARROIDAE) AND APIS MELLIFERA (HYMENOPTERA: APIDAE): COMPARISON OF TWO ADMINISTRATION METHODS	I	349	24/08/00	16:30	CC		7	PS	7
Ramírez, C. C.	2232	GENETIC CONSTRAINTS IN THE SPECIALIZATION PATTERN OF AN APHID	I	563	22/08/00	16:30	CC		12	PS	12
Ramirez, L. A.	4103	IMPACT OF URBANIZATION ON AN INSECT/PLANT INTERACTION: BRUCHID BEETLES ON BLUE PALO VERDE	II	1036	24/08/00	16:30	CC		23	PS	23
Ramirez, S.	653	CONTACT CHEMICAL CUES RELEASED BY ADULTS OF NEZARA VIRIDULA HAVE A KAIROMONAL EFFECT ON THE EGG PARASITOID TRISSOLCUS BASALIS: A CHROMATOGRAPHIC INVESTIGATION	I	165	22/08/00	16:30	CC		4	PS	4
Ramiro, Z. A.	1122	SURVEYS ON BEMISIA ARGENTIFOLII WITH STICK TRAPS IN COTTON CULTIVATIONS IN MIGUELÓPOLIS - S.P - BRAZIL	I	283	24/08/00	16:30	CC		6	PS	6
Ramiro, Z. A.	2794	USE OF THIAMETHOXAM IN THE BEMISIA SPP (HOMOPTERA: ALEYRODIDAE) CONTROL IN CULTIVATION OF VEGETABLES AND COTTON, IN MONITORED AREAS	II	705	25/08/00	16:30	CC		14	PS	14
Ramiro, Z. A.	2795	FOLIAR AREA CONSUMPTION BY THE WORM, ANTICARSIA GEMMATALIS IN SOYBEAN CULTIVATION	II	706	25/08/00	16:30	CC		14	PS	14
Ramos, M. E.	2015	MANIPULATION OF SPRAY PARAMETERS TO IMPROVE EFFICACY OF MYCOINSECTICIDES AGAINST INSECT PESTS OF FIELD CROPS	I	508	23/08/00	15:05	HM	P	11	6	11
Ramos, M. E.	2165	MANIPULATION OF SPRAY PARAMETERS TO IMPROVE EFFICACY OF MYCOINSECTICIDES AGAINST INSECT PESTS OF FIELD CROPS	I	546	25/08/00	16:30	CC		11	PS	11
Ramos, R. C. P.	3833	DIPTERA CALIPTRATA SUCESSION IN A CARCASS OF SUS SCROFA, IN TWO ECOSYSTEMS OF RIO DE JANEIRO, RJ	II	967	24/08/00	16:30	CC		21	PS	21

Sub-titles: (HB=Hotel Bourbon) - (HM=Hotel Mabu) - (CC=Convention Center) - (Bol=Foz Boulevard) - (PS=Poster Session) - (PL=Plenary Lecturer)

AUTHOR	N°	TITLE	Book	Page	Date	Time	Local	Room	Session	Symp	New Session
Ramos, S.	207	CHARACTERIZATION OF GREENBUG POPULATIONS COLLECTED IN ARGENTINA AND CHILE	I	53	22/08/00	16:30	CC		2	PS	2
Ramos, V. M.	2675	ANALYSIS OF RESIDUES OF SULFLURAMIDA IN GRASS AND SOIL AS WELL AS EFFICIENCY OF THE PRODUCT "MIREX-S MAX" IN THE CONTROL OF ATTA CAPIGUARA (HYMENOPTERA: FORMICIDAE)	II	676	22/08/00	16:30	CC		14	PS	14
Ramos-Elorduy B., J.	4116	EDIBLE COLEOPTERA OF THE WORLD	II	1040	25/08/00	9:35	HM	Q	24	1	24
Ramos-Elorduy B., J.	4143	USE OF INSECTS AS BIOTRANSFORMERS	II	1046	21/08/00	16:30	CC		24	PS	24
Ramos-Elorduy B., J.	4144	MEDICINAL INSECTS	II	1047	21/08/00	16:30	CC		24	PS	24
Rampini, M.	3785	A PHYLOGENETIC STUDY IN THE CAVE CRICKET GENUS TROGLOPHILUS (ORTHOPTERA, RAPHIDOPHORIDAE): COMBINING ALLOZYMIC AND MITOCHONDRIAL DNA SEQUENCE VARIATION DATA	II	955	23/08/00	16:30	CC		21	PS	21
Randolph, S. E.	2894	CO-FEEDING: EPIDEMIOLOGICAL SIGNIFICANCE FOR TICK-BORNE PATHOGEN TRANSMISSION	II	730	22/08/00	16:05	Bol	R	15	4	15
Randolph, S. E.	2902	SAME VECTOR, SIMILAR HOSTS, DIFFERENT PATHOGENS: CONTRASTING RISK MAPS OF LYME BORRELIOSIS AND TICK-BORNE ENCEPHALITIS ACROSS EURASIA	II	732	23/08/00	14:05	Bol	R	15	6	15
Randolph, S. E.	2906	INTEGRATING REMOTELY-SENSED DATA INTO BIOLOGICAL MODELS OF TRYPANOSOME TRANSMISSION IN AFRICA	II	733	23/08/00	15:50	Bol	R	15	6	15
Range, S.	2492	JUVENILE HORMONE BIOSYNTHESIS AND REGULATION OF VITELLOGENESIS IN THE FALL ARMYWORM, SPODOPTERA FRUGIPERDA (LEPIDOPTERA: NOCTUIDAE)	II	629	24/08/00	16:30	CC		13	PS	13
Rangel, E. F.	2926	PHLEBOTOMINE SANDFLIES TRANSMITTING LEISHMANIA IN CHANGING ENVIRONMENTS IN BRAZIL	II	738	25/08/00	11:05	Bol	R	15	9	15
Rango, J. J.	4104	PATCH ISOLATION AND PRIORITY EFFECTS AND THE STRUCTURE OF ARTHROPOD COMMUNITIES INHABITING CREOSOTE BUSH IN CENTRAL ARIZONA	II	1036	24/08/00	16:30	CC		23	PS	23
Ranieri, B. D.	1922	RESIN-COLLECTING BEES (HYMENOPTERA, APIDAE) ON CLUSIA PALMICIDA (CLUSIACEAE) IN A RIPARIAN FOREST IN BRAZIL	I	484	22/08/00	16:30	CC		10	PS	10
Rankin, M. A.	2468	FLIGHT INDUCED LIPID MOBILIZATION AND ENHANCED REPRODUCTION IN MELANOPLUS SANGUINIPES	II	623	23/08/00	16:30	CC		13	PS	13
Rankin, M. A.	1030	MIGRATORY SPECIES, INDIVIDUAL VARIATION IN MIGRATORY TENDENCY: CORRELATIONS WITH RESOURCE STORAGE AND MOBILIZATION	I	260	23/08/00	16:30	CC		6	PS	6
Rankin, S. M.	3256	FMRFAMIDE-LIKE MATERIAL IN THE EARWIG, EUBORELLIA ANNULIPES, AND ITS FUNCTIONAL SIGNIFICANCE	II	822	21/08/00	14:00	HB	K	18	1	18
Ranson, H.	1387	GENETIC MAPPING OF LOCI AFFECTING RESISTANCE TO INSECTICIDES IN ANOPHELES GAMBIAE	I	350	24/08/00	16:30	CC		7	PS	7
Ranson, H.	1376	DDT- AND ORGANOPHOSPHATE-RESISTANCE IN ANOPHELES GAMBIAE MEDIATED BY GLUTATHIONE S-TRANSFERASE GENES	I	347	24/08/00	16:30	CC		7	PS	7
Ranz, J. M.	2213	TRANSPOSONS ARE IMPLICATED IN THE GENERATION OF NATURAL CHROMOSOMAL REARRANGEMENTS IN INSECTS	I	559	24/08/00	16:15	HB	L	12	8	12
Rao, A.	1123	IMPACT OF AREA ON THE BEHAVIORAL INTERACTIONS OF SOLENOPSIS INVICTA AND MONOMORIUM MINIMUM COLONIES	I	283	24/08/00	16:30	CC		6	PS	6
Rao, D. K.	3368	SPERM TRANSFER AND PRECEDENCE IN THE COMMON CUTWORM, SPODOPTERA LITURA: AN IMPORTANT FACTOR IN OPTIMIZATION OF F-1 STERILITY TECHNIQUE FOR PEST SUPPRESSION	II	850	21/08/00	16:30	CC		18	PS	18
Rao, J.	2597	INTEGRATED MANAGEMENT OF KEY INDIAN RICE INSECT PESTS	II	656	25/08/00	11:05	HB	B	14	8	14
Rao, J.	2789	INTEGRATED MANAGEMENT OF KEY INDIAN RICE INSECT PESTS	II	704	24/08/00	16:30	CC		14	PS	14
Rapisarda, C.	1631	TEN YEARS OF STUDIES ON PARASITOIDS OF THE PEAR PSYLLA, CACOPSYLLA PYRI, IN SICILY (RHYNCHOTA PSYLLOIDEA)	I	411	24/08/00	16:30	CC		8	PS	8
Rappaport, N.	52	THE UNIQUE INSECT BIODIVERSITY OF THE KLAMATH/SISKIYOU MOUNTAIN REGION IN NW USA; CHALLENGES FOR INVENTORY AND CONSERVATION	I	13	24/08/00	16:30	CC		1	PS	3
Rasam, M.	580	PHEROMONE BINDING PROTEINS: STRUCTURAL, FUNCTIONAL AND GENETIC IMPERATIVES IN TORTRICID MOTHS	I	147	21/08/00	15:00	Bol	S	4	1	4
Rashkovan, V. M.	290	HF-ENERGY INFLUENCE ON GRANARY PESTS	I	74	23/08/00	16:30	CC		2	PS	2
Rasplus, J.-Y.	1913	CARABID BEETLES AS MODEL ORGANISMS IN POPULATION GENETIC STUDIES ON HIGHLY FRAGMENTED TEMPERATE FORESTS (FLANDERS, BELGIUM)	I	482	21/08/00	16:30	CC		10	PS	10
Raspudić, E.	324	BT CORN IN CONTROLING ECB IN CROATIA	I	82	24/08/00	16:30	CC		2	PS	2
Raspudić, E.	2711	ECB (OSTRINIA NUBILALIS) AND WCR (DIABROTICA VIRGIFERA VIRGIFERA) IN EAST SLAVONIA (CROATIA)	II	685	22/08/00	16:30	CC		14	PS	14
Rassmann, W	3949	EXTREME TEMPERATURES FOR RAPID AND NON-TOXIC STORED PRODUCT PROTECTION	II	997	21/08/00	16:30	CC		22	PS	22
Rastrya, S. T.	1624	THE EFFECT OF THE ADDITION OF AMINO ACIDS TO THE TOXICITY OF BACILLUS THRUINGIENSIS AGAINST PLUTELLA XYLOSTELLA LARAVE	I	409	22/08/00	16:30	CC		8	PS	8
Ratcliffe, B.	392	DUNG BEETLES OF CENTRAL AMAZONIAN FLOODPLAINS	I	100	22/08/00	13:35	HB	C	3	2	3
Ratcliffe, B. C.	3678	A FAUNISTIC SURVEY OF THE DYNASTINAE (COLEOPTERA: SCARABAEIDAE) OF CENTRAL AMERICA	II	929	24/08/00	16:20	HB	E	21	7	21
Ratcliffe, S. T.	159	CROP ROTATION COLLAPSES AS A VIABLE PEST MANAGEMENT STRATEGY FOR WESTERN CORN ROOTWORMS, DIABROTICA VIRGIFERA VIRGIFERA LECONTE, IN THE EASTERN CORN BELT OF THE USA	I	41	26/08/00	14:05	HB	A	2	11	2
Rattes, J. F.	325	SAMPLING PARASITIC EGGS OF PHYTOPHAGOUS STINKBUGS IN SOYBEAN [GLYCINE MAX] CROPS IN THE SOUTHWEST REGION OF GOIAS	I	82	24/08/00	16:30	CC		2	PS	2
Rattes, J. F.	2796	INSECTICIDES AND PLASTER USED FOR CONTROLLING BROWNY STINKBUG (SCAPTOCORIS CASTANEA) POPULATIONS IN CORN CROPS IN THE SOUTHWEST REGION OF GOIÁS	II	706	24/08/00	16:30	CC		14	PS	14
Rattes, J. F.	2797	EFFICIENCY OF INSECTICIDES AND GYPSUM IN THE CONTROL OF BROWN STINK BUGS (SCAPTOCORIS CASTANEA) IN CORN, IN THE SOUTHEAST OF THE STATE OF GOIÁS	II	706	24/08/00	16:30	CC		14	PS	14
Raubenheimer, D.	3897	EFFECTS OF GLOBAL CHANGE ON PLANTS, INDIVIDUAL INSECTS AND IMPLICATIONS FOR POPULATION MODELS	II	984	23/08/00	14:05	HB	H	22	5	22
Ravary, F.	3362	POSSIBLE REPRODUCTIVE DIVISION OF LABOR IN THE THELYTOKOUS ANT CERAPACHYS BIROI	II	849	24/08/00	16:30	CC		18	PS	18
Ravikumar, G.	2493	IDENTIFICATION AND CHARACTERIZATION OF A LIPOPHORIN RECEPTOR FROM THE TERATOCYTES OF DINOCAMPUS COCCINELLAE	II	630	24/08/00	16:30	CC		13	PS	13
Raw, A.	91	THE INTERNATIONAL POLLINATORS INITIATIVE	I	24	22/08/00	9:35	HB	A	2	3	2
Razafindratsima, A.	958	SPREAD OF A MIGRATORY LOCUST PLAGUE IN MADAGASCAR	I	242	22/08/00	16:30	CC		6	PS	6
Razvi, S. A.	2617	EFFICACY OF PLANT EXTRACTS AGAINST NYMPHS OF WHITEFLY, BEMISIA TABACI GENNADIUS	II	661	21/08/00	16:30	CC		14	PS	14
Rea, J.	128	AGRICULTURAL AND NEIGHBORING SYSTEMS: LANDSCAPE EBB AND FLOW OF BIOTA	I	33	24/08/00	11:10	HB	A	2	7	2
Ready, P.D.	2926	PHLEBOTOMINE SANDFLIES TRANSMITTING LEISHMANIA IN CHANGING ENVIRONMENTS IN BRAZIL	II	738	25/08/00	11:05	Bol	R	15	9	15
Rebagliati, P. J.	2307	COMPARATIVE CYTOGENETICS IN ARGENTINE SPECIES OF PENTATOMINAE (PENTATOMIDAE, HETEROPTERA)	I	582	24/08/00	16:30	CC		12	PS	12
Rebelato, G. S.	4087	INCUBATION PERIOD AND EGGS VIABILITY OF LONOMIA OBLIQUA WALKER, 1855 (LEPIDOPTERA; SATURNIIDAE) IN LABORATORY	II	1032	23/08/00	16:30	CC		23	PS	23
Rebouças, L. M. C.	717	FEMALE SEX PHEROMONE OF CASTNIA LICUS (LEPIDOPTERA:CASTNIIDEA): IDENTIFICATION AND FIELD APPLICATION	I	181	24/08/00	16:30	CC		4	PS	4
Recco-Pimentel, S. M.	2235	POLYTENE CHROMOSOMES OF CULEX QUINQUEFASCIATUS (DIPTERA: CULICIDAE)	I	564	21/08/00	16:30	CC		12	PS	12

Sub-titles: (HB=Hotel Bourbon) - (HM=Hotel Mabu) - (CC=Convention Center) - (Bol=Foz Boulevard) - (PS=Poster Session) - (PL=Plenary Lecturer)

AUTHOR	Nº	TITLE	Book	Page	Date	Time	Local	Room	Session	Symp	New Session
Reckziegel, A.	654	SEX PHEROMONE OF THE BRAZILIAN APPLE LEAFROLLER, BONAGOTACRANAODES (LEPIDOPTERA: TORTRICIDAE): EFFECT OF GEOMETRICISOMERS ON MALE ATTRACTION TO (E,Z)-3,5-DODECADIENYL ACETATE	I	165	22/08/00	16:30	CC		4	PS	4
Redaelli, L. R.	1024	POPULATION DYNAMICS OF COSMOCLOPIUS NIGROANNULATUS (HEMIPTERA, REDUVIIDAE) IN NICOTIANA TABACUM	I	258	23/08/00	16:30	CC		6	PS	6
Redaelli, L. R.	3176	DESCRIPTION OF INTERNAL REPRODUCTIVE ORGANS OF COSMOCLOPIUS NIGROANNULATUS (HEMIPTERA, REDUVIIDAE)	II	801	24/08/00	16:30	CC		16	PS	16
Redaelli, L. R.	542	THYSANOPTERA DIVERSITY AT PARQUE ESTADUAL DE ITAPUÃ, VIAMÃO, RS, BRAZIL	I	137	24/08/00	16:30	CC		3	PS	3
Redak, R. A.	1103	DIPTERA COMMUNITY COMPOSITION AND SUCCESSION FOLLOWING HABITAT DISTURBANCE BY WILDFIRE	I	278	21/08/00	16:30	CC		6	PS	6
Rees, D.	1669	SUITABILITY OF AUSTRALIAN TRICHOGRAMMA SPECIES (HYMENOPTERA: TRICHOGRAMMATIDAE) FOR BIOLOGICAL CONTROL OF STORED PRODUCT MOTHS	I	421	25/08/00	16:30	CC		8	PS	8
Rees, H. H.	4	ECDYSTEROID SYNTHESIS AND ACTION IN THE IXODID TICKS	I	1	24/08/00	15:05	HB	F	1	1	1
Rees, M.	1154	MODELLING THE POPULATION INTERACTIONS BETWEEN THE CROWN WEEVIL MOGULONES LARVATUS AND ITS HOST PLANT ECHIUM PLANTAGINEUM	I	291	25/08/00	16:30	CC		6	PS	6
Reeson, A. F.	2164	COPING WITH CROWDS: THE EVOLUTION OF DENSITY-DEPENDENT RESISTANCE TO PATHOGENS	I	546	25/08/00	16:30	CC		11	PS	11
Reeves, N. L.	3152	ANALYSIS OF HUNCHBACK IN NASONIA VITRIPENNIS	II	795	23/08/00	16:30	CC		16	PS	16
Regier, J. C.	3695	MOLECULAR PHYLOGENY OF NOCTUOIDEA: THE NOCTUIDAE REDEFINED	II	933	26/08/00	10:35	HB	E	21	9	21
Regier, J. C.	3687	MOLECULAR EVIDENCE FOR THE BASAL RADIATION OF THE LEPIDOPTERA	II	931	25/08/00	15:35	HB	E	21	8	21
Reginato, R. D.	3031	OVARIAN DIFFERENTIATION IN THE WORKER OF APIS MELLIFERA (HYMENOPTERA, APIDAE)	II	765	21/08/00	10:00	HB	G	16	1	16
Regis, L.	2096	EFFECT OF SUNLIGHT ON THE RESIDUAL ACTIVITY OF A TABLET FORMULATION BASED ON BACILLUS THURINGIENSIS ISRAELENSIS AGAINST AEDES AEGYPTI LARVAE	I	529	23/08/00	16:30	CC		11	PS	11
Regis, L.	2117	SELECTION OF CULEX QUINQUEFASCIATUS POPULATION RESISTANT TO BACILLUS SPHAERICUS STRAIN 2362	I	534	24/08/00	16:30	CC		11	PS	11
Régis, L.	2227	RAPD MARKERS FOR GENETIC POPULATIONS STUDIES IN AEDES	I	562	21/08/00	16:30	CC		12	PS	12
Regis, L. N.	634	RESPONSE OF GRAVID FEMALE CULEX QUINQUEFASCIATUS (DIPTERA - CULICIDAE) TO NATURAL PHEROMONE IN THE CHOICE OF AN OVIPOSITION SITE	I	160	21/08/00	16:30	CC		4	PS	4
Regis, L. N.	623	UTILIZATION OF PCR FOR DETECTION OF WUCHERERIA BANCROFTI IN BARRA DE GUABIRABA - PE, NON-EDEMIC CONSIDERED AREA	I	158	21/08/00	16:30	CC		4	PS	4
Regis, L. N.	2150	BIOLOGIC CONTROL OF CULEX QUINQUEFASCIATUS IN CITIES FROM PERNAMBUCO STATE APPLYING BACILLUS SPHAERICUS	I	542	25/08/00	16:30	CC		11	PS	11
Regnery, R. L.	2963	TAXONOMIC AND PHYLOGENETIC STUDIES OF PERUVIAN LUTZOMYIA SPECIES BASED ON MOLECULAR DATA	II	748	21/08/00	16:30	CC		15	PS	15
Rêgo, M. M. C.	461	PRELIMINARY LIST OF STINGLESS BEES (APIDAE, MELIPONINAE) OCURRING IN ECOSSYSTEMS OF MARANHÃO STATE, BRAZIL	I	117	21/08/00	16:30	CC		3	PS	3
Regupathy, A.	1280	DEVELOPMENT AND APPLICATION OF AN INSECTICIDE RESISTANCE IMPACT MINIMISATION STRATEGY FOR COTTON PEST CONTROL IN INDIA	I	323	25/08/00	15:05	HM	N	7	10	7
Rehner, S. A.	3538	CRITERIA AND EVIDENCE FOR DOMESTICATION OF THE FUNGAL CULTIVARS OF LEAFCUTTER ANTS (TRIBE ATTINI)	II	893	24/08/00	16:30	CC		19	PS	19
Rehner, S. A.	3484	MYCOCEPURUS SMITHI IN PUERTO RICO: LIFE HISTORY OF A PHYLOGENETICALLY BASAL FUNGUS-GARDENING ANT	II	879	22/08/00	16:30	CC		19	PS	19
Reichert, J. L.	1388	EFFICACY OF GROWTH REGULATOR INSECTICIDES FOR THE CONTROL OF RACHIPLUSIA NU (LEPIDOPTERA - NOCTUIDAE) ON SOYBEAN	I	350	24/08/00	16:30	CC		7	PS	7
Reichert, J. L.	1389	EVALUATION OF GROWTH REGULATOR INSECTICIDES ON THE CONTROL OF RACHIPLUSIA NU (LEPIDOPTERA - NOCTUIDAE) ON SOYBEAN	I	350	24/08/00	16:30	CC		7	PS	7
Reichert, J. L.	2798	PERFORMANCE OF GROWTH REGULATOR INSECTICIDES ON THE CONTROL OF ARMYWORM (PSEUDALETIA SEQUAX) IN CORN	II	706	25/08/00	16:30	CC		14	PS	14
Reichhart, J. M.	2355	DEFICIENCY OF A BLOOD SERPIN LEADS TO CONSTITUTIVE ACTIVATION OF THE TOLL-MEDIATED ANTIFUNGAL DEFENSE IN DROSOPHILA	II	595	23/08/00	11:25	HB	I	13	4	13
Reichmuth, C.	4017	BIOLOGICAL CONTROL OF EPHESTIA ELUTELLA IN BULK GRAIN	II	1014	22/08/00	10:15	HB	J	23	3	23
Reichmuth, Ch.	4031	PHOSPHINE FUMIGATION IN GERMANY	II	1018	23/08/00	10:15	HB	J	23	6	23
Reichmuth, Ch.	4033	PHOSPHINE RESISTANCE – A THREAT FOR EUROPEAN STORED PRODUCT PROTECTION?	II	1018	23/08/00	11:00	HB	J	23	6	23
Reichmuth, Ch.	4044	LEVELS OF GASTIGHTNESS AND CONTAINMENT OF FUMIGANTS – CONSEQUENCES FOR ARTHROPOD PEST CONTROL	II	1021	24/08/00	10:00	HB	J	23	8	23
Reichmuth, Ch.	4030	EFFICACY OF CONTROLLED ATMOSPHERES ON CIMEX LECTULARIUS (HET., CIMICIDAE) AND ARGAS REFLEXUS (ACARI, ARGASIDAE)	II	1018	23/08/00	10:00	HB	J	23	6	23
Reichmuth, Ch.	4009	COMPARISON OF SOME DIATOMACEOUS EARTHS FOR INSECT PEST CONTROL IN STORED PRODUCT PROTECTION	II	1012	21/08/00	14:15	HB	J	23	2	23
Reichmuth, Ch.	4002	THE ROLE OF INSECT PHEROMONES IN STORED PRODUCT PROTECTION	II	1011	21/08/00	9:35	HB	J	23	1	23
Reichmuth, Ch.	4028	CAN DERMESTIDS BE CONTROLLED WITH MODIFIED ATMOSPHERES?	II	1017	23/08/00	9:35	HB	J	23	6	23
Reichmuth, Ch.	1749	ANALYSIS OF SOME IMPORTANT FACTORS AFFECTING OVIPOSITION AND LONGEVITY OF THE ECTOPARASITIC WASP LAELIUS PEDATUS (HYMENOPTERA: BETHYLIDAE), A PARASITOID OF DERMESTIDE PESTS	I	441	21/08/00	16:30	CC		9	PS	9
Reichmuth, Ch.	3949	EXTREME TEMPERATURES FOR RAPID AND NON-TOXIC STORED PRODUCT PROTECTION	II	997	21/08/00	16:30	CC		22	PS	22
Reichmuth, Ch.	4053	EFFICACY OF CHENOPODIUM AMBROSIOIDES, PIPER GUINENSE, AND XYLOPIA AETHIOPICA AS GRAIN PROTECTANTS AGAINST STORED PRODUCT PESTS	II	1023	24/08/00	14:00	HB	J	23	9	23
Reid, S	2001	IS SOLID STATE FERMENTATION THE BEST OPTION TO PRODUCE FUNGAL BIOPESTICIDES	I	505	22/08/00	10:20	HM	P	11	3	11
Reid, S.	1998	BACULOVIRUS PRODUCTION IN VITRO – RECENT DEVELOPMENTS	I	504	22/08/00	9:05	HM	P	11	3	11
Reims, P.	1487	STATUS OF BIOLOGICAL CONTROL OF THE CITRUS LEAFMINER (PHYLLOCNISTIS CITRELLA) IN ITALY	I	375	21/08/00	16:30	CC		8	PS	8
Reinert, J. A.	63	HOST RESISTANCE TO INSECTS AND MITES IN ZOYSIA SPP. FOR URBAN LANDSCAPES	I	16	24/08/00	16:30	CC		1	PS	1
Reinhardt, J. N.	3567	INSTALLATION GUIDELINES FOR THE BASALTIC TERMITE BARRIER: A PARTICLE BARRIER FOR FORMOSAN SUBTERRANEAN TERMITES (ISOPTERA: RHINOTERMITIDAE)	II	900	25/08/00	16:30	CC		19	PS	19
Reintjes, N.	1124	TEMPORAL AND SPATIAL DISTRIBUTION OF DIVING BEETLES IN A HIGHLY SEASONAL ENVIRONMENT (COMOÉ NATIONAL PARK, IVORY COAST)	I	283	24/08/00	16:30	CC		6	PS	6
Reis Filho, W.	1823	INTRODUCTION AND RELEASE OF RHISSINES TO CONTROL SIREX NOCTILIO IN BRAZIL	I	460	22/08/00	9:35	HB	M	10	2	10
Reis Jr, R.	1632	PREDATORS IMPAIRING PARASITOIDS IN THE NATURAL BIOLOGICAL CONTROL	I	411	24/08/00	16:30	CC		8	PS	8
Reis, P. R.	1633	EFFECT OF THE PREY DENSITY ON THE FUNCTIONAL AND NUMERICAL RESPONSE OF TWO SPECIES OF PREDACEOUS MITES	I	412	24/08/00	16:30	CC		8	PS	8
Reis, P. R.	2827	EFFICIENCY OF THIAMETHOXAM 10 GR IN THE CONTROL OF THE COFFEE LEAF MINER	II	714	25/08/00	16:30	CC		14	PS	14
Reisenman, C. E.	718	INTERACTION BETWEEN VISUAL AND OLFACTORY CUES IN THE ASSEMBLING BEHAVIOUR OF THE HAEMATOPHAGOUS BUG TRIATOMA INFESTANS	I	181	24/08/00	16:30	CC		4	PS	4
Reiter, P.	2885	CLIMATE CHANGE AND VECTOR-BORNE DISEASES	II	728	22/08/00	11:35	Bol	R	15	3	15
Remes Lenicov, A. M. M.	3235	RESOURCE AVAILABILITY AND SPATIAL DISTRIBUTION OF DELPHACODES KUSCHELI (FULGOROMORPHA: DELPHACIDAE)	II	817	23/08/00	16:30	CC		17	PS	17

Sub-titles: (HB=Hotel Bourbon) - (HM=Hotel Mabu) - (CC=Convention Center) - (Bol=Foz Boulevard) - (PS=Poster Session) - (PL=Plenary Lecturer)

AUTHOR	Nº	TITLE	Book	Page	Date	Time	Local	Room	Session	Symp	New Session
Remes Lenicov, A. M. M.	3236	DELPHACID PLANTHOPPERS AND THE "MAL DE RIO CUARTO" IN MAIZE IN THE NORTH OF ARGENTINA (INSECTA - FULGOROMORPHA)	II	817	23/08/00	16:30	CC		17	PS	17
Remes Lenicov, A. M. M. de	3225	EPIDEMIOLOGY OF "MAL DE RÍO CUARTO" DISEASE AND THE RELATION WITH ITS VECTORS IN ARGENTINA	II	814	22/08/00	16:30	CC		17	PS	17
Remis, M. I.	2239	RIBOSOMAL DNA VARIATION IN NATURAL POPULATIONS OF DICHROPLUS ELONGATUS (ORTHOPTERA: ACRIDIDAE)	I	565	21/08/00	16:30	CC		12	PS	12
Remis, M. I.	2240	SEXUAL SELECTION ON MORPHOMETRIC AND CHROMOSOME VARIABLES IN LEPTYSMA ARGENTINA (ORTHOPTERA)	I	565	21/08/00	16:30	CC		12	PS	12
Ren, J.	1704	APPLIED TECHNOLOGY OF PEST CONTROLLING BY TRICHOGRAMMA FROM ARTIFICIAL HOST EGG IN SHANXI, CHINA	I	429	25/08/00	16:30	CC		8	PS	8
Ren, J.	1229	SODIUM CHANNEL MUTATIONS AND PYRETHROID RESISTANCE	I	310	21/08/00	14:35	HM	N	7	2	7
Rendon, P.	1661	FRUIT FLY BIOLOGICAL CONTROL IN LATIN AMERICA: MINIMIZING THE RISKS POSED BY TEPHRITIDAE IN MEXICO AND CENTRAL AMERICA	I	419	25/08/00	16:30	CC		8	PS	8
Rene, S.	1415	INFLUENCE OF SPINOSAD ON SOME HYMENOPTEROUS NATURAL ENEMIES OF AVOCADO, CITRUS AND OTHER ORCHARD PESTS	I	357	25/08/00	16:30	CC		7	PS	7
Renn, S. C. P.	2339	PEPTIDERGIC OUTPUT OF THE CIRCADIAN CLOCK IN DROSOPHILA.	II	591	21/08/00	10:10	HB	I	13	1	13
Renou, M.	640	NO PLEIOTROPIC EFFECT OF INSECTIDE RESISTANCE ON SEXUAL COMMUNICATION IN CYDIA POMOMELLA	I	162	21/08/00	16:30	CC		4	PS	4
Renou, M.	582	MATE RECOGNITION IN NEZARA VIRIDULA (HETEROPTERA, PENTATOMIDAE): A MATTER OF SONGS AND PHEROMONES	I	147	22/08/00	9:35	Bol	S	4	2	4
Rensburg, B. J. van	414	TESTING AN ECOLOGICAL BIOINDICATOR SYSTEM: DUNG BEETLES IN NORTHERN KWAZULU-NATAL, SOUTH AFRICA	I	105	23/08/00	14:35	HB	C	3	4	3
Renstrom, M.	2880	TICKS AND GLOBAL CHANGE - A HOT TOPIC IN NORTHERN EUROPE!	II	727	21/08/00	16:05	Bol	R	15	2	15
Renzi, P.	3539	AN AUTOMATIC DEVICE FOR DETECTING LOCOMOTOR ACTIVITY OF SINGLE ANT IN A SOCIAL CONTEXT	II	893	24/08/00	16:30	CC		19	PS	19
Renzi, P.	3540	CIRCADIAN AND ULTRADIAN RHYTHMS OF LOCOMOTOR ACTIVITY IN WORKERS OF ANT FORMICA PRATENSIS	II	893	24/08/00	16:30	CC		19	PS	19
Resende, R. O.	3233	THE TRANSMISSION SPECIFICITY AND EFFICIENCY OF BRAZILIAN TOSPOVIRUSES OCCURRING ON TOMATO BY FOUR THRIPS SPECIES	II	816	23/08/00	16:30	CC		17	PS	17
Resta, C. C. M.	326	ENHANCED CHEMICAL CONTROL OF NEZARA VRIDULA USING UNCONVENTIONAL SPRAYING TECHNOLOGY.	I	83	24/08/00	16:30	CC		2	PS	2
Resta, C. C. M.	2803	EVALUATION OF INSECTICIDES TO CONTROL MIGDOLUS FRYANUS IN SUGARCANE	II	708	24/08/00	16:30	CC		14	PS	14
Retnakaran, A.	1838	AN OVERVIEW OF BIOTECHNOLOGICAL APPROACHES TO BIOLOGICAL AND BIORATIONAL CONTROL OF FOREST INSECT PESTS	I	463	23/08/00	9:35	HB	M	10	4	10
Retnakaran, A.	2382	HORMONAL REGULATION OF CUTICLE FORMATION AND CHITIN SYNTHESIS	II	602	25/08/00	13:35	HB	I	13	9	13
Retnakaran, A.	1320	AN RNA HELICASE OF THE "DEAD BOX" FAMILY CLONED FROM A LEPIDOPTERAN SPECIES, THE SPRUCE BUDWORM (CHORISTONEURA FUMIFERANA)	I	333	22/08/00	16:30	CC		7	PS	7
Retnakaran, A.	3280	MOLECULAR ANALYSIS OF THE OVERWINTERING DIAPAUSE IN THE SPRUCE BUDWORM, CHORISTONEURA FUMIFERANA	II	828	23/08/00	10:20	HB	K	18	4	18
Retnakaran, A.	1845	BIOLOGICAL CONTROL OF FOREST PESTS USING INSECT SPECIFIC VIRUSES	I	465	23/08/00	14:35	HB	M	10	4	10
Retnakaran, A.	3325	GLUTATHIONE S-TRANSFERASE FROM THE SPRUCE BUDWORM, CHORISTONEURA FUMIFERANA: IDENTIFICATION, CHARACTER-IZATION, LOCALIZATION, CDNA CLONING, DEVELOPMENTAL EXPRESSION AND INDUCTION BY VARIOUS FACTORS	II	840	21/08/00	16:30	CC		18	PS	18
Rettich, F.	1390	SULFOTINETM, A NEW ACTIVE FOR BAITS AGAINST COCKROACHES AND PHARAOH'S ANTS	I	351	24/08/00	16:30	CC		7	PS	7
Rettich, F.	4105	THE NEAR FUTURE OF URBAN ENTOMOLOGY	II	1036	25/08/00	16:30	CC		23	PS	23
Reuss, J.	3086	ACTOGRAPHIC RESPIROMETRY REVEALS THE STRATEGIES OF SPIRACULAR CONTROL OF GAS EXCHANGE IN INSECTS	II	779	25/08/00	14:05	HB	G	16	8	16
Reuter, R.	3075	MOLECULAR MECHANISMS OF PATTERN FORMATION IN THE INSECT GUT	II	776	24/08/00	15:00	HB	G	16	6	16
Reviriego, M. E.	327	IMPACT OF DIURAPHIS NOXIA (HOMOPTERA: APHIDIDAE) ON WHEAT YIELD	I	83	22/08/00	16:30	CC		2	PS	2
Reviriego, M. E.	1125	REPRODUCTION OF DIURAPHIS NOXIA (HOMOPTERA: APHIDIDAE) ON DIFFERENT WINTER CEREALS	I	284	25/08/00	16:30	CC		6	PS	6
Reviriego, M. E.	228	EFFECT OF PREVENTIVE INSECTICIDES ON SITOPHILUS SPP (COLEOPTERA: CURCULIONIDAE)	I	58	22/08/00	16:30	CC		2	PS	2
Reviriego, M. E.	949	REPRODUCTION OF SITOPHILUS SPP. (COLEOPTERA: CURCULIONIDAE) ON DIFFERENT WHEAT CULTIVARS	I	240	25/08/00	16:30	CC		6	PS	6
Reviriego, M. E.	1314	INSECTICIDES TOXICITY TO DIURAPHIS NOXIA (HOMOPTERA:APHIDIDAE)	I	332	21/08/00	16:30	CC		7	PS	7
Reviriego, M. E.	1315	TOXICITY OF DELTAMETRIN TO A STRAIN OF TRIBOLIUM CASTANEUM (COLEOPTERA: TENEBRIONIDAE)	I	332	21/08/00	16:30	CC		7	PS	7
Reyes-Lugo, M.	3007	DOMICILIATION OF SELVATIC CHAGAS DISEASE VECTOR PANSTROGYLUS GENICULATUS (TRIATOMINAE:REDUVIIDAE) IN VENEZUELA.	II	759	24/08/00	16:30	CC		15	PS	15
Reynolds, C.J.M.	798	DO HOST-PLANT INTERACTIONS AND SUSCEPTIBILITY TO SOIL CULTIVATION DETERMINE THE ABUNDANCE OF GRAMINIVOROUS SAWFLIES ON BRITISH FARMLAND?	I	202	21/08/00	9:50	HB	D	6	1	6
Reynolds, D. R.	138	SEASONAL MONITORING OF THE INSECT FAUNA FLYING AT ALTITUDE OVER SOUTHERN ENGLAND: RESULTS FROM A VERTICAL-LOOKING RADAR	I	36	25/08/00	10:25	HB	A	2	9	2
Reynolds, D. R.	743	STUDIES OF FORAGING FLIGHTS WITH HARMONIC RADAR.	I	188	21/08/00	9:35	Bol	T	5	1	5
Reynolds, D. R.	930	VERTICAL-LOOKING RADAR: A POWERFUL NEW TOOL FOR MONITORING INSECT FLIGHT AT ALTITUDE	I	235	21/08/00	16:30	CC		6	PS	6
Reynolds, D. R.	1212	SPATIO-TEMPORAL DYNAMICS OF AERIAL INSECT POPULATIONS EXAMINED WITH VERTICAL-LOOKING RADAR	I	305	25/08/00	16:30	CC		6	PS	6
Reynolds, R. J.	986	IMPLICATIONS OF HOST-PLANT CARBON UPTAKE PATTERNS AND LEAF SIZE ON THE PERFORMANCE AND ABUNDANCE OF A CYNIPID GALLFORMER	I	249	22/08/00	16:30	CC		6	PS	6
Reynolds, S. E.	3099	TRYPSIN-INDUCED MOTILITY IN MANDUCA SEXTA SPERMATOZOA IN VITRO	II	782	26/08/00	14:15	HB	G	16	9	16
Reynolds, S. E.	3369	ANTIREPRODUCTIVE EFFECTS OF THE ECDYSTEROID AGONISTS ON THE COMMON CUTWORM, SPODOPTERA LITURA	II	851	21/08/00	16:30	CC		18	PS	18
Reynolds, S. E.	3368	SPERM TRANSFER AND PRECEDENCE IN THE COMMON CUTWORM, SPODOPTERA LITURA: AN IMPORTANT FACTOR IN OPTIMIZATION OF F-1 STERILITY TECHNIQUE FOR PEST SUPPRESSION	II	850	21/08/00	16:30	CC		18	PS	18
Rezende, A. C.	1358	AGRONOMIC EFFICIENCY OF NEW MITICIDES FOR CONTROL OF THE COFFEE LEPROSIS	I	343	23/08/00	16:30	CC		7	PS	7
Rezende, J. A. M.	2110	SUSCEPTIBILITY OF IMMATURE STAGES OF THYRINTEINA ARNOBIA (LEPIDOPTERA: GEOMETRIDAE) TO A POSSIBLE PICORNAVIRUS	I	532	23/08/00	16:30	CC		11	PS	11
Rezk, H. A	1480	TETRASTICHUS PHYTOMYZAE (HYMENOPTERA: EULOPHIDAE), AN INTERNAL PARASITOID ON THE BROOMRAPE FLY, PHYTOMYZA OROBANCHIA (DIPTERA : AGROMYZIDAE)	I	373	21/08/00	16:30	CC		8	PS	8
Rheinlaender, J.	1765	GOING WALKABOUT: MOVEMENTS OF INDIVIDUAL ADULTS IN A BREEDING POPULATION OF THE SPECKLED BUSHCRICKET, LEPTOPHYES PUNCTATISSIMA	I	445	22/08/00	16:30	CC		9	PS	9
Ribas, C. C.	3177	EARLY EMBRYOLOGY AND SEGMENTATION GENES EXPRESSION IN THE TEPHRITID FLY ANASTREPHA SP. 2 (DIPTERA; TEPHRITIDAE)	II	801	24/08/00	16:30	CC		16	PS	16
Ribeiro, A. F.	2399	ISOLATION OF PERITROPHIC MEMBRANE PROTEINS AND THEIR SECRETION BY SPODOPTERA FRUGIPERDA (LEPIDOPTERA) LARVAE	II	606	21/08/00	16:30	CC		13	PS	13
Ribeiro, A. F.	1754	APOCRINE SECRETION OF AMYLASE AND EXOCYTOSIS OF TRYPSIN ALONG THE MIDGUT OF TENEBRIO MOLITOR LARVAE	I	442	21/08/00	16:30	CC		9	PS	13
Ribeiro, B. M.	2508	MORPHOLOGICAL CHARACTERIZATION OF LARVAL HAEMOCYTES FROM ANTICARSIA GEMMATALIS	II	633	24/08/00	16:30	CC		13	PS	13

Sub-titles: (HB=Hotel Bourbon) - (HM=Hotel Mabu) - (CC=Convention Center) - (Bol=Foz Boulevard) - (PS=Poster Session) - (PL=Plenary Lecturer)

AUTHOR	N°	TITLE	Book	Page	Date	Time	Local	Room	Session	Symp	New Session
Ribeiro, G. T.	1849	OCCURRENCE OF HYMENOPTERA PARASITOIDS IN LARVAE OF PHORACANTHA SEMIPUNCTATA (COLEOPTERA: CERAMBYCIDAE)	I	466	23/08/00	16:05	HB	M	10	4	10
Ribeiro, G. T.	1953	DEVELOPMENT OF PSILOPTERA SP. (COLEOPTERA: BUPRESTIDAE) IN STUMPS OF PINUS CARIBAEA, IN THE NORTHEAST REGION OF THE STATE OF BAHIA, BRAZIL	I	492	24/08/00	16:30	CC		10	PS	10
Ribeiro, G. T.	1954	OCCURRENCE OF PSILOPTERA SP. (COLEOPTERA: BUPRESTIDAE) DAMAGING PLANTS OF EUCALYPTUS SPP., IN THE NORTHEAST REGION OF BAHIA, BRAZIL	I	492	24/08/00	16:30	CC		10	PS	10
Ribeiro, J. S.	1313	A SUSTAINABLE AND ECONOMICAL INSECTICIDAL MANAGEMENT PROGRAM ON COTTON IN BRAZIL	I	331	21/08/00	16:30	CC		7	PS	7
Ribeiro, L. J.	1634	FIRST RECORD OF CHRYSOPERLA EXTERNA PREYING THE CITRUS LEAF MINER PHYLLOCNISTIS CITRELLA	I	412	25/08/00	16:30	CC		8	PS	8
Ribeiro, M. de F.	3363	SEASONAL PARTIAL INACTIVITY IN THE STINGLESS BEE PLEBEIA REMOTA (HYMENOPTERA, APIDAE)	II	849	24/08/00	16:30	CC		18	PS	19
Ribeiro, M.C.V.C.	3008	ANTHROPOPHILIC BEHAVIOUR OF CULICIDAE DURING SUNSET INSIDE FOREST OF IGUAÇU REGIONAL PARK, PARANA STATE, BRAZIL	II	759	24/08/00	16:30	CC		15	PS	15
Ribeiro, M.C.V.C.	3009	BITING ACTIVITY OF DIURNAL MOSQUITOES INSIDE FOREST OF IGUAÇU REGIONAL PARK, PARANA STATE, BRAZIL.	II	759	24/08/00	16:30	CC		15	PS	15
Ribeiro, M.C.V.C.	3010	PRODUCTIVITY OF BREEDING ARTIFICIAL OF CULICIDAE, CAMPUS FEDERAL UNIVERSITY OF PARANA, PARANA STATE, BRAZIL	II	759	25/08/00	16:30	CC		15	PS	15
Ribeiro, S. P.	3584	INSECTS ON CROWNS OF TABEBUIA OCHRACEA AND TABEBUIA AUREA IN NEOTROPICAL SAVANNAS: HOST SPECIFICITY AND HABITAT EFFECTS ON INSECT SPECIES RICHNESS AND ABUNDANCE	II	904	24/08/00	15:00	Bol	U	20	2	20
Ribeiro, Z. M. de A.	2040	ANTICARSIA GEMMATALIS NUCLEOPOLYHEDROVIRUS INFECTIVITY IN SEVEN INSECT CELL LINES	I	515	21/08/00	16:30	CC		11	PS	11
Ribeiro-Costa, C. S.	1963	SEED PREDATION BY CTENOCOLUM CROTONAE (COLEOPTERA:BRUCHIDAE) IN LONCHOCARPUS MUEHLBERGIANUS (LEGUMINOSAE)	I	495	24/08/00	16:30	CC		10	PS	10
Ribeiro-Costa, C. S.	3183	MORPHOLOGICAL STUDY OF THE ADULT OF MEIBOMEUS CYANIPENNIS (COLEOPTERA:BRUCHIDAE)	II	803	25/08/00	16:30	CC		16	PS	16
Ribeiro-Costa, C. S.	1961	INSECTS ASSOCIATED WITH SEEDS OF THREE NATIVE SPECIES OF BRAZILIAN ATLANTIC FOREST	I	494	24/08/00	16:30	CC		10	PS	10
Ribeiro-Mendes, H. N	2494	INFLUENCE OF WATER AND NUTRITIONAL STATUS OF BACCHARIS DRACUNCULIFOLIA ON THE ABUNDANCE AND RICHNESS OF ENDOPHYTES	II	630	24/08/00	16:30	CC		13	PS	13
Ribera, I.	2330	A MOLECULAR PHYLOGENY OF COLEOPTERA FROM 18S rRNA SEQUENCES	I	588	25/08/00	16:30	CC		12	PS	12
Ribera, I.	379	HABITAT CONSTRAINTS AND PATTERNS OF DIVERSITY	I	96	21/08/00	11:05	HB	C	3	1	3
Ribera, I.	546	HABITAT CONSTRAINTS AND PATTERNS OF DIVERSITY	I	138	24/08/00	16:30	CC		3	PS	3
Riberio, S. P.	425	INSECTS AS INDICATORS OF SUBTLE, CLIMATE-INDUCED HABITAT FRAGMENTATION	I	108	24/08/00	11:20	HB	C	3	5	3
Ribolla, P. E. M.	2919	SELECTION OF PEPTIDES FROM A PHAGE-DISPLAY LIBRARY WHICH BIND TO THE MOSQUITO MIDGUT AND TO SALIVARY GLANDS	II	737	24/08/00	16:05	Bol	R	15	8	15
Ribolla, P. M.	2234	PROTEIN PURIFICATION AND cDNA CLONING OF SALIVARY GLANDS COMPONENTS OF ANOPHELES DARLINGI	I	564	21/08/00	16:30	CC		12	PS	12
Ribolla, P.E.M.	2406	CHARACTERIZATION OF THE DIGESTIVE PROCESS IN NEOTROPICAL ANOPHELINES	II	608	21/08/00	16:30	CC		13	PS	13
Ricci, C.	3178	MOUTH PARTS AND THE FEEDING HABITS OF COCCINELLIDS (COLEOPTERA)	II	802	24/08/00	16:30	CC		16	PS	16
Ricci, C.	319	THE ECOLOGICAL ROLE OF NATURAL HEDGES ON LEAFHOPPERS POPULATIONS IN VINEYARDS OF CENTRAL ITALY	I	81	24/08/00	16:30	CC		2	PS	2
Ricciardelli D'Albore, G.	1126	THE POLLINATORS OF CHICKLING VETCH (LATHYRUS SATIVUS L., LEGUMINOSAE) IN CENTRAL ITALY.	I	284	24/08/00	16:30	CC		6	PS	6
Rice, M. E.	1289	TRANSGENIC BT MAIZE AND RESISTANCE MANAGEMENT: FARMER ATTITUDES AND PRACTICES IN THE CORN BELT OF THE UNITED STATES	I	325	26/08/00	10:50	HM	N	7	11	7
Rice, R. E.	719	DEVELOPMENTS IN SPRAYABLE PHEROMONE DELIVERY SYSTEMS FOR MATING DISRUPTION	I	182	25/08/00	16:30	CC		4	PS	4
Rice, R. E.	585	IDENTIFICATION OF SEX PHEROMONES OF ECONOMICALLY IMPORTANT STINK BUG PESTS OF AGRICULTURE	I	148	22/08/00	10:35	Bol	S	4	2	4
Richael, C.	3364	THE EFFECT OF EXTRACTS FROM ARID AND SEMI-ARID PLANTS ON FALL ARMYWORM GROWTH	II	849	24/08/00	16:30	CC		18	PS	18
Richards, E. F.	2981	PARATRANSGENESIS OF REDUVIID VECTORS OF CHAGAS DISEASE	II	752	22/08/00	16:30	CC		15	PS	15
Richards, M. H.	3541	DEFINING THE NATURE OF COOPERATION IN THE BARELY EUSOCIAL SWEAT BEE, HALICTUS SEXCINCTUS, IN SOUTHERN GREECE	II	893	24/08/00	16:30	CC		19	PS	19
Richter, L.	3999	ECOLOGICAL STUDIES ACCOMPANYING THE CULTIVATION OF TRANSGENIC RAPE AND MAIZE IN THURINGIA (GERMANY)	II	1009	25/08/00	16:30	CC		22	PS	22
Richtzenhain, L. J.	3794	INVESTIGATION OF THE VALIDITY OF SPECIES STATUS OF IXODES DIDELPHIDIS (ACARI: IXODIDAE) USING THE SECOND INTERNAL TRANSCRIBED SPACER (ITS2) OF RIBOSOMAL DNA	II	958	23/08/00	16:30	CC		21	PS	21
Riddiford, L. M.	2522	POSSIBLE MOLECULAR STRATEGIES THAT UNDERLIE THE EVOLUTION OF METAMORPHIC DEVELOPMENT	II	637	25/08/00	16:30	CC		13	PS	13
Riddiford, L. M.	3296	POSSIBLE MOLECULAR STRATEGIES THAT UNDERLIE THE EVOLUTION OF METAMORPHIC DEVELOPMENT	II	832	25/08/00	14:35	HB	K	18	6	18
Riddiford, L. M.	3288	CROSS TALK BETWEEN ECDYSTEROIDS AND JUVENILE HORMONE AT THE CELLULAR LEVEL	II	830	23/08/00	15:05	HB	K	18	5	18
Riddiford, L. M.	3336	JH APPLICATION MODIFIES THE ADULT DEVELOPMENT PROGRAM AND ECDYSONE RECEPTOR EXPRESSION IN THE TOBACCO HORNWORM, MANDUCA SEXTA	II	842	22/08/00	16:30	CC		18	PS	18
Rider Jr., S. D.	2308	MOLECULAR GENETIC MAPPING IN THE HESSIAN FLY	I	582	24/08/00	16:30	CC		12	PS	12
Riede, K.	773	AN INFORMATION INFRASTRUCTURE FOR GERMAN INSECT COLLECTIONS INCLUDING MULTIMEDIA AND GIS-TOOLS	I	195	24/08/00	11:20	Bol	T	5	5	5
Riedl, H.	2546	CODLING MOTH ADAPTATIONS: HOST AND GEOGRAPHIC RACES	II	643	21/08/00	14:05	HB	B	14	2	14
Riedl, H.	2550	THE FUTURE OF CODLING MOTH CONTROL WITH CONVENTIONAL INSECTICIDES, INSECT GROWTH REGULATORS AND MICROBIALS	II	644	21/08/00	15:05	HB	B	14	2	14
Riedl, H.	2648	THE FUTURE OF CODLING MOTH CONTROL WITH CONVENTIONAL INSECTICIDES, INSECT GROWTH REGULATORS AND MICROBIALS	II	669	21/08/00	16:30	CC		14	PS	14
Riehle, M. A.	3252	ACTIVATION OF STEROIDOGENESIS IN FEMALE MOSQUITOES BY OVARY ECDYSTEROIDOGENIC HORMONE AND INSULIN	II	821	21/08/00	10:35	HB	K	18	1	18
Rijswijk, F. J. F. W. van	746	COMPUTERIZED VIDEO TRACKING, MOVEMENT ANALYSIS AND BEHAVIOR RECOGNITION IN INSECTS	I	188	21/08/00	10:55	Bol	T	5	1	5
Riley, J. R.	138	SEASONAL MONITORING OF THE INSECT FAUNA FLYING AT ALTITUDE OVER SOUTHERN ENGLAND: RESULTS FROM A VERTICAL-LOOKING RADAR	I	36	25/08/00	10:25	HB	A	2	9	2
Riley, J. R.	743	STUDIES OF FORAGING FLIGHTS WITH HARMONIC RADAR.	I	188	21/08/00	9:35	Bol	T	5	1	5
Riley, J. R.	1212	SPATIO-TEMPORAL DYNAMICS OF AERIAL INSECT POPULATIONS EXAMINED WITH VERTICAL-LOOKING RADAR	I	305	25/08/00	16:30	CC		6	PS	6
Riley, J. R.	930	VERTICAL-LOOKING RADAR: A POWERFUL NEW TOOL FOR MONITORING INSECT FLIGHT AT ALTITUDE	I	235	21/08/00	16:30	CC		6	PS	6
Rinaldi, I. M. P.	547	THE SPIDER FAUNA FROM SUGAR CANE CROP, SÃO PAULO STATE, BRAZIL.	I	138	24/08/00	16:30	CC		3	PS	3
Rindner, M.	4049	APPLICATION OF GASTIGHT STORAGE IN THE TROPICS	II	1022	24/08/00	11:15	HB	J	23	8	23
Rinehart, J. P.	2495	DOWNREGULATION OF ULTRASPIRACLE BUT NOT ECDYSONE RECEPTOR DURING PUPAL DIAPAUSE IN SARCOPHAGA CRASSIPALPIS	II	630	24/08/00	16:30	CC		13	PS	13
Rinehart, J. P.	3278	DIAPAUSE-SPECIFIC GENE EXPRESSION	II	828	23/08/00	9:50	HB	K	18	4	18

Sub-titles: (HB=Hotel Bourbon) - (HM=Hotel Mabu) - (CC=Convention Center) - (Boi=Foz Boulevard) - (PS=Poster Session) - (PL=Plenary Lecturer)

AUTHOR	Nº	TITLE	Book	Page	Date	Time	Local	Room	Session	Symp	New Session
Ring, D. R.	3542	A PILOT TEST FOR AREA WIDE MANAGEMENT OF THE FORMOSAN SUBTERRANEAN TERMITE IN THE FRENCH QUARTER, NEW ORLEANS, LOUISIANA	II	894	24/08/00	16:30	CC		19	PS	19
Rios, E. M. M. M.	2095	LARGE SCALE BACILLUS SPHAERICUS PRODUCTION	I	528	23/08/00	16:30	CC		11	PS	11
Rios, E. M. M. M.	2150	BIOLOGIC CONTROL OF CULEX QUINQUEFASCIATUS IN CITIES FROM PERNAMBUCO STATE APPLYING BACILLUS SPHAERICUS	I	542	25/08/00	16:30	CC		11	PS	11
Rios-Velásquez, C. M.	1127	TRICHOMYCETES FUNGI (ZYGOMYCOTINA) ASSOCIATED WITH THE DIGESTIVE TRACTS OF BLACK FLY LARVAE (DIPTERA: SIMULIIDAE) IN CENTRAL AMAZONIA, BRAZIL	I	284	24/08/00	16:30	CC		6	PS	6
Ripa, R.	1551	HYDROTAEA AENESCENS, A LARVAL PREDATOR OF THE HOUSE FLY: A SUMMARY OF RECENT RESERCH	I	391	22/08/00	16:30	CC		8	PS	8
Risco, M. D. M.	1375	BASES FOR AN INSECTICIDE RESISTANCE MANAGEMENT OF SPODOPTERA FRUGIPERDA IN CORN IN BRAZIL	I	347	24/08/00	16:30	CC		7	PS	7
Risser, P. G.	2571	AN ECOLOGIST'S VIEW OF IPM	II	650	23/08/00	9:45	HB	B	14	5	14
Ritchie, M. G.	1711	THE INHERITANCE OF FEMALE PREFERENCE FUNCTIONS IN A MATE RECOGNITION SYSTEM	I	431	21/08/00	11:35	HB	F	9	1	9
Ritchie, M. G.	1730	A MIS-MATCH IN AN AUDITORY SEXUAL COMMUNICATION SYSTEM	I	436	22/08/00	15:15	HB	F	9	3	9
Rivero, A.	2496	NUTRITIONAL STATUS AND THE BEHAVIOURAL ECOLOGY OF PARASITOIDS	II	630	24/08/00	16:30	CC		13	PS	13
Rivkina, O. G.	1128	THE BLACK LIGHT TRAP FOR MONITORING OF CODLING MOTH CYDIA POMONELLA (LEPIDOPTERA: TORTRICIDAE) IN POME FRUIT ORCHARD UNDER MATING DISRUPTION	I	284	24/08/00	16:30	CC		6	PS	6
Rizio, E.	2786	USE AND IMPACT OF MATING DISRUPTION IN COMMERCIAL PEACH INTEGRATED CROP MANAGEMENT PROGRAMS IN NEW JERSEY, USA	II	703	24/08/00	16:30	CC		14	PS	14
Rizzo, M. C.	1068	ON SOME BEHAVIOURAL DECISIONS FOR POSTEMBRYONIC DEVELOPMENT AND FOR RESOURCE COMPETITION OBSERVED IN EULOPHID ECTOPARASITES (HYMENOPTERA: CHALCIDOIDEA)	I	269	23/08/00	16:30	CC		6	PS	6
Rizzuto, S.	1955	DESCRIPTION OF LARVAL TUNNELS AND PUPAL CHAMBERS OF CALYDON SUBMETALLICUM IN ROBLE PELLIN OF PATAGONIA, ARGENTINA	I	493	24/08/00	16:30	CC		10	PS	10
Robbins, R. K.	3697	BUTTERFLIES (PAPILIONOIDEA): NOT ALL CHARACTERS ARE EQUAL	II	933	26/08/00	11:05	HB	E	21	9	21
Robbins, R. K.	776	DEVELOPING AND SHARING DATA GLOBALLY: THE 'GLOBAL BUTTERFLY INFORMATION SYSTEM' – GLOBIS	I	196	24/08/00	14:00	Boi	T	5	5	5
Robbins, R. K.	3126	LIFE HISTORY AND MORPHOLOGY OF THE IMMATURE STAGES OF THE HAIRSTREAK BUTTERFLY "THECLA" CISSUSA (LEPIDOPTERA, LYCAENIDAE, THECLINAE)	II	789	22/08/00	16:30	CC		16	PS	16
Robert-Nicoudb, M.	3042	STAGE SPECIFIC APOPTOTIC PATTERNS DURING DROSOPHILA OOGENESIS	II	768	21/08/00	15:30	HB	G	16	1	16
Roberto, S. R.	2861	EFFICIENCY OF THIAMETHOXAM TO CONTROL ONCOMETOPIA FACIALIS (HEMIPTERA: CICADELLIDAE) IN CITRUS	II	722	25/08/00	16:30	CC		14	PS	14
Roberto, S. R.	3209	VECTOR AND EPIDEMIOLOGICAL ASPECTS OF CITRUS VARIEGATED CHLOROSIS	II	810	21/08/00	15:50	Boi	U	17	1	17
Roberts, D. M.	1790	EGG HATCHING IN AEDES CASPIUS MOSQUITOES	I	451	24/08/00	16:30	CC		9	PS	9
Roberts, D. R.	2882	THE INFLUENCE OF DEFORESTATION ON VECTOR-BORNE DISEASES	II	727	22/08/00	10:05	Boi	R	15	3	15
Roberts, D. R.	3011	A PROBABILITY MODEL OF VECTOR BEHAVIOR: EFFECTS OF DDT AND DELTAMETHRIN REPELLENCY, IRRITANCY, AND TOXICITY IN MALARIA CONTROL	II	760	24/08/00	16:30	CC		15	PS	15
Roberts, D. R.	2957	A PROBABILITY MODEL OF VECTOR BEHAVIOR: EFFECTS OF DDT AND DELTAMETHRIN REPELLENCY, IRRITANCY, AND TOXICITY IN MALARIA CONTROL	II	746	21/08/00	16:30	CC		15	PS	15
Roberts, N.	1376	DDT- AND ORGANOPHOSPHATE-RESISTANCE IN ANOPHELES GAMBIAE MEDIATED BY GLUTATHIONE S-TRANSFERASE GENES	I	347	24/08/00	16:30	CC		7	PS	7
Roberts, S. P.	3062	FLIGHT RESPIRATION AND ENERGETICS	II	773	23/08/00	14:35	HB	G	16	5	16
Robinson, A. S.	2223	THE INTEGRATED AREA-WIDE APPROACH TO INSECT PEST MANAGEMENT. PROSPECTS FOR ITS APPLICATION TO TSETSE	I	561	25/08/00	9:35	HB	L	12	11	12
Robinson, D. J.	720	DESIGNING EFFECTIVE MULTIMEDIA TEACHING PACKAGES FOR ENTOMOLOGY	I	182	25/08/00	16:30	CC		4	PS	4
Robinson, D. J.	755	DESIGNING EFFECTIVE MULTIMEDIA TEACHING PACKAGES FOR ENTOMOLOGY	I	191	22/08/00	13:35	Boi	T	5	3	5
Robinson, D. J.	1765	GOING WALKABOUT: MOVEMENTS OF INDIVIDUAL ADULTS IN A BREEDING POPULATION OF THE SPECKLED BUSHCRICKET, LEPTOPHYES PUNCTATISSIMA	I	445	22/08/00	16:30	CC		9	PS	9
Robinson, G. E.	2188	CHANGES IN BRAIN EXPRESSION OF cGMP-DEPENDENT PROTEIN KINASE GENE AND DIVISION OF LABOR IN COLONIES OF THE HONEY BEE APIS MELLIFERA	I	552	22/08/00	15:55	HB	L	12	4	12
Robinson, G. E.	3274	FROM SOCIOBIOLOGY TO CHRONOBIOLOGY: DIVISION OF LABOR IN COLONIES OF THE HONEY BEE APIS MELLIFERA.	II	827	23/08/00	15:20	HB	K	18	3	18
Robinson, G. S.	2335	EVOLUTIONARY TRENDS ON MALE GENITAL STRUCTURES OF CHALCOSIINAE (LEPIDOPTERA: ZYGAENIDAE)	I	589	25/08/00	16:30	CC		12	PS	12
Robison, D. J.	1858	OVERVIEW OF TREE RESISTANCE DEPLOYMENT APPROACHES	I	468	24/08/00	13:35	HB	M	10	6	10
Robson, M. K.	2337	TRACKING AUSTRALIAN FRUIT FLIES USING MICROSATELLITES	I	590	25/08/00	16:30	CC		12	PS	12
Roces, F.	1796	THE ENERGETICS OF NECTAR FEEDING IN THE ANT CAMPONOTUS RUFIPES	I	452	24/08/00	16:30	CC		9	PS	9
Roces, F.	3428	DIVISION OF LABOUR AND SIZE POLYMORPHISM OF FORAGERS OF THE LEAFCUTTER ANT ATTA VOLLENWEIDERI	II	865	23/08/00	10:20	HM	Q	19	4	19
Roces, F.	3564	HONEYBEES ARE ABLE TO REPRESENT DURING TROPHALLAXIS INSTANTANEOUS CHANGES IN FLOW OF SOLUTION	II	899	25/08/00	16:30	CC		19	PS	19
Roces, F.	3427	ENERGETICS AND THE CONTROL OF FORAGING DECISIONS IN LEAF CUTTING ANTS	II	865	23/08/00	10:05	HM	Q	19	4	19
Rocha, E.	2916	GENETICALLY-ENGINEERED MOSQUITOES RESISTANT TO THE TRANSMISSION OF MALARIA	II	736	24/08/00	14:35	Boi	R	15	8	15
Rocha, H. G. C.	2774	INTEGRATED METHODS TO CONTROL BEMISIA TABACI BIOTYPE B, IN MELONS	II	700	25/08/00	16:30	CC		14	PS	14
Rocha, L. C. D.	2640	SELECTIVITY OF INSECTICIDES USED IN CHRYSANTEMUS PEST CONTROL TO ORIUS INSIDIOSUS	II	667	21/08/00	16:30	CC		14	PS	14
Rocha, M. A. G.	2845	SCREENING FORAGE GRASSES OF THE GENUS BRACHIARIA FOR RESISTANCE TO THE SPITTLEBUGS (HOMOPTERA: CERCOPIDAE)	II	718	25/08/00	16:30	CC		14	PS	14
Rocha, O. J.	3006	THE IMPORTANCE OF DEVELOPING NOVEL STRATEGIES FOR PESTICIDE USE IN CONTROLLING VECTOR-BORNE DISEASES	II	758	24/08/00	16:30	CC		15	PS	15
Rochat, D.	682	CONTROL OF SCAPANES AUSTRALIS A MAJOR PEST OF COCONUT USING SEMIOCHEMICALS	I	172	23/08/00	16:30	CC		4	PS	4
Rochat, D.	716	EFFECT OF ORYCTES RHINOCEROS PHEROMONE (ETHYL 4-METHYLOCTANOATE) DIFFUSION RATE ON THE SIZE OF PEST CATCHES	I	181	24/08/00	16:30	CC		4	PS	4
Rochester, W.	129	LANDSCAPE LEVEL CULTURAL CONTROL: FUTURE PROSPECTS AND LIMITATIONS	I	33	24/08/00	11:30	HB	A	2	7	2
Rochester, W. A.	751	SPATIAL ANALYSIS OF HELIOTHIS DISTRIBUTION AND ABUNDANCE FOR MEASURING THE EFFECTS OF MOTH MOVEMENT AT THE REGIONAL SCALE	I	190	21/08/00	14:10	Boi	T	5	1	5
Rodas, V.	1106	FIELD BIOLOGY OF THE GLASSY-WINGED SHARPSHOOTER IN SOUTHERN CALIFORNIA	I	279	24/08/00	16:30	CC		6	PS	6
Rodas, V.	1106	FIELD BIOLOGY OF THE GLASSY-WINGED SHARPSHOOTER IN SOUTHERN CALIFORNIA	I	279	24/08/00	16:30	CC		6	PS	6
Rodas, V.	2592	MANAGEMENT STRATEGIES FOR CITRUS VARIEGATED CHLOROSIS	II	655	24/08/00	15:35	HB	B	14	7	14
Rodas, Vanderlei	3210	MANAGEMENT STRATEGIES FOR CITRUS VARIEGATED CHLOROSIS	II	810	21/08/00	16:30	CC		17	PS	17
Roderick, G.	2202	IDENTIFYING THE GEOGRAPHIC SOURCE OF INDIVIDUALS THROUGH MULTILOCUS GENOTYPES	I	556	24/08/00	10:05	HB	L	12	7	12
Rodrigo, I.	2756	IPM STRATEGIES ON GREENHOUSE VEGETABLES: CONSTRAINTS TO A GENERAL ADOPTION	II	696	23/08/00	16:30	CC		14	PS	14

Sub-titles: (HB=Hotel Bourbon) - (HM=Hotel Mabu) - (CC=Convention Center) - (Bol=Foz Boulevard) - (PS=Poster Session) - (PL=Plenary Lecturer)

AUTHOR	Nº	TITLE	Book	Page	Date	Time	Local	Room	Session	Symp	New Session
Rodrigues Filho, E.	1309	METANOLIC EXTRACTS FROM DIMORPHANDRA MOLLIS (BARBATIMÃO) AND THEIR ACTIVITY IN WORKERS OF APIS MELLIFERA	I	330	21/08/00	16:30	CC		7	PS	7
Rodrigues Netto, S. M.	4070	USE OF SYNTHETIC PHEROMONE TRAPS FOR MONITORING OF STORED GRAINS PESTS	II	1028	21/08/00	16:30	CC		23	PS	23
Rodrigues, D.	1791	SEASONAL VARIATION AND EFFECTS OF LARVAL FEEDING RESOURCES ON HELICONIUS ERATO (LEPIDOPTERA: NYMPHALIDAE) ADULT BODY SIZE	I	451	24/08/00	16:30	CC		9	PS	9
Rodrigues, I. B.	1635	EVALUATION OF BIOLOGICAL CONTROL – BACILLUS SPHAERICUS 2362, EFFECTIVENESS AGAINST MALARIA VECTORS IN AMAZONIA	I	412	24/08/00	16:30	CC		8	PS	8
Rodrigues, I. B.	3019	ANOPHELES DARLINGI AND MALARIA IN AREAS OF SETTLEMENT IN AMAZÔNIA – MUNICÍPIO DE NOVO AIRÃO (AM)	II	762	25/08/00	16:30	CC		15	PS	15
Rodrigues, J. C. V.	64	POPULATION DYNAMICS OF BREVIPALPUS PHOENICIS ON DIFFERENT CITRUS VARIETIES IN BRAZIL: I - INFLUENCE OF CITRUS LEAF MINER INJURIES	I	16	25/08/00	16:30	CC		1	PS	1
Rodrigues, J. C. V.	65	POPULATION DYNAMICS OF BREVIPALPUS PHOENICIS ON DIFFERENT CITRUS VARIETIES IN BRAZIL: II - INFLUENCE OF CITRUS VARIETY	I	17	25/08/00	16:30	CC		1	PS	1
Rodrigues, J. C. V.	2130	ULTRASTRUCTURAL ASPECTS OF THE COLONIZATION PROCESS OF ECDYTOLOPHA AURANTIANA BY THE ENTOMOPATHOGENIC NEMATODE STEINERNEMA GLASERI	I	537	24/08/00	16:30	CC		11	PS	11
Rodrigues, S. M. M.	1636	PARASITISM RATE BY LYSIPHLEBUS TESTACEIPES (HYM.: APHIDIIDAE) ON SCHIZAPHIS GRAMINUM AND APHIS GOSSYPII (HEM.: APHIDIDAE)	I	412	24/08/00	16:30	CC		8	PS	8
Rodrigues, W. C.	1659	PARASITOIDS OF PHYLLOCNISTIS CITRELLA IN RIO DE JANEIRO STATE, BRASIL	I	418	25/08/00	16:30	CC		8	PS	8
Rodrigues, W. C.	1108	NITROGEN AND POTASSIUM FERTILIZATION WERE INFLUENCING THE WHITEFLIES POPULATIONS IN CITRIC PLANTS	I	279	24/08/00	16:30	CC		6	PS	6
Rodrigues, W. C.	1109	INFLUENCE OF DIFFERENT LEVELS OF NITROGEN AND POTASSIUM FERTILIZATION ON THE SCALES POPULATIONS ASSOCIATED WITH CITRIC PLANTS	I	280	24/08/00	16:30	CC		6	PS	6
Rodrigues, W. C.	1139	A SURVEY OF THE ENTOMO-WILDLIFE ASSOCIATED THE GUAVA ORCHARDS (PSIDIUM GUAYAVA) CULTUVAR OGAWA 2, WITH THE UTILIZATION OF LURING TRAP MODEL C-47 AND THE (BINOMIAL) 'PRESENCE-ABSENCE' SAMPLING METHOD, IN THE STATE OF RIO DE JANEIRO, BRAZIL	I	287	23/08/00	16:30	CC		6	PS	6
Rodrigues, W. C.	1137	IDENTIFICATION OF THE SPATIAL DISTRIBUTION PATTERNS OF INSECT SPECIES BELONGING TO THE HOMNOPETRA-STERNORHYNCA COMPELX IN CITRUS PLANTS (CITRUS SPP.) IN THE STATE OF RIO DE JANEIRO THROUGH THE USE OF VARIOUS STATISTICAL AND MATHEMATICAL MODELS	I	287	24/08/00	16:30	CC		6	PS	6
Rodrigues, W. C.	1158	DAMAGE CAUSED BY SNOUT BEETLES OF THE GENERA PANTOMORUS AND NAUPACTUS IN THE "TAHITI" TRUE LIME IN ARARUAMA CITY, RJ - BRAZIL	I	292	25/08/00	16:30	CC		6	PS	6
Rodrigues, W. C.	2621	OCCURRENCE OF THE ENTOMOPATHOGENIC FUNGUS ASCHERSONIA SP. INFESTING SELENASPIDUS ARTICULATUS (HOMOPTERA: DIASPIDIDAE), IN THE STATE OF RIO DE JANEIRO, BRAZIL	II	662	21/08/00	16:30	CC		14	PS	14
Rodrigues, W.C.	2799	EFFECT OF NITROGENOUS AND POTASSIC FERTILIZATION ON THE POPULATION OF ALEUROTHRIXUS FLOCCOSUS (HOMOPTERA; ALEYRODIDAE), IN SWEET ORANGE (CITRUS SINENSIS), CULTIVAR "FOLHA MURCHA"	II	707	24/08/00	16:30	CC		14	PS	14
Rodrigues, W.C.	2800	EFFECT OF DIFFERENT LEVELS OF NITROGENOUS AND POTASSIC FERTILIZATION ON THE POPULATION OF COCCUS VIRIDIS (HOMOPTERA; COCCIDAE) IN SWEET ORANGE (CITRUS SINENSIS), CULTIVAR "FOLHA MURCHA"	II	707	24/08/00	16:30	CC		14	PS	14
Rodríguez Gil, S. G.	2309	CYTOGENETIC HETEROGENEITY IN COMMON ARGENTINE HAPLOGINE SPIDERS	I	583	24/08/00	16:30	CC		12	PS	12
Rodriguez Pardina, P.	3236	DELPHACID PLANTHOPPERS AND THE "MAL DE RIO CUARTO" IN MAIZE IN THE NORTH OF ARGENTINA (INSECTA - FULGOROMORPHA)	II	817	23/08/00	16:30	CC		17	PS	17
Rodriguez Prado, R. N.	368	FRUIT FLY (DIPTERA:TEPHRITIDAE) QUARANTINE PROCEDURES FOR EXPORT OF AVOCADOS FROM ARGENTINA TO CHILE	I	93	25/08/00	16:30	CC		2	PS	2
Rodriguez, A. D.	1281	INSECTICIDE RESISTANCE MANAGEMENT APPLICATION TO THE CONTROL OF MALARIA VECTORS	I	323	25/08/00	15:20	HM	N	7	10	7
Rodríguez, A. D.	3012	A THREE-YEAR FIELD EVALUATION OF THE IMPACT OF ROTATIONS AND MOSAIC AS RESISTANCE MANAGEMENT STRATEGIES IN ANOPHELES ALBIMANUS IN SOUTHERN MEXICO	II	760	24/08/00	16:30	CC		15	PS	15
Rodríguez, A. D.	1381	RESISTANCE MECHANISMS IN ANOPHELES ALBIMANUS DURING A LARGE-SCALE FIELD TRIAL USING A SINGLE INSECTICIDE, ROTATION AND MOSAIC STRATEGIES IN MEXICO	I	348	24/08/00	16:30	CC		7	PS	7
Rodriguez, M.	1281	INSECTICIDE RESISTANCE MANAGEMENT APPLICATION TO THE CONTROL OF MALARIA VECTORS	I	323	25/08/00	15:20	HM	N	7	10	7
Rodríguez, M. H.	1381	RESISTANCE MECHANISMS IN ANOPHELES ALBIMANUS DURING A LARGE-SCALE FIELD TRIAL USING A SINGLE INSECTICIDE, ROTATION AND MOSAIC STRATEGIES IN MEXICO	I	348	24/08/00	16:30	CC		7	PS	7
Rodríguez, M. H.	3012	A THREE-YEAR FIELD EVALUATION OF THE IMPACT OF ROTATIONS AND MOSAIC AS RESISTANCE MANAGEMENT STRATEGIES IN ANOPHELES ALBIMANUS IN SOUTHERN MEXICO	II	760	24/08/00	16:30	CC		15	PS	15
Rodríguez, M.L.	1526	SUBLETHAL EFFECTS OF BACILLUS THURINGIENSIS VAR. ISRAELENSIS (VECTOBAC G & AS) ON LIFE PARAMETERS OF AEDES AEGYPTI	I	385	22/08/00	16:30	CC		8	PS	8
Rodriguez, R.	366	ASSESSING AREAS OF CLIMATIC STRESS FOR CERATITIS CAPITATA (DIPTERA: TEPHRITIDAE) IN ARGENTINA	I	93	25/08/00	16:30	CC		2	PS	2
Rodriguez, R.	3024	POTENTIAL GEOGRAPHIC RANGE OF AEDES ALBOPICTUS (DIPTERA: CULICIDAE) IN ARGENTINA	II	763	23/08/00	16:30	CC		15	PS	15
Rodríguez, S.	651	FLOWER PREFERENCE AND FORAGING BEHAVIOR OF CENTRIS RODOPHTHALMA PÉREZ (HYMENOPTERA: ANTHOPHORIDAE)	I	165	22/08/00	16:30	CC		4	PS	4
Rodríguez, S.	931	BIOLOGY AND REPRODUCTIVE BEHAVIOR OF CENTRIS RODOPHTHALMA (HYMENOPTERA: ANTHOPHORIDAE)	I	235	21/08/00	16:30	CC		6	PS	6
Rodriguez, S. M	328	BASIL-TOMATO INTERCROPPING EFFECT ON MACROSIPHUM EUPHORBIAE (HEMIPTERA: APHIDIDAE) ABUNDANCE	I	83	24/08/00	16:30	CC		2	PS	2
Rodriguez, S. M	1391	EXTRACTS OF CHRYSANTHEMUM CINERARIAEFOLIUM AND QUASSIA AMARA: EVALUATION OF EFICIENCE AND EFFECT ON SITOPHILUS ORYZAE (COLEOPTERA:CURCULIONIDAE)	I	351	25/08/00	16:30	CC		7	PS	7
Rodríguez, S. M.	1135	USE OF NATURAL EXTRACTS OF BASIL, DILL AND FENNEL LIKE ALTERNATIVE MEASURE OF CONTROL OF MACROSIPHOM EUPHORBIAE (HEMIPTERA: APHIDIDAE)	I	286	24/08/00	16:30	CC		6	PS	6
Rodriguez, V.	4127	SYSTEMATIC POSITION OF TWO POLYMORPHIC SPECIES OF CHELYMORPHA BOH. (COLEOPTERA: CHRYSOMELIDAE: CASSIDINAE)	II	1042	25/08/00	13:40	HM	P	24	2	24
Rodriguez, V.	3856	SYSTEMATIC POSITION OF TWO POLYMORPHIC SPECIES OF CHELYMORPHA BOH. (COLEOPTERA: CHRYSOMELIDAE: CASSIDINAE)	II	973					21		21
Rodriguez-Acosta, A.	3007	DOMICILIATION OF SELVATIC CHAGAS DISEASE VECTOR PANSTROGYLUS GENICULATUS (TRIATOMINAE:REDUVIIDAE) IN VENEZUELA.	II	759	24/08/00	16:30	CC		15	PS	15
Rodríguez-del-Bosque, L. A.	1564	JALISCO FLY (DIPTERA: TACHINIDAE) AS A BIOLOGICAL CONTROL AGAINST MEXICAN RICE BORER (LEPIDOPTERA: PYRALIDAE) IN TEXAS SUGARCANE	I	394	22/08/00	16:30	CC		8	PS	8
Rodriguez-M., J. C.	1316	RESPONSE OF PLUTELLA XYLOSTELLA (LEPIDOPTERA: PLUTELLIDAE) TO THE SELECTION WITH BACILLUS THURINGIENSIS	I	332	22/08/00	16:30	CC		7	PS	7
Rodríguez-Padilla, C.	2125	GENETIC VARIABILITY AMONG BEAUVERIA BASSIANA AND PAECILOMYCES FUMOSOROSEUS	I	536	24/08/00	16:30	CC		11	PS	11
Rodríguez-Padilla, C.	2077	A PAECILOMYCES FUMOSOROSEUS MUTANT OVERPRODUCING CHITINASE DISPLAYS HIGH VIRULENCE AGAINST BEMISIA TABACI	I	524	22/08/00	16:30	CC		11	PS	11
Roeder, T.	2347	BIOGENIC AMINES AS NEUROTRANSMITTERS AND NEUROMODULATORS	II	593	22/08/00	9:35	HB	I	13	3	13

Sub-titles: (HB=Hotel Bourbon) - (HM=Hotel Mabu) - (CC=Convention Center) - (Bol=Foz Boulevard) - (PS=Poster Session) - (PL=Plenary Lecturer)

AUTHOR	Nº	TITLE	Book	Page	Date	Time	Local	Room	Session	Symp	New Session
Roeder, T.	2433	FUNCTION-SPECIFIC TRANSCRIPTION IN THE NERVOUS SYSTEM AND SENSE ORGANS OF INSECTS	II	615	22/08/00	16:30	CC		13	PS	13
Roelofs, W. L.	596	PHEROMONE BIOSYNTHESIS: UNIQUE DESATURASE GENES	I	151	23/08/00	9:35	Bol	S	4	4	4
Roesli, R.	4110	MODELING TEMPERATURE CHANGES DURING HEAT TREATMENT OF FLOUR MILLS FOR INSECT CONTROL	II	1038	25/08/00	16:30	CC		23	PS	23
Rogers, D. J.	2906	INTEGRATING REMOTELY-SENSED DATA INTO BIOLOGICAL MODELS OF TRYPANOSOME TRANSMISSION IN AFRICA	II	733	23/08/00	15:50	Bol	R	15	6	15
Rogers, M. E.	578	DIVERSITY, PHYLOGENY, AND FUNCTIONS OF ODOR RECEPTION PROTEINS: OBP, ODE AND SNMP	I	146	21/08/00	13:30	Bol	S	4	1	4
Rogo, L. M.	1956	CONSERVE OR NOT TO CONSERVE FOREST FRAGMENTS: CASE STUDY USING BUTTERFLIES AT THE KENYA COAST	I	493	24/08/00	16:30	CC		10	PS	10
Roisin, Y.	519	LEAF LITTER ANT AND TERMITE DIVERSITY IN IGUASSU AND RIO PILCOMAYO NATIONAL PARKS, ARGENTINA	I	131	23/08/00	16:30	CC		3	PS	3
Roitberg, B. D.	2572	ARTHROPOD BEHAVIOR AND IPM	II	650	23/08/00	10:30	HB	B	14	5	14
Rojas de Arias, A.	2958	ISOENZYMATIC CHARACTERIZATION OF TRIATOMA INFESTANS POPULATIONS FROM EASTERN AND WESTERN REGIONS OF PARAGUAY	II	746	21/08/00	16:30	CC		15	PS	15
Rojas de Arias, A.	3154	MORPHOMETRIC DIFFERENCES OF TRIATOMA INFESTANS FROM THE EASTERN AND WESTERN REGIONS OF PARAGUAY	II	796	23/08/00	16:30	CC		16	PS	16
Rojas, G. C.	1637	LARVAL ENDOPARASITOIDS OF EPINOTIA APOREMA (LEPIDOPTERA:TORTRICIDAE) IN THE PROVINCE OF BUENOS AIRES, ARGENTINA	I	413	24/08/00	16:30	CC		8	PS	8
Rojas, M. G.	1554	DEVELOPMENT OF AN ARTIFICIAL DIET FOR REARING EDOVUM PUTTLERI, AN EGG PARASITOID OF THE COLORADO POTATO BEETLE, LEPTINOTARSA DECEMLINEATA	I	392	22/08/00	16:30	CC		8	PS	8
Roland, J.	745	TRACKING ALPINE BUTTERFLY MOVEMENT USING HARMONIC 'RADAR'	I	188	21/08/00	10:15	Bol	T	5	1	5
Roland, J.	125	LARGE TACHINID PARASITOIDS RESPOND TO HABITAT STRUCTURE AT LARGER SPATIAL SCALES	I	32	24/08/00	10:10	HB	A	2	7	2
Roland, J.	1129	FITTING POPULATION DYNAMICS MODELS TO SPATIAL INSECT DATA: SCALING DISPERSAL TO LANDSCAPE STRUCTURE AT MULTIPLE SPATIAL SCALES	I	285	24/08/00	16:30	CC		6	PS	6
Rolón, M	2987	TRIATOMINES AND OTHER ARTHROPODS IN BIRD NESTS IN NATIVE AND MENNONITE COMMUNITIES OF THE PARAGUAYAN CHACO	II	754	22/08/00	16:30	CC		15	PS	15
Roltsch, W.	3959	REVIEWING A MULTI-AGENCY BIOLOGICAL CONTROL PROGRAM FOR BEMISIA ARGENTIFOLII IN THE SOUTHWEST UNITED STATES: ESTABLISHING, CONSERVING & AUGMENTING NEW PARASITOIDS & EVALUATING THEIR IMPACT	II	999	22/08/00	16:30	CC		22	PS	22
Roltsch, W.	3960	REVIEWING A MULTI-AGENCY BIOLOGICAL CONTROL PROGRAM FOR BEMISIA ARGENTIFOLII IN THE SOUTHWEST UNITED STATES: FOREIGN EXPLORATION, MASS CULTURE & EVALUATIONS	II	999	22/08/00	16:30	CC		22	PS	22
Romani, R.	1456	SPIRACULAR GLANDS OF DROSOPHILA MELANOGASTER PUPARIA ELICIT RECOGNITION REPONSE IN TRICHOPRIA DROSOPHILAE	I	367	23/08/00	15:15	HM	O	8	6	8
Romani, R.	3145	SPIRACULAR GLANDS OF DROSOPHILA MELANOGASTER PUPARIA ELICIT RECOGNITION RESPONSE IN TRICHOPRIA DROSOPHILAE	II	793	23/08/00	16:30	CC		16	PS	16
Romanini, M. H.	2162	NUCLEOPOLYHEDROVIRUS SPECIFIC TO FALL ARMYWORM SPODOPTERA FRUGIPERDA	I	545	22/08/00	16:30	CC		11	PS	11
Romano	1451	HOST SELECTION STRATEGIES BY THE APHID PARASITOID APHIDIUS ERVI	I	366	23/08/00	13:35	HM	O	8	6	8
Romanowski, H. P.	1130	POPULATION ECOLOGY OF CORECORIS DENTIVENTRIS (HEMIPTERA: COREIDAE) IN AN EXPERIMENTAL PLOT OF NICOTIANA TABACUM (SOLANACEAE): SPATIAL DISTRIBUTION AND DISPERSAL.	I	285	24/08/00	16:30	CC		6	PS	6
Romanowski, H. P.	542	THYSANOPTERA DIVERSITY AT PARQUE ESTADUAL DE ITAPUÃ, VIAMÃO, RS, BRAZIL	I	137	24/08/00	16:30	CC		3	PS	3
Romanowski, H. P.	1026	POPULATION DYNAMICS OF CORECORIS DENTIVENTRIS ADULTS (HEMIPTERA: COREIDAE) IN A TOBACCO EXPERIMENTAL PLOT	I	259	23/08/00	16:30	CC		6	PS	6
Romanowski, H. P.	3608	SPATIAL AND TEMPORAL VARIATION OF EFFLAGITATUS FREUDEI (HETEROCERIDAE) POPULATIONS AT THE SUPRALITTORAL OF RONDINHA SANDY BEACH, RS, BRAZIL, BETWEEN AUTUMN AND SPRING	II	910	25/08/00	16:30	CC		20	PS	20
Romanowski, H. P.	919	POPULATION ECOLOGY OF CORECORIS DENTIVENTRIS (HEMIPTERA: COREIDAE) IN AN EXPERIMENTAL PLOT OF NICOTIANA TABACUM (SOLANACEAE): SEASONAL FLUCTUATIONS, MORTALITY AND PARASITIZATION	I	232	21/08/00	16:30	CC		6	PS	6
Romans, P.	3218	THE EFFECT OF MALARIA INFECTION ON MOSQUITO VITELLOGENESIS	II	812	22/08/00	16:30	CC		17	PS	17
Romay, G.	932	BIOLOGY OF THE GUAVA COTTONY SCALE, CAPULINIA SP. NEAR JABOTICABAE (HEMIPTERA: ERIOCOCCIDAE) AND PHYSICAL EFFECT OF BARK EXFOLIATIONS OF GUAVA PLANT	I	235	21/08/00	16:30	CC		6	PS	6
Romeis, J.	1792	GUSTATORY RESPONSE AND NUTRITIONAL SUITABILITY OF INDIVIDUAL NECTAR SUGARS FOR PIERIS BRASSICAE	I	451	24/08/00	16:30	CC		9	PS	9
Romeis, J.	1793	VARIABILITY IN THE BEHAVIOURAL RESPONSE OF THE ONION FLY TO N-DIPROPYL DISULFIDE	I	452	24/08/00	16:30	CC		9	PS	9
Römer, H.	1733	PREDATION BY GLEANING AND AERIAL HAWKING BATS: ITS EFFECT ON THE EVOLUTION OF HEARING AND SOUND COMMUNICATION IN TWO GROUPS OF KATYDIDS IN PANAMA	I	437	22/08/00	16:00	HB	F	9	3	9
Römer, H.	1735	SERAGLIOS AND SIGNALING IN BLADDER GRASSHOPPERS	I	437	23/08/00	9:30	HB	F	9	3	9
Romera, L.	3826	SOME WINTER GEOMETRIDS FROM CENTRAL SPAIN (INSECTA: LEPIDOPTERA, GEOMETRIDAE)	II	966	24/08/00	16:30	CC		21	PS	21
Romera, L.	3857	CONTRIBUTION TO THE KNOWLEDGE OF BUTTERFLIES IN THE COIBA NATIONAL PARK, PANAMA. (LEPIDOPTERA: PAPILIONOIDEA)	II	973	24/08/00	16:30	CC		21	PS	21
Romera, L.	3759	THE GENUS CRYPHIA (INSECTA, LEPIDOPTERA, NOCTUIDAE) IN CENTRAL SPAIN	II	949	22/08/00	16:30	CC		21	PS	21
Romero, V. F.	495	STRUCTURE AND DIVERSITY OF STREAM INSECT ASSEMBLAGES APPLIED TO ASSESSMENT: THE LULES RIVER (TUCUMAN, ARGENTINA)	I	125	22/08/00	16:30	CC		3	PS	3
Romacher, B.	1724	PROCESSING OF ACOUSTIC SIGNALS IN THE AUDITORY SYSTEM OF GRASSHOPPERS: POSSIBLE CONSTRAINTS ON SIGNAL TYPES	I	434	22/08/00	13:45	HB	F	9	3	9
Roncada, M. J.	220	FILTH IN FRUIT PRODUCTS MARKETED IN SÃO PAULO, BRAZIL	I	56	22/08/00	16:30	CC		2	PS	2
Ronchi-Teles, B.	1131	POPULATION FLUCTUATION OF ANASTREPHA SPP (DIPTERA: TEPHRITIDAE) IN AMAZONAS STATE, BRAZIL	I	285	24/08/00	16:30	CC		6	PS	6
Ronchi-Teles, B.	1132	ASSOCIATION BETWEEN ANASTREPHA SPP (DIPTERA: TEPHRITIDAE) AND THEIR PARASITOIDS IN TWO SPECIES OF FRUIT IN AMAZONAS STATE, BRAZIL	I	285	24/08/00	16:30	CC		6	PS	6
Rondan Dueñas, J. C.	2310	MITOCHONDRIAL DNA "A+T RICH" REGION AS A GENETIC MARKER IN AEDES AEGYPTI POPULATION STUDIES	I	583	24/08/00	16:30	CC		12	PS	12
Ronderos, M. M.	3179	THE LARVA AND PUPA OF CULICOIDES BAMBUSICOLA LUTZ OBSERVED WITH SEM, AND ADDITIONAL NOTES ON THE ADULTS (DIPTERA: CERATOPOGONIDAE)	II	802	24/08/00	16:30	CC		16	PS	16
Rong, R. Q.	1505	THE OCCURRENCE OF LEAFMINERS AND THEIR PARASITOIDS ON VEGETABLE CROPS AND WEEDS IN SOUTHEAST CHINA	I	380	21/08/00	16:30	CC		8	PS	8
Ronquist, F.	827	HOW GALL WASPS BECAME GALL WASPS	I	209	23/08/00	10:05	HB	D	6	5	6
Ronquist, F.	3827	HOW GALL WASPS BECAME GALL WASPS	II	966	24/08/00	16:30	CC		21	PS	21
Ronquist, F.	550	PATTERNS OF ANIMAL DISPERSAL, VICARIANCE AND DIVERSIFICATON IN THE HOLARCTIC	I	139	24/08/00	16:30	CC		3	PS	3
Ronquist, F.	3193	MAJOR TRENDS IN THE EVOLUTION OF HYMENOPTERAN MORPHOLOGY	II	805	24/08/00	16:30	CC		16	PS	16

Sub-titles: (HB=Hotel Bourbon) - (HM=Hotel Mabu) - (CC=Convention Center) - (Bol=Foz Boulevard) - (PS=Poster Session) - (PL=Plenary Lecturer)

AUTHOR	Nº	TITLE	Book	Page	Date	Time	Local	Room	Session	Symp	New Session
Room, P.M.	2600	PLANT ARCHITECTURE AND IPM: PROGRESS IN DEVELOPING 'VIRTUAL RICE'	II	657	25/08/00	14:00	HB	B	14	8	14
Roos, F.	2634	CRUISER® 70 WS: A NEW-LOOK NEONICOTINOID SEED TREATMENT FOR CEREAL CROPS.	II	665	22/08/00	16:30	CC		14	PS	14
Ros, A. B.	170	AGRONOMIC EFFICIENCY OF INSECTICIDES AT DIFFERENT RATES TO THE CONTROL OF APHIS GOSSYPII IN COTTON CROP	I	44	21/08/00	16:30	CC		2	PS	2
Rosa, J. A. da	4069	BEHAVIOUR'S ESTIMATION OF PANSTRONGYLUES MEGISTUS (HEMIPTERA-REDUVIIDAE) UNDER THE ACTION OF LIME (CAOH)	II	1027	21/08/00	16:30	CC		23	PS	23
Rosa, C. A.	2494	INFLUENCE OF WATER AND NUTRITIONAL STATUS OF BACCHARIS DRACUNCULIFOLIA ON THE ABUNDANCE AND RICHNESS OF ENDOPHYTES	II	630	24/08/00	16:30	CC		13	PS	13
Rosa, M. De	2423	PRELIMINARY INVESTIGATION ON INDIVIDUAL RESPIRATION OF ADULTS AND PUPAE OF OSMIA CORNUTA DURING DIAPAUSE BY MEANS OF A CO2 ANALYZER BASED ON AN INFRARED TUNABLE DIODE LASER	II	612	22/08/00	16:30	CC		13	PS	13
Rosado Neto, G. H.	1116	BIOLOGICAL ASPECTS OF ORYZOPHAGUS ORYZAE (COLEOPTERA: CURCULIONIDAE) IN WATER-SEEDED RICE	I	281	24/08/00	16:30	CC		6	PS	6
Rosado Neto, G. H.	1789	ETOLOGICAL ASPECTS OF ORYZOPHAGUS ORYZAE (COLEOPTERA: CURCULIONIDAE) IN WATER- SEEDED RICE	I	451	25/08/00	16:30	CC		9	PS	9
Rosado Neto, G. H.	2127	CONTROL ASPECTS OF ORYZOPHAGUS ORYZAE WITH BEAUVERIA BASSIANA, METARHIZIUM ANISOPLIAE AND FIPRONIL IN WATER-SEEDED RICE	I	536	23/08/00	16:30	CC		11	PS	11
Rosado-Neto, G. H.	3619	SYSTEMATICS, CLADISTIC ANALYSIS, AND GEOGRAPHICAL DISTRIBUTION OF THE TRIBE STERNECHINI (COLEOPTERA, CURCULIONIDAE, MOLYTINAE)	II	914	21/08/00	14:05	HB	E	21	2	21
Rosado-Neto, G. H.	3795	CONFIRMING A NEW STATUS FOR ODONTOPUS BREVIROSTRIS (COLEOPTERA: CURCULIONIDAE) VERSUS ANNONA MURICATA (ANONACEAE)	II	958	24/08/00	16:30	CC		21	PS	21
Rosales, R.	3013	BLOOD SOURCES OF THE TRIATOMINE BUGS COLLECTED AT THE RURAL VILLAGES IN GUATEMALA (HEMIPTERA: TRIATOMIDAE)	II	760	24/08/00	16:30	CC		15	PS	15
Rosario, I. A.	3590	SPECIATION PROCESSES IN TWO SYMPATRIC CAVE-DWELLING TRECHUS FROM PICO ISLAND, AZORES	II	906	25/08/00	13:30	Bol	U	20	3	20
Rosas, M. V.	3828	BUTTERFLIES OF FOUR LOCALITIES IN "TIERRA CALIENTE" MICHOACAN, MEXICO	II	966	24/08/00	16:30	CC		21	PS	21
Rosbash, M.	2339	PEPTIDERGIC OUTPUT OF THE CIRCADIAN CLOCK IN DROSOPHILA.	II	591	21/08/00	10:10	HB	I	13	1	13
Rosca, I.	895	RESEARCH REGARDING POPULATIONS DYNAMICS AND MARKING EUROPEAN CORN BORER (OSTRINIA NUBILALIS)	I	226	21/08/00	16:30	CC		6	PS	6
Rosca, I.	548	ZOOGEOGRAPHICAL ANALYSIS OF THE FAUNA OF TERRESTRIAL HETEROPTERA FROM ROMANIA	I	139	24/08/00	16:30	CC		3	PS	3
Rosca, I.	713	RESEARCH DIRECTIONS OF USING THE SYNTHETIC SEXUAL PHEROMONES ON FIELD CROPS IN ROMANIA	I	180	24/08/00	16:30	CC		4	PS	4
Roschard, J.	3428	DIVISION OF LABOUR AND SIZE POLYMORPHISM OF FORAGERS OF THE LEAFCUTTER ANT ATTA VOLLENWEIDERI	II	865	23/08/00	10:20	HM	Q	19	4	19
Rose, A. M.	2872	HOW THE FINE-SCALE PLUME STRUCTURE OF HOST-ODOURS AFFECT THE FLIGHT BEHAVIOUR OF MOSQUITOES	II	725	21/08/00	10:50	Bol	R	15	1	15
Rose, H.	3223	INTERACTIONS BETWEEN INSECT VECTORS OF PLANT DISEASES IN AUSTRALIA	II	814	22/08/00	16:30	CC		17	PS	17
Rosell, R. C.	314	IDENTIFICATION OF PROTEOLYTIC ACTIVITY IN BEMISIA TABACI B TYPE (HOMOPTERA: ALEYRODIDAE)	I	80	24/08/00	16:30	CC		2	PS	2
Rosenberg, L. J.	1133	MIGRATIONS OF LOCUSTS OUT OF THEIR NORMAL RANGE	I	286	24/08/00	16:30	CC		6	PS	6
Rosenkranz, P.	3448	UTILIZATION OF DIFFERENT CULTURE MEDIA FOR BEE SEMEN STORAGE (APIS MELLIFERA; HYMENOPTERA: APOIDEA)	II	870	21/08/00	16:30	CC		19	PS	19
Ros-Farré, P.	488	BIODIVERSITY OF CYNIPOIDEA FROM BRAZIL (HYMENOPTERA)	I	124	22/08/00	16:30	CC		3	PS	3
Roslavtseva, S. A.	21	ASSESSMENT OF PUBLIC HYGIENE INSECTO ACARICIDES IN RUSSIA	I	6	21/08/00	16:30	CC		1	PS	1
Ross, D. W.	2432	PUPAL DIAPAUSE OF COLORADIA PANDORA: THERMAL CONSTRAINTS ON SUCCESSFUL PUPATION	II	614	22/08/00	16:30	CC		13	PS	13
Ross, J. B.	289	DO INVERSIONS INCREASE SPRAY DRIFT	I	73	23/08/00	16:30	CC		2	PS	2
Ross, K. G.	2189	A DELETERIOUS GENETIC ELEMENT PROMOTES MULTIPLE-QUEEN ASSOCIATIONS IN THE FIRE ANT SOLENOPSIS INVICTA	I	553	22/08/00	16:15	HB	L	12	4	12
Ross, L. S.	2434	AN EST PROJECT ON AEDES AEGYPTI IDENTIFIES PROTEINS INVOLVED IN ION TRANSPORT IN THE MIDGUT AND MALPIGHIAN TUBULES	II	615	22/08/00	16:30	CC		13	PS	13
Ross, L. S.	2408	A TRANSPORTER-LIKE PROTEIN INEBRIATED, WHICH RESPONDS TO OSMOTIC STIMULI, IS INVOLVED IN POTASSIUM TRANSPORT	II	608	21/08/00	16:30	CC		13	PS	13
Ross, M.	1354	TIMING INSECTICIDE APPLICATIONS FOR DUSKY SAP BEETLE (COLEOPTERA: NITIDULIDAE) CONTROL IN BT SWEET CORN.	I	342	23/08/00	16:30	CC		7	PS	7
Ross, R. T.	3930	IRRADIATION PROCESSING TO MEET PHYTOSANITARY REQUIREMENTS FOR EXPORT OF BRAZILIAN FRUITS	II	992	26/08/00	11:15	HB	H	22	8	22
Rossi, M. N.	1638	ANALYSIS OF THE BIOLOGICAL CONTROL OF THE DIATRAEA SACCHARALIS AT DIFFERENT SPATIAL SCALES: LACK OF CONTROL OR POOR DATA SET?	I	413	24/08/00	16:30	CC		8	PS	8
Rossler, Y.	3988	FLY FREE ZONES - TECHNOLOGY, APPLICABILITY AND LIMITATIONS (THE ISRAELI EXPERIENCE)	II	1006	24/08/00	16:30	CC		22	PS	22
Rostaman	709	LABORATORY AND FIELD TEST OF SEX PHEROMONE OF SPODOPTERA EXIGUA (LEPIDOPTERA: NOCTUIDAE)	I	179	25/08/00	16:30	CC		4	PS	4
Rotenberry, J. T.	910	PATTERNS AND PROCESSES OF ARTHROPOD COMMUNITY SUCCESSION AFTER A FIRE	I	230	21/08/00	16:30	CC		6	PS	6
Rotenberry, J. T.	1103	DIPTERA COMMUNITY COMPOSITION AND SUCCESSION FOLLOWING HABITAT DISTURBANCE BY WILDFIRE	I	278	21/08/00	16:30	CC		6	PS	6
Rotenberry, J. T.	1708	SINGING AND SCALES: VARIATION IN SEXUAL SIGNALS OF CRICKETS SUBJECT TO PHONOTACTIC PARASITOIDS	I	430	21/08/00	10:35	HB	F	9	1	9
Roth, B. R.	2979	CHARACTERIZATION OF LONOMIA OBLIQUA AND PERIGA CIRCUNSTANS (LEPIDOPTERA, SATURNIIDAE) OCCURING IN RIO GRANDE DO SUL STATE, BRAZIL	II	752	22/08/00	16:30	CC		15	PS	15
Roth, S.	3074	DORSOVENTRAL PATTERNING IN TRIBOLIUM CASTANEUM	II	776	24/08/00	14:30	HB	G	16	6	16
Rothmann T., S.	1824	DETECTION AND CONTROL OF THE GUM TREE WEEVIL GONIPTERUS SCUTELLATUS IN CHILE (COLEOPTERA: CURCULIONIDAE)	I	460	22/08/00	10:05	HB	M	10	2	10
Rothschild, M.	25	IGG BINDING SITES IN THE SALIVARY GLANDS AND CEMENT CONE OF AN IXODID TICK	I	7	21/08/00	16:30	CC		1	PS	1
Rotundo, M.	1378	EFFECT OF CHEMIGATION THROUGH CENTRAL PIVOT, FOR THE CONTROL OF THE FALL ARMYWORM, SPODOPTERA FRUGIPERDA, (LEPIDOPTERA: NOCTUIDAE), IN CORN	I	348	24/08/00	16:30	CC		7	PS	7
Rotundo, M.	1400	EFFECT OF A NEW FORMULATION OF LAMBDA-CYHALOTHRIN FOR THE CONTROL OF THE BOLL WEEVIL, ANTHONOMUS GRANDIS (COLEOPTERA: CURCULIONIDAE), IN COTTON	I	353	25/08/00	16:30	CC		7	PS	7
Roush, R. T.	1249	DEVELOPMENT AND IMPLEMENTATION OF RESISTANCE MANAGEMENT STRATEGIES FOR BT COTTON IN AUSTRALIA	I	315	23/08/00	14:05	HM	N	7	6	7
Rousseau, M.	1649	BEMISIA TABACI BIOTYPE B (HEMIPTERA: ALEYRODIDAE) AND ITS PARASITOIDS: GUADELOUPE ISLAND AS A REPRESENTATIVE SITE OF THE CARIBBEAN	I	416	24/08/00	16:30	CC		8	PS	8
Roux, J.	1894	ASSOCIATIONS OF INSECTS AND PATHOGENS RESULTING IN DISEASE AND DAMAGE TO PLANTATION GROWN EUCALYPTUS IN THE TROPICS AND SOUTHERN HEMISPHERE	I	477	26/08/00	15:35	HB	M	10	10	10
Roversi, P. F.	1920	DISTRIBUTION AND ABUNDANCE OF MONOCHAMUS SPECIES ON PINES IN ITALY	I	484	22/08/00	16:30	CC		10	PS	10
Rowell-Rahier, M.	1085	COST OF FLIGHT DISPERSAL IN OREINA CACALIAE (COLEOPTERA: CHRYSOMELIDAE)	I	274	24/08/00	16:30	CC		6	PS	6

Sub-titles: (HB=Hotel Bourbon) - (HM=Hotel Mabu) - (CC=Convention Center) - (Bol=Foz Boulevard) - (PS=Poster Session) - (PL=Plenary Lecturer)

AUTHOR	Nº	TITLE	Book	Page	Date	Time	Local	Room	Session	Symp	New Session
Rowley, W. A.	3006	THE IMPORTANCE OF DEVELOPING NOVEL STRATEGIES FOR PESTICIDE USE IN CONTROLLING VECTOR-BORNE DISEASES	II	758	24/08/00	16:30	CC		15	PS	15
Roy, P. J. S.	1598	DEVELOPING A COMMERCIALLY VIABLE SYSTEM USING TRICHOGRAMMA CHILONIS FOR CONTROL OF COTTON BOLLWORM HELIOTHIS ARMIGERA IN INDIA	I	403	23/08/00	16:30	CC		8	PS	8
Roy, P. J. S.	1599	DEVELOPING A COMMERCIALLY VIABLE SYSTEM USING CHRYSOPERLA CARNEA FOR CONTROL OF COTTON PESTS IN INDIA	I	403	23/08/00	16:30	CC		8	PS	8
Royalley, H. R.	1455	LOCAL ADAPTATION OF PARASITOID POPULATIONS: WHAT DOES LEARNING HAVE TO DO WITH IT?	I	367	23/08/00	14:55	HM	O	8	6	8
Rozkošný, R.	1134	DIPTERA OF THE PÁLAVA BIOSPHERE RESERVE OF UNESCO (CZECH REPUBLIC)	I	286	24/08/00	16:30	CC		6	PS	6
Rozman, V.	1392	THE EFFICACY OF SOME AROMATIC PLANTS AGAINST STORED PRODUCT INSECTS	I	351	25/08/00	16:30	CC		7	PS	7
Rozman, V.	4083	CONTROL OF PSOCIDS IN STORED WHEAT AND ITS PRODUCTS	II	1031	23/08/00	16:30	CC		23	PS	23
Ruberti, D. S.	2131	INSECTS AFFECTING SWEETPOTATO HARVEST	I	537	24/08/00	16:30	CC		11	PS	11
Rubink, W.	4177	SPATIAL AND TEMPORAL PATTERNS OF MITOCHONDRIAL DNA IN FERAL HONEY BEES: IMPACT OF AFRICANIZATION	II	1055	21/08/00	16:30	CC		Erratum	PS	12
Rubio, L.	3213	BIOLOGY OF CRINIVIRUSES AND WHITEFLY-TRANSMISSION	II	811	22/08/00	14:30	Bol	U	17	2	17
Rubio, M.	3606	EFFECT OF INTERCROP WITH CHINESE BEET (BRASSICA JUNCEA) ON THE ABUNDANCE OF BREVICORYNE BRASSICAE AND THE QUALITY OF CABBAGE (BRASSICA OLERACEA VAR. CAPITATA)	II	910	24/08/00	16:30	CC		20	PS	20
Rubiolo, E. R.	2497	TRIACYLGLYCEROL LIPASE FROM THE MIDGUT OF LARVAL MANDUCA SEXTA: PROPERTIES AND PARTIAL CHARACTERIZATION	II	631	24/08/00	16:30	CC		13	PS	13
Rubiolo, E. R.	2972	VECTOR-TRYPANOSOMA CRUZI RELATIONSHIP: CHANGES IN THE HEMOLYMPHATIC PROTEIN COMPOSITION OF DIPETALOGASTER MAXIMUS AFTER EXPERIMENTAL INFECTION	II	750	21/08/00	16:30	CC		15	PS	15
Rubsam, R.	3040	GERM LINE AND SOMA DIFFERENTIATION IN BOCN MUTANT DROSOPHILA OVARIES	II	767	21/08/00	14:30	HB	G	16	1	16
Rubsam, R.	3365	VIVE LA DIFFERENCE: FUSOMES AND RING CANALS IN POLYTROPHIC INSECT OVARIES	II	850	24/08/00	16:30	CC		18	PS	18
Rubsam, R.	3378	CYTOSKELETON DYNAMICS DURING SPERMATOGENESIS IN APIS MELLIFERA DRONES	II	853	25/08/00	16:30	CC		18	PS	18
Rudenskaja, Y. A.	2420	PROTEINASE INHIBITORS IN THE MIDGUT OF THE COCKROACH	II	611	21/08/00	16:30	CC		13	PS	13
Rueda, M. C.	3829	TAXOCAENOSIS OF THE FAMILY ASILIDAE (INSECTA: DIPTERA) IN ONE SUBTROPICAL AREA OF ARGENTINA	II	966	24/08/00	16:30	CC		21	PS	21
Ruf, M. L. L.	3830	THE GENUS LIMNOCORIS IN ARGENTINA (HETEROPTERA, NAUCORIDAE)	II	967	24/08/00	16:30	CC		21	PS	21
Ruiz, A.	2197	NATURAL SELECTION EFFECTS ON INVERSION SIZE IN DIPTERA	I	555	23/08/00	14:05	HB	L	12	6	12
Ruiz, A.	2213	TRANSPOSONS ARE IMPLICATED IN THE GENERATION OF NATURAL CHROMOSOMAL REARRANGEMENTS IN INSECTS	I	559	24/08/00	16:15	HB	L	12	8	12
Ruiz, R.	329	SPATIAL DISTRIBUTION OF THE COFFEE BERRY BORER HYPOTHENEMUS HAMPEI ON COFFEE TREES, ANS ITS IMPLICATIONS FOR SAMPLING	I	83	24/08/00	16:30	CC		2	PS	2
Ruiz, V. J.	2801	INTEGRATED BIOLOGICAL CONTROL OF WHITE FLIES (BEMISIA TABACI) IN OAXACA, MEXICO	II	707	24/08/00	16:30	CC		14	PS	14
Ruiz-Cancino, E.	330	PRESENCE OF HYPSIPYLA GRANDELLA IN THE STATE OF TAMAULIPAS, MÉXICO	I	84	24/08/00	16:30	CC		2	PS	2
Ruiz-Cancino, E.	2520	ECESIS OF ENCYRTIDAE (HYMENOPTERA: CHALCIDOIDEA) INTO MÉXICO	II	636	25/08/00	16:30	CC		13	PS	13
Ruiz-Cancino, E.	478	ADVANCES IN THE KNOWLEDGE OF HYMENOPTERA IN THE BIOSPHERE RESERVE "EL CIELO", MÉXICO	I	121	21/08/00	16:30	CC		3	PS	3
Ruiz-Cancino, E.	1600	THE ENCARSIA SPECIES - PARASITOIDS OF WHITEFLIES (HOMOPTERA: ALEYRODIDAE) IN MÉXICO	I	403	23/08/00	16:30	CC		8	PS	8
Runyon, J. B.	801	IMPACT OF CULTURAL PRACTICES ON POPULATIONS OF THE WHEAT STEM SAWFLY (HYMENOPTERA: CEPHIDAE) AND ITS ASSOCIATED PARASITOIDS	I	203	21/08/00	10:35	HB	D	6	1	6
Runzhi, Z.	2802	THEORY OF MUTUALISTIC PLANT PROTECTION (MPP) AND ITS PRACTICE: MAINLY REGARDING COTTON APHID MANAGEMENT BY SURROUNDING MARGINAL ALFAFA ZONE	II	707	24/08/00	16:30	CC		14	PS	14
Ruohomaki, K.	856	DO NATURAL ENEMIES PREVENT OUTBREAKS OF EPIRRITA AUTUMNATA IN SOUTHERN FENNOSCANDIA?	I	216	25/08/00	10:20	HB	D	6	7	6
Rupes, V.	1390	SULFOTINETM, A NEW ACTIVE FOR BAITS AGAINST COCKROACHES AND PHARAOH'S ANTS	I	351	24/08/00	16:30	CC		7	PS	7
Rupp, M. M. M.	2803	EVALUATION OF INSECTICIDES TO CONTROL MIGDOLUS FRYANUS IN SUGARCANE	II	708	24/08/00	16:30	CC		14	PS	14
Rushing, J. W.	350	WHITEFLIES (HOMOPTERA: ALEYRODIDAE) ON SPECIES OF MEDICINAL HERBAL PLANTS	I	89	25/08/00	16:30	CC		2	PS	2
Russell, B. L.	762	PEST MANAGEMENT INFORMATION IN AUSTRALIA	I	192	23/08/00	10:35	Bol	T	5	4	5
Russell, B. L.	782	MINING GEOGRAPHICAL DATA FOR BIOLOGICAL INFORMATION	I	197	25/08/00	10:05	Bol	T	5	6	5
Russell, B. L.	3990	INTEGRATION OF GLOBAL CHANGE IMPACTS	II	1007	24/08/00	16:30	CC		22	PS	22
Russell, D. A.	1280	DEVELOPMENT AND APPLICATION OF AN INSECTICIDE RESISTANCE IMPACT MINIMISATION STRATEGY FOR COTTON PEST CONTROL IN INDIA	I	323	25/08/00	15:05	HM	N	7	10	7
Russell, K.	2903	SPATIAL AND TEMPORAL HETEROGENEITY IN DENGUE VIRUS TRANSMISSION AND AEDES AEGYPTI POPULATION DENSITIES IN IQUITOS, PERU	II	733	23/08/00	14:35	Bol	R	15	6	15
Russell, R. J.	1263	A HITCH-HIKER'S GUIDE TO RESISTANCE IN THE SHEEP BLOWFLY	I	319	24/08/00	14:50	HM	N	7	8	7
Russo, A.	331	SCALE INSECTS OF CITRUS IN ITALY (HOMOPTERA COCCOIDEA)	I	84	24/08/00	16:30	CC		2	PS	2
Russo, S.	1135	USE OF NATURAL EXTRACTS OF BASIL, DILL AND FENNEL LIKE ALTERNATIVE MEASURE OF CONTROL OF MACROSIPHOM EUPHORBIAE (HEMIPTERA: APHIDIDAE)	I	286	24/08/00	16:30	CC		6	PS	6
Russo, S.	2804	HARMFUL AND BENEFICAL INSECT SPECIES IN TWO VARIETIES OF LUPINUS SPP. IN ARGENTINA	II	708	25/08/00	16:30	CC		14	PS	14
Rust, M. K.	3500	NUTRIENT FLOW AND NUTRITIONAL HEIRARCHY IN ANTS	II	883	23/08/00	16:30	CC		19	PS	19
Rust, M. K.	4106	BIORATIONAL APPROACH TO SUPRESSING AMERICAN COCKROACHES, PERIPLANETA AMERICANA, IN SEWAGE SYSTEMS	II	1037	25/08/00	16:30	CC		23	PS	23
Ruther, J.	1670	FORAGING CUES FROM DIFFERENT HOSTS USED BY THE GENERALIST PARASITOID LARIOPHAGUS DISTINGUENDUS (HYMENOPTERA: PTEROMALIDAE)	I	421	25/08/00	16:30	CC		8	PS	8
Rutkósky, F. C.	295	BIOLOGICAL ACTIVITY OF ORANGE MOTH, ECDYTOLOPHA AURANTIANUM, WHEN SUBMITED TO THE PHYSIOLOGICAL INSECTICIDE - METHOFENOZIDE	I	75	24/08/00	16:30	CC		2	PS	2
Ruzicka, J.	3704	PHYLOGENY OF CHOLEVA AGILIS SPECIES GROUP (COLEOPTERA: LEIODIDAE: CHOLEVINAE): MORPHOLOGICAL AND MOLECULAR POINT OF VIEW	II	935	26/08/00	15:05	HB	E	21	10	21
Ryall, K. L.	1136	RESPONSE OF XYLOPHAGOUS BEETLES AND THEIR NATURAL ENEMIES TO INCREASED RESOURCE AVAILABILITY FOLLOWING A SEVERE ENVIRONMENTAL DISTURBANCE	I	286	24/08/00	16:30	CC		6	PS	6
Rybczynski, R.	3330	CONTROL OF JUVENILE HORMONE SYNTHESIS BY THE CORPUS ALLATUM	II	841	22/08/00	16:30	CC		18	PS	18
Ryne, C.	721	MALE EMITTED SEX PHEROMONES IN CONFUSED FLOUR BEETLE BEHAVIOUR AND POSSIBLE PRODUCTION SITE	I	182	25/08/00	16:30	CC		4	PS	4
Ryne, C.	734	PHEROMONE-BASED MATING DISRUPTION OF THE INDIAN MEAL MOTH PLODIA INTERPUNCTELLA (LEPIDOPTERA: PYRALIDAE) USING SINGLE- AND MULTI-COMPONENT BLENDS	I	185	25/08/00	16:30	CC		4	PS	4
Ryrholm, N.	3708	MOLECULAR PHYLOGENY OF THE SUBFAMILIES IN GEOMETRIDAE (GEOMETROIDEA: LEPIDOPTERA)	II	936	21/08/00	16:30	CC		21	PS	21

Sub-titles: (HB=Hotel Bourbon) - (HM=Hotel Mabu) - (CC=Convention Center) - (Bol=Foz Boulevard) - (PS=Poster Session) - (PL=Plenary Lecturer)

AUTHOR	Nº	TITLE	Book	Page	Date	Time	Local	Room	Session	Symp	New Session
Ryu, J.-H.	2269	GRAM-NEGATIVE BACTERIA BINDING PROTEIN, A PATTERN RECOGNITION RECEPTOR FOR LIPOPOLYSACCHARIDE AND b-1,3-GLUCAN, WHICH MEDIATES THE SIGNALING FOR THE INDUCTION OF INNATE IMMUNE GENES IN DROSOPHILA MELANOGASTER CELLS	I	573	22/08/00	16:30	CC		12	PS	12
Rzhetsky, A.	577	THE MOLECULAR BIOLOGY OF DROSOPHILA ODORANT RECEPTORS	I	146	21/08/00	10:45	Bol	S	4	1	4
S. C. Dias	2132	CARACTERIZATION OF NEW STRAINS OF BACILLUS THURINGIENSIS TOXIC AGAINST BOLL WEVILL, ANTHONOMUS GRANDIS	I	538	24/08/00	16:30	CC		11	PS	11
S. M. Mendes	1639	FUNCIONAL AND NUMERICAL RESPONSE OF ORIUS INSIDIOSUS (HEMIPTERA:ANTHOCORIDAE) FED ON APHIS GOSSYPII (HEMIPTERA:APHIDIDAE)	I	413	24/08/00	16:30	CC		8	PS	8
S. M. Mendes	1640	BIOLOGICAL ASPECTS AND PREDATION OF ORIUS INSIDIOSUS (HEMIPTERA:ANTHOCORIDAE) ON CALIOTHRIPS PHASEOLI (THYSANOPTERA: THRIPIDAE)	I	413	24/08/00	16:30	CC		8	PS	8
S. S. P. de Souza	1137	IDENTIFICATION OF THE SPATIAL DISTRIBUTION PATTERNS OF INSECT SPECIES BELONGING TO THE HOMNOPETRA-STERNORHYNCA COMPELX IN CITRUS PLANTS (CITRUS SPP.) IN THE STATE OF RIO DE JANEIRO THROUGH THE USE OF VARIOUS STATISTICAL AND MATHEMATICAL MODELS	I	287	24/08/00	16:30	CC		6	PS	6
S. S. P. de Souza	1138	MONITORING AND POPULATION DYNAMICS OF THE ENTOMO-WILDLIFE ASSOCIATED TO THE CULTIVATION OF COCONUT PALM (COCOS NUCIFERA) BY MEANS OF TRAPS MODEL C-47: I. – MUNICIPALITY OF ITAGUAÍ, STATE OF RIO DE JANEIRO, BRAZIL	I	287	24/08/00	16:30	CC		6	PS	6
S. S. P. de Souza	1139	A SURVEY OF THE ENTOMO-WILDLIFE ASSOCIATED THE GUAVA ORCHARDS (PSIDIUM GUAYAVA) CULTUVAR OGAWA 2, WITH THE UTILIZATION OF LURING TRAP MODEL C-47 AND THE (BINOMIAL) 'PRESENCE-ABSENCE' SAMPLING METHOD, IN THE STATE OF RIO DE JANEIRO, BRAZIL	I	287	23/08/00	16:30	CC		6	PS	6
S.-Bhatkar, H.	3045	ULTRASTRUCTURAL ANALYSIS OF NEUROSECRETORY CELLS IN THE ANTENNAE OF THE MOSQUITO, CULEX SALINARIUS (DIPTERA: CULICIDAE)	II	768	22/08/00	10:05	HB	G	16	2	16
S.S.P. de Souza	1140	THE OCCURENCE AND BIOLOGICAL ASPECTS OF THE JUMPING PLANT LICE (HOMOPTERA:PSYLIDAE) ON GUAVA PLANTS (PSIDIUM GUAYAVA) AND 'SOMBREIRO' TREES (VICTORIA FAIRCHILDIANA) IN THE STATE OF RIO DE JANEIRO, BRAZIL	I	287	23/08/00	16:30	CC		6	PS	6
Sá Fischer, A. C.	4028	CAN DERMESTIDS BE CONTROLLED WITH MODIFIED ATMOSPHERES?	II	1017	23/08/00	9:35	HB	J	23	6	23
Sá, F. N.	1850	INFLUENCE OF NATURAL ENEMIES ON THE POPULATIONS OF TWO STOLAINI SPECIES (COLEOPTERA: CHRYSOMELIDAE: CASSIDINAE) IN A BRAZILIAN TROPICAL FOREST	I	466	23/08/00	16:20	HB	M	10	4	10
Sá, F. N.	1958	BIOLOGICAL DATA AND POPULATION ABUNDANCE OF THREE SPECIES OF CASSIDINAE (COLEOPTERA: CHRYSOMELIDAE) IN A TROPICAL FOREST AREA IN BRAZIL	I	493	24/08/00	16:30	CC		10	PS	10
Sá, F. N.	4145	BIOLOGICAL DATA AND POPULATION ABUNDANCE OF THREE SPECIES OF CASSIDINAE (COLEOPTERA: CHRYSOMELIDAE) IN A TROPICAL FOREST AREA IN BRAZIL	II	1047	26/08/00	10:00	HM	P	24	0	24
Sá, F. N.	4146	INFLUENCE OF NATURAL ENEMIES ON THE POPULATIONS OF TWO STOLAINI SPECIES (COLEOPTERA: CHRYSOMELIDAE: CASSIDINAE) IN A BRAZILIAN TROPICAL FOREST	II	1047	26/08/00	10:00	HM	P	24	0	24
Sá, L. A. N. de	753	INTERNATIONAL INFORMATION SYSTEM ABOUT BIOLOGICAL CONTROL OF PESTS THROUGH THE INTERNET	I	190	22/08/00	10:05	Bol	T	5	2	5
Sá, L. A. N. de	1675	TEN YEARS OF INTERNATIONAL EXCHANGE AND QUARANTINE OF BENEFICIAL ORGANISMS BY THE BRAZILIAN QUARANTINE LABORATORY FOR BIOLOGICAL CONTROL	I	422	25/08/00	16:30	CC		8	PS	8
Sá, L. A. N. de	1596	CLASSICAL BIOLOGICAL CONTROL OF IMPORTED FIRE ANTS BY PARASITOID FLIES.	I	402	23/08/00	16:30	CC		8	PS	8
Sá, L. A. N. de	1676	NON-SUITABILITY OF THE BRAZILIAN SUGARCANE BORER, DIATRAEA SACCHARALIS, (LEPIDOPTERA: PYRALIDAE) AS A HOST FOR PEDIOBIUS FURVUS (HYMENOPTERA: EULOPHIDAE)	I	422	25/08/00	16:30	CC		8	PS	8
Sá, L. A. N. de	1678	SPATIO-TEMPORAL DISTRIBUTION OF CITRUS LEAFMINER AND ITS NATURAL ENEMIES IN SÃO PAULO STATE, BRAZIL	I	423	25/08/00	16:30	CC		8	PS	8
Sá, L. A. N. de	1641	POS-INTRODUCTION OF THE NATURAL ENEMY AGENIAPIS CITRICOLA IN CITRUS GROVES IN JAGUARIÚNA AND AGUAÍ REGIONS, SÃO PAULO STATE, BRAZIL: PRELIMINARY RESULTS	I	414	24/08/00	16:30	CC		8	PS	8
Saarenmaa, H.	768	TECHNOLOGICAL OPPORTUNITIES AND CHALLENGES IN BUILDING a GLOBAL BIOLOGICAL INFORMATION INFRASTRUCTURE	I	194	24/08/00	9:35	Bol	T	5	5	5
Sabat, A.	985	CONNECTIVITY AND HABITAT PREFERENCE OF SPASSALUS CRENATUS (COLEOPTERA: PASSALIDAE) IN THE LUQUILLO EXPERIMENTAL FOREST, PUERTO RICO	I	249	22/08/00	16:30	CC		6	PS	6
Sabatini, A. G.	3492	THE USE OF HONEYBEES (APIS MELLIFERA) AS INDICATORS FOR THE PRESENCE OF THE PHYTOPATHOGEN BACTERIUM ERWINIA AMYLOVORA IN THE ENVIRONMENT	II	881	22/08/00	16:30	CC		19	PS	19
Sabatini, M.A.	987	APHIDS: NOT ONLY A PEST INSECT	I	249	22/08/00	16:30	CC		6	PS	6
Sabatino, A.Di	475	BIODIVERSITY AND ECOLOGICAL IMPORTANCE OF WATER MITES (ACARI, HYDRACHNIDIA) IN ITALIAN SPRINGS	I	120	21/08/00	16:30	CC		3	PS	3
Sabău, I.	3940	RESULTS REGARDING MAIZE RESISTANCE TO THE EUROPEAN CORN BORER IN ROMANIA	II	994	23/08/00	16:30	CC		22	PS	22
Sabbour, M.	2134	DEVELOPMENTAL STAGES OF PITTHORIMAEA OPERCULELLA AS AFFECTED BY BACILLUS THURINGIENSIS	I	538	24/08/00	16:30	CC		11	PS	11
Sabelis, M. W.	0	TO BE ANNOUNCED	I	0	24/08/00	9:50	HB	A	1	7	2
Sabelis, M. W.	11	THE ROLE OF HERBIVORE-INDUCED PLANT VOLATILES IN DISPERSAL AND FORAGING OF PHYTOSEIID PREDATORY MITES	I	3	22/08/00	11:05	Bol	U	1	2	1
Sabelis, M. W.	9	PREDATOR DISPERSAL AND PREY-EXPLOITATION STRATEGIES	I	3	22/08/00	10:20	Bol	U	1	2	1
Sabelis, M. W.	961	CAN PLANTS USE ENTOMOPATHOGENS AS BODYGUARDS?	I	243	22/08/00	16:30	CC		6	PS	6
Sabelis, M. W.	1199	INTRAGUILD INTERACTIONS IN AN ARTHROPOD FOOD WEB ON PLANTS	I	302	25/08/00	16:30	CC		6	PS	6
Sabelis, M. W.	1567	PREDATOR-PREY INTERACTIONS AT VARIOUS SPATIAL SCALES: BIOLOGICAL CONTROL OF THE BULB MITE, RHIZOGLYPHUS ROBINI, BY THE PREDATORY MITE, HYPOASPIS ACULEIFER, ON LILIES	I	395	22/08/00	16:30	CC		8	PS	8
Sabelis, M. W.	1712	DIET-DEPENDENT FEMALE CHOICE FOR MALES WITH GOOD GENES	I	431	21/08/00	13:30	HB	F	9	1	9
Sabelis, M. W.	2170	GENETIC POLYMORPHISM IN PREY PREFERENCE AT A SMALL SPATIAL SCALE: A CASE STUDY OF SOIL PREDATORY MITES (HYPOASPIS ACULEIFER) AND TWO SPECIES OF ASTIGMATIC MITES AS PREY	I	548	21/08/00	10:35	HB	L	12	1	12
Sabelis, M. W.	662	PHYSIOLOGICAL STATE AND ASSOCIATIVE LEARNING DETERMINE RESPONSE OF PREDATORY MITE TO FOOD-RELATED AND OVIPOSITION-RELATED VOLATILES	I	167	22/08/00	16:30	CC		4	PS	4
Sabelis, M. W.	707	ODOUR-MEDIATED INDIRECT INTERACTIONS IN FOOD WEBS	I	179	24/08/00	16:30	CC		4	PS	4
Sabelis, M. W.	707	ODOUR-MEDIATED INDIRECT INTERACTIONS IN FOOD WEBS	I	179	24/08/00	16:30	CC		4	PS	4
Sabelis, M. W.	300	PROSPECTS FOR BIOLOGICAL CONTROL OF THE WHITEFLY BEMISIA TABACI WITH PHYTOSEIID PREDATORS	I	76	24/08/00	16:30	CC		2	PS	2
Sabelis, M. W.	862	BEHAVIOUR AND INDIRECT INTERACTIONS IN FOOD WEBS OF PLANT-INHABITING ARTHROPODS	I	218	25/08/00	14:05	HB	D	6	8	6
Sabelis, M.W.	3936	DO PLANTS BENEFIT FROM PROVIDING FOOD TO PREDATORS IF IT IS ALSO EDIBLE TO HERBIVORES? MODELS AND EXPERIMENTS	II	993	24/08/00	16:05	HM	Q	22	9	22

Sub-titles: (HB=Hotel Bourbon) - (HM=Hotel Mabu) - (CC=Convention Center) - (Boi=Foz Boulevard) - (PS=Poster Session) - (PL=Plenary Lecturer)

AUTHOR	Nº	TITLE	Book	Page	Date	Time	Local	Room	Session	Symp	New Session
Saber, S. A.	1520	RESPONSE OF THE PREDACIOUS MITE, AMBLYSEIUS CYDNODACTYLON TO INCREASING PREY DENSITY OF THE TWO SPOTTED SPIDER MITE, TETRANYCHUS URTICAE IN ABSENCE OR PRESENCE OF NYMPHS OF TOBACCO WHITE FLY, BEMESIA TABACI (ACARI: PHYTOSEIIDAE)	I	383	21/08/00	16:30	CC		8	PS	8
Sacher, M.	1222	MODE OF ACTION OF INDOXACARB IN PEST INSECTS AND IMPLICATIONS FOR CONTROL	I	309	21/08/00	9:35	HM	N	7	1	7
Sadasivam, S.	2287	MOLECULAR CHARACTERIZATION OF RICE BROWN PLANTHOPPER POPULATION	I	577	24/08/00	16:30	CC		12	PS	12
Sadasivam, S.	3886	MOLECULAR CHARACTERIZATION OF RICE BROWN PLANTHOPPER POPULATION	II	981	22/08/00	15:05	HB	H	22	3	22
Sadomov, E. A.	1441	RESULTS OF THE DEVELOPMENT AND INTRODUCTION OF ENGENEERING TECHNOLOGIES FOR THE MASS REARING OF ENTOMOPHAGES AND ACARIPHAGES IN THE EASTERN PALEARCTIC REAGION	I	364	22/08/00	13:50	HM	O	8	4	8
Sadras, V. O.	2858	IPM AND EARLY PEST DAMAGE IN COTTON; HOW TO SUCCEED BY DOING NOTHING	II	721	25/08/00	16:30	CC		14	PS	14
Sæther, O. A.	3638	MOLECULAR EVIDENCE SUPPORTS, FAILS TO REFUTE, OR PROVOKES NEW MORPHOLOGICAL ASSESSMENT IN THE CHIRONOMIDAE (DIPTERA)	II	919	22/08/00	14:00	HB	E	21	4	21
Sáez, C. C.	2464	A NEW CAGE FOR GRAPHOLITA MOLESTA FEMALES OVIPOSITION	II	622	23/08/00	16:30	CC		13	PS	13
Saez, L.	2318	RESTORATION OF CIRCADIAN BEHAVIORAL RHYTHM OF DROSOPHILA DOUBLE-TIME MUTANTS BY GENE TRANFE.	I	585	25/08/00	16:30	CC		12	PS	12
Saffi, R.	3647	MITOCHONDRIAL AND NUCLEAR DNA PHYLOGENETIC ANALYSIS OF STREPSIPTERA	II	921	23/08/00	14:05	HB	E	21	5	21
Sagarra, L. A.	1642	SURVIVAL AND FECUNDITY OF ANAGYRUS KAMALI (ENCYRTIDAE) UNDER DIFFERENT STORAGE CONDITIONS	I	414	24/08/00	16:30	CC		8	PS	8
Sagenmüller, A.	2805	AVENTIS CONTRIBUTION TO INTEGRATED CROP MANAGEMENT (ICM)	II	708	24/08/00	16:30	CC		14	PS	14
Saghai Maroof, M. A.	2286	MARKER-ASSISTED SELECTION AS A STRATEGY FOR SELECTING INSECT RESISTANT BREEDING LINES WITH IMPROVED EFFICIENCY	I	577	24/08/00	16:30	CC		12	PS	12
Sagi, V. L. S.	1918	RESPONSE OF BRAZILIAN AMBROSIA BEETLES (COLEOPTERA, SCOLYTIDAE) TO KAIROMONES AND PHEROMONES	I	483	22/08/00	16:30	CC		10	PS	10
Sahragard, A.	887	DETERMINATION OF SPATIAL DISTRIBUTION PATTERN OF EGG AND LARVAL INSTARS OF ELM-LEAF BEETLE XANTHOGALEAROCELLA LUTEOLA (COL.; CHRYSOMELLIDAE)	I	224	21/08/00	16:30	CC		6	PS	6
Saiano, F.	653	CONTACT CHEMICAL CUES RELEASED BY ADULTS OF NEZARA VIRIDULA HAVE A KAIROMONAL EFFECT ON THE EGG PARASITOID TRISSOLCUS BASALIS: A CHROMATOGRAPHIC INVESTIGATION	I	165	22/08/00	16:30	CC		4	PS	4
Saido-Sakanaka, H.	2446	ISOLATION, cDNA CLONING AND MODIFICATION OF DEFENSIN FROM THE COCONUT RHINOCEROS BEETLE, ORYCTES RHINOCEROS	II	618	22/08/00	16:30	CC		13	PS	13
Saienni, J. P.	1270	INDOXACARB: ATTRIBUTES THAT IMPACT FIELD PERFORMANCE AND CONTRIBUTE TO CONSERVATION OF BENEFICIALS	I	321	25/08/00	10:20	HM	N	7	9	7
Saigusa, T.	3831	MONOPHYLETIC GROUPS AND THEIR GEOGRAPHICAL DISTRIBUTIONS IN THE GENUS RHAMPHOMYIA (DIPTERA, EMPIDIDAE)	II	967	24/08/00	16:30	CC		21	PS	21
Saigusa, T.	1054	SPECIATION AND DISPERSAL OF MARINE SHORE DOLICHOPODID FLIES IN EAST ASIA (DIPTERA: DOLICHOPODIDAE, HYDROPHORINAE)	I	266	23/08/00	16:30	CC		6	PS	6
Saigusa, T.	3846	EVOLUTIONAL ASPECTS OF A WINGLESS AND LEGLESS FEMALES IN THE FAMILY PSYCHIDAE (LEPIDOPTERA)	II	971	25/08/00	16:30	CC		21	PS	21
Saigusa, T.	3863	A SYSTEMATIC STUDY OF THE SUBFAMILY LYCAENINAE (LEPIDOPTERA, LYCAENIDAE)	II	975	25/08/00	16:30	CC		21	PS	21
Saiki, H.	2439	HARDINESS TO LOW OR HIGH TEMPERATURE AND DRYING-OUT IN A WATER STRIDER, AQUARIUS PALUDUM AND A SUBSPECIES, A. P. AMAMIENSIS	II	616	22/08/00	16:30	CC		13	PS	13
Saiki, T.	2145	WOLBACHIA ARE DISTRIBUTED THROUGHOUT SOMATIC AND GENITAL ORGANS OF A MULBERRY LEAFHOPPER, HISHIMONOIDES SELLATIFORMIS	I	541	25/08/00	16:30	CC		11	PS	11
Saikkonen, K.	848	ENDOPHYTIC FUNGI, HOST PLANT GENOTYPE AND INSECT HERBIVORES	I	214	24/08/00	10:05	HB	D	6	6	6
Saini, R. K.	1345	STATUS OF INSECTICIDE RESISTANCE IN HELICOVERPA ARMIGERA POPULATIONS FROM AREAS WITH DIFFERENT INSECTICIDE-USE REGIMES	I	339	23/08/00	16:30	CC		7	PS	7
Saini, R. K.	1346	SUSCEPTIBILITY OF HELICOVERPA ARMIGERA EGGS TO SOME COMMONLY USED INSECTICIDES	I	340	23/08/00	16:30	CC		7	PS	7
SaintOurs, F.	791	DEVELOPING ELECTRONIC FIELD GUIDES: FIRST RESULTS USING COSTA RICAN BUTTERFLIES AND MASSACHUSETTS AQUATIC MACROINVERTEBRATES	I	200	23/08/00	16:30	CC		5	PS	5
Sainz, H.	4077	PARSIMONY ANALYSIS OF ENDEMICITY AND ITS APPLICATION TO DETECT HIGH ENDEMISM AREAS USING COMBINED DATA FROM INSECTS, VERTEBRATES, AND PLANTS, FROM THE IBERIAN PENINSULA	II	1029	21/08/00	16:30	CC		23	PS	23
Sait, S. M.	1141	INVASION SEQUENCE DETERMINES PREDATOR-PREY DYNAMICS IN A MULTISPECIES ASSEMBLAGE	I	288	24/08/00	16:30	CC		6	PS	6
Saiz-Ardanaz, M.	3832	MULTIVARIATE STATISTICAL ANALYSIS AIDS TO THE CHARACTERIZATION OF THE GENUS RETICULITERMES IN SPAIN (ISOPTERA: RHINOTERMITIDAE)	II	967	24/08/00	16:30	CC		21	PS	21
Sajap, A. S.	3387	TERMITE PESTS AND THEIR CONTROL IN MALAYSIA	II	855	21/08/00	10:05	HM	Q	19	1	19
Sakagami, Y.	3366	CONTROL OF APPLE KEY PESTS WITH MULTITIPLE MATING DISRUPTION IN JAPAN	II	850	24/08/00	16:30	CC		18	PS	18
Sakai, M.	4162	THE ACTIVITY OF GENITAL MOTONEURONS DURING REPRODUCTIVE BEHAVIOR IN THE MALE CRICKET	II	1051	21/08/00	16:30	CC		Erratum	PS	6
Sakaki, Y.	2504	THE GENOME ORGANIZATION OF BUCHNERA, AN INTRACELLULAR BACTERIAL SYMBIONT OF APHIDS	II	632	24/08/00	16:30	CC		13	PS	13
Sakamoto, S. M.	3794	INVESTIGATION OF THE VALIDITY OF SPECIES STATUS OF IXODES DIDELPHIDIS (ACARI: IXODIDAE) USING THE SECOND INTERNAL TRANSCRIBED SPACER (ITS2) OF RIBOSOMAL DNA	II	958	23/08/00	16:30	CC		21	PS	21
Sakuma, M.	722	VIRTUAL REALITY IN A WALKING MALE SILKWORM MOTH ON A SERVO SPHERE	I	182	25/08/00	16:30	CC		4	PS	4
Sakurai, S.	3287	ENDOCRINE CONTROL OF PROGRAMMED CELL DEATH OF ANTERIOR SILK GLAND IN BOMBYX MORI	II	830	23/08/00	14:35	HB	K	18	5	18
Sakurai, T.	3237	INTRA-SPECIES VARIATION OF TOMATO SPOTTED WILT TOSPOVIRUS TRANSMISSION BY THE WESTERN FLOWER THRIPS	II	817	24/08/00	16:30	CC		17	PS	17
Sala, O. E.	506	FUNCTIONAL BIODIVERSITY AMONGST DIFFERENT MICROSITES IN A PATAGONIAN STEPPE, SOUTHERN ARGENTINA	I	128	23/08/00	16:30	CC		3	PS	3
Salama, H. S.	2133	POTENCY OF BACILLUS THURINGIENSIS AGAINST INSECTS OF STORED PRODUCTS	I	538	24/08/00	16:30	CC		11	PS	11
Salama, H. S.	2134	DEVELOPMENTAL STAGES OF PHTHORIMAEA OPERCULELLA AS AFFECTED BY BACILLUS THURINGIENSIS	I	538	24/08/00	16:30	CC		11	PS	11
Salama, H. S.	2135	POTENTIATION OF BACILLUS THURINGIENSIS AGAINST LEPIDOPTEROUS INSECTS USING SAFE CHEMICAL ADDITIVES	I	538	24/08/00	16:30	CC		11	PS	11
Salama, H. S.	2136	THE USE OF BACILLUS THURINGIENSIS TO CONTROL LEPIDOPTEROUS INSECTS ON POTATO CULTIVATIONS IN EGYPT	I	539	24/08/00	16:30	CC		11	PS	11
Salas, F. J. S.	3238	THE USE OF LEAF DISC LOCAL LESION TEST ON THE STUDY OF PLANT VIRUS TRANSMISSION	II	817	24/08/00	16:30	CC		17	PS	17
Salas, H.	1700	BIOLOGICAL CONTROL OF THE CITRUS LEAFMINER (LEPIDOPTERA: GRACILLARIIDAE) IN NORTHWEST ARGENTINA	I	428	21/08/00	16:30	CC		8	PS	8

Sub-titles: (HB=Hotel Bourbon) - (HM=Hotel Mabu) - (CC=Convention Center) - (Bol=Foz Boulevard) - (PS=Poster Session) - (PL=Plenary Lecturer)

AUTHOR	N°	TITLE	Book	Page	Date	Time	Local	Room	Session	Symp	New Session
Salazar, B. A.	1142	A SURVEY OF FECAL FIRING AND HOUSECLEANING IN LEPIDOPTERAN CATERPILLARS	I	288	24/08/00	16:30	CC		6	PS	6
Saldanha, L. A.	2311	GENETIC VARIATION OF EUROPEAN CORN BORER (OSTRINIA NUBILALIS) POPULATIONS IN NEBRASKA DETECTED BY RANDOM AMPLIFIED POLYMORPHIC DNA (RAPD)	I	583	24/08/00	16:30	CC		12	PS	12
Salehi, L.	1643	THE INFLUENCE OF TEMPERATURE ON DEVELOPMENT AND LONGEVITY OF APANTELES SUBANDINUS AND ORGILUS LEPIDUS (HYMENOPTERA: BRACONIDAE)	I	414	25/08/00	16:30	CC		8	PS	8
Salehi, L.	1644	REPRODUCTIVE CAPACITIES OF TWO PARASITOIDS OF POTATO TUBER MOTH	I	414	25/08/00	16:30	CC		8	PS	8
Salem, S. A.	2136	THE USE OF BACILLUS THURINGIENSIS TO CONTROL LEPIDOPTEROUS INSECTS ON POTATO CULTIVATIONS IN EGYPT	I	539	24/08/00	16:30	CC		11	PS	11
Salerno, G.	653	CONTACT CHEMICAL CUES RELEASED BY ADULTS OF NEZARA VIRIDULA HAVE A KAIROMONAL EFFECT ON THE EGG PARASITOID TRISSOLCUS BASALIS: A CHROMATOGRAPHIC INVESTIGATION	I	165	22/08/00	16:30	CC		4	PS	4
Salerno, G. L.	2045	A NEW FUNGAL ISOLATE FOR THE CONTROL OF DIABROTICA SPECIOSA	I	516	21/08/00	16:30	CC		11	PS	11
Salerno, G.L.	2038	CHARACTERIZATION OF A BACILLUS THURINGIENSIS STRAIN TOXIC AGAINST LEPIDOPTERANS AND COLEOPTERANS	I	514	21/08/00	16:30	CC		11	PS	11
Salerno, P.	3737	A NEW SPECIES OF ATHRIPSODES (INSECTA TRICHOPTERA: LEPTOCERIDAE) FROM CENTRAL-SOUTHERN ITALY	II	943	22/08/00	16:30	CC		21	PS	21
Sales Jr., O.	1063	INFLUENCE OF WATER BALANCE ON THE POPULATION DYNAMICS OF THE BURROWING BUG ATARSOCORIS BRACHIARIAE (HEMIPTERA: CYDNIDAE)	I	268	23/08/00	16:30	CC		6	PS	6
Sales Jr., O.	1064	INFLUENCE OF PRECIPITATION VOLUME AND SOIL TEMPERATURE ON THE POPULATION DYNAMICS OF THE BURROWING BUG ATARSOCORIS BRACHIARIAE (HEMIPTERA: CYDNIDAE)	I	268	23/08/00	16:30	CC		6	PS	6
Sales Jr., O.	3160	MORPHOLOGICAL ASPECTS OF THE EGG, 1ST AND 5TH NYMPHAL INSTARS OF THE BURROWING BUG, ATARSOCORIS BRACHIARIAE (HEMIPTERA: CYDNIDAE)	II	797	22/08/00	16:30	CC		16	PS	16
Sales Jr., O.	3345	LIFE HISTORY OF THE BURROWING BUG, ATARSOCORIS BRACHIARIAE (HEMIPTERA: CYDNIDAE) ON BRACHIARIA DECUMBENS PLANTS	II	845	25/08/00	16:30	CC		18	PS	18
Sales Jr., O.	3367	METAMORPHOSIS IN THE BURROWING BUG, ATARSOCORIS BRACHIARIAE (HEMIPTERA: CYDNIDAE)	II	850	25/08/00	16:30	CC		18	PS	18
Salgado, L. O.	283	A DOSE RECOMENDATION AND AN EVALUATION OF THE EFFICIENCY OF THE FARM CHEMICAL CONFIDOR (IMIDACLOPRID) TO CONTROL MYZUS PERSICAE (HOMOPTERA: APHIDIDAE) IN THE POTATO CROP SOLANUM TUBEROSUM	I	72	23/08/00	16:30	CC		2	PS	2
Salgado, L. O.	284	CHEMICAL CONTROL OF THIPS TABACI (THYSANOPTERA: THRIPIDAE) WITH INSECTICIDE CONFIDOR (IMIDACLOPRID), IN POTATO CROP, SOLANUM TUBEROSUM	I	72	23/08/00	16:30	CC		2	PS	2
Salgado, L. O.	656	CHEMICAL CONTROL OF THE "LEAF MINER", LEUCOPTERA COFFEELLA (LEPIDOPTERA: LYONETIIDAE), WITH FURY 400 CE AND MARSHAL 400 SC IN COFFEE CROP, COFFEA ARABICA	I	166	22/08/00	16:30	CC		4	PS	4
Salgado, L. O.	1397	CONTROL OF "WHITE FLY", BEMISIA ARGENTIFOLII WITE THE INSECTICIDES THIACLOPRID 480 SC; IMIDACLOPRID 700 GRDA AND IMIDACLOPRID 200 SC, IN CUCUMBER PLANTATION	I	352	25/08/00	16:30	CC		7	PS	7
Salgado, L. O	2823	EFFICIENCY OF THE INSECTICIDE LAMBDACYHALOTHRIN 50 CS, 250 CS, 50 EC AND ASSOCIATE WITH CHLORPYRIFOS 480 BR, FOR THE CONTROL OF " LEAF MINER" LEUCOPTERA COFFEELLA, IN COFFEE CROP	II	713	24/08/00	16:30	CC		14	PS	14
Salgado, L. O.	2806	CHEMICAL CONTROL OF "LEAF MINER", LEUCOPTERA COFFEELLA WITH BINFENTHRIN 100 CE LONELY AND ASSOCIATE WITH ANOTHERS INSECTICIDES, IN COFFEE CROP	II	708	24/08/00	16:30	CC		14	PS	14
Salgado, L. O.	2807	CHEMICAL CONTROL OF "LITTLE FRUIT BORER", NEOLEUCINODES ELEGANTALLIS WITH LAMBDACYHALOTHRIN 50 CS AND 50 CE IN TOMATO CROP	II	709	24/08/00	16:30	CC		14	PS	14
Salgado, L. O.	179	PERFORMANCE OF THE INSECTICIDES BUPROFEZIN 250; PYRIPROXIFEN 100 AND BUPROFEZIN 250 + ACEPHATE, IN CONTROL OF "WHITE FLY", BEMISIA ARGENTIFOLII, IN CABBAGE CROP	I	46	21/08/00	16:30	CC		2	PS	2
Salgado, L.O.	347	CHEMICAL CONTROL OF "WHITE FLY", BEMISIA ARGENTIFOLII (HEMIPTERA: ALEYRODIDAE) WITH CALYPSO 480 SC (THIACLOPRID), CONFIDOR 700 GRDA (IMIDACLOPRID) E CONFIDOR 200SC (IMIDACLOPRID) IN PAPRIKA CROP, CAPSICUM ANNUUM	I	88	25/08/00	16:30	CC		2	PS	2
Salgado, L.O.	348	CHEMICAL CONTROL OF "WHITE FLY", BEMISIA ARGENTIFOLII (HEMIPTERA: ALEYRODIDAE) WITH CALYPSO 480 SC (THIACLOPRID), CONFIDOR 700 GRDA (IMIDACLOPRID0) E CONFIDOR 200SC (IMIDACLOPRID) IN EGG PLANT CROP, SOLANUM MELONGENA	I	88	25/08/00	16:30	CC		2	PS	2
Salin, K. P.	332	ATTRACTION OF SHOOT BORER, CHILO INFUSCATELLUS, DAMAGED SUGARCANE TO THE BRACONID COTESIA FLAVIPES	I	84	24/08/00	16:30	CC		2	PS	2
Salin, K. P.	723	EFFECT OF BUCCAL CAVITY SECRETIONS OF PARASITISED AND UNPARASITISED CHILO INFUSCATELLUS LARVAE ON THE SYNOMONAL ACTIVITY OF SUGRACANE PLANT	I	183	25/08/00	16:30	CC		4	PS	4
Salles, L. A. B.	2808	EFFICACY OF THIAMETHOXAN (ACTARA 10GR) TO CONTROL THE WHITE PEACH SCALE, PSEUDAULACASPIS PENTAGONA. (HOMOPTERA:DIASPIDIDAE) IN PEACH TREES	II	709	24/08/00	16:30	CC		14	PS	14
Salmane, I.	66	INVESTIGATIONS OF THE SOIL DWELLING PREDATORY GAMASINA MITES (ACARI, MESOSTIGMATA) IN LATVIA	I	17	25/08/00	16:30	CC		1	PS	1
Salom, S. M.	652	THE SOUTHERN PINE BEETLE INTERNET CONTROL CENTER: AN INTERACTIVE INTEGRATED PEST MANAGEMENT WEB-SITE	I	165	24/08/00	16:30	CC		4	PS	4
Salom, S. M.	1908	SUPPRESSION OF SOUTHERN PINE BEETLE INFESTATIONS USING VERBENONE, AN ANTI-AGGREGATION PHEROMONE	I	481	23/08/00	16:30	CC		10	PS	10
Salomon, O. D.	2925	A LONGITUDINAL PAIRED TRIAL OF TWO SENSING DEVICES FOR DETECTING PERIDOMESTIC POPULATIONS OF TRIATOMA INFESTANS (HEMIPTERA: REDUVIIDAE) IN RURAL NORTHWESTERN ARGENTINA	II	738	25/08/00	10:50	Bol	R	15	9	15
Salomón, O. D.	2978	PHLEBOTOMINAE SAND FLIES IN TUCUMAN, ARGENTINA	II	751	22/08/00	16:30	CC		15	PS	15
Salomón, O. D.	2988	PHLEBOTOMINAE SAND FLIES AND LEISHMANIASIS IN ARGENTINA	II	754	23/08/00	16:30	CC		15	PS	15
Saloña, M. I.	996	INSECTS AS BATS' PREY: A CASE STUDY ON KUHL'S PIPISTRELLE (PIPISTRELLUS KUHLII)	I	251	22/08/00	16:30	CC		6	PS	6
Salpigidis, G. K.	2083	COMBINED APPLICATION OF MATING DISRUPTION AND BACILLUS THURINGIENSIS FOR CONTROL OF THE BERRY MOTH IN GREEK ISLANDS, LIMNOS AND SAMOS	I	525	22/08/00	16:30	CC		11	PS	11
Salpigidis, G. K.	2111	EFFICACY OF SPINOSAD NATURALYTE INSECT CONTROL AGAINST LOBESIA BOTRANA (LEPIDOPTERA: TORTRICIDAE) ON GREEK VINEYARDS	I	532	23/08/00	16:30	CC		11	PS	11
Salvado, E.	333	BUMBLEBEE FORAGING ACTIVITY AT GREENHOUSE TOMATO CROP WITH DIFFERENT POLLINATOR DENSITY	I	84	25/08/00	16:30	CC		2	PS	2
Salvado, E.	334	PATTERN OF BUMBLEBEE VISITS TO GREENHOUSE MUSKMELON FLOWERS	I	85	25/08/00	16:30	CC		2	PS	2
Salvado, E.	167	FORAGING ACTIVITY OF BUMBLEBEES IN GREENHOUSE MUSKMELON CROP	I	43	21/08/00	16:30	CC		2	PS	2
Salvado, E.	168	GENERAL PATTERN OF BUMBLEBEE VISITS TO TOMATO FLOWERS IN GREENHOUSE CONDITIONS	I	43	21/08/00	16:30	CC		2	PS	2
Salvado, E.	169	INFLUENCE OF CROPPING SEASON IN FORAGING ACTIVITY OF BUMBLEBEE IN GREENHOUSE TOMATO CROP	I	43	21/08/00	16:30	CC		2	PS	2
Salvado, E.	286	COMPARATIVE STUDY OF BUMBLEBEES AND HONEYBEES EFFICIENCY IN GREENHOUSE MUSKMELON CROPS	I	73	23/08/00	16:30	CC		2	PS	2
Salvado, E.	287	POLLINATION OF GREENHOUSE TOMATO CROP BY BUMBLEBEES	I	73	23/08/00	16:30	CC		2	PS	2

Sub-titles: (HB=Hotel Bourbon) - (HM=Hotel Mabu) - (CC=Convention Center) - (Boi=Foz Boulevard) - (PS=Poster Session) - (PL=Plenary Lecturer)

AUTHOR	Nº	TITLE	Book	Page	Date	Time	Local	Room	Session	Symp	New Session
Salvadori, J. R.	335	EVALUATION OF DOSES OF IMIDACLOPRID AND THIAMETHOXAN AS SEED TREATMENT ON APHID CONTROL IN WHEAT	I	85	25/08/00	16:30	CC		2	PS	2
Salvatore, A. R.	1000	COMPARISON OF SENSITIVITY TO COLD IN SOUTH AMERICAN FRUIT FLY AND MEDFLY (DIPTERA: TEPHRITIDAE)	I	252	22/08/00	16:30	CC		6	PS	6
Salviano, R. J. B.	3833	DIIPTERA CALIPTRATA SUCESSION IN A CARCASS OF SUS SCROFA, IN TWO ECOSYSTEMS OF RIO DE JANEIRO, RJ	II	967	24/08/00	16:30	CC		21	PS	21
Salvo, A.	1197	A TRITROPHIC ANALYSIS OF HOST PREFERENCE AND PERFORMANCE IN THE POLYPHAGOUS LEAFMINER LIRIOMYZA HUIDOBRENSIS	I	302	23/08/00	16:30	CC		6	PS	6
Salvo, S.	270	OCCURENCE OF THRIPS ON NIAGARA TABLE GRAPE AND ITS CONTROL WITH THE INSECTICIDES THIACLOPRID AND METHIOCARB ASSOCIATED WITH METARHIZIUM ANISOPLIAE	I	69	23/08/00	16:30	CC		2	PS	2
Salvo, S. A.	565	ESTIMATING INSECT DIVERSITY IN CENTRAL ARGENTINA: A COMPARISON AMONG TAXA AND HABITATS	I	143	25/08/00	16:30	CC		3	PS	3
Salvucci, M. E.	3284	POLYOL ACCUMULATION AS A MECHANISM FOR THERMOTOLERANCE IN HOMOPTERANS	II	829	23/08/00	11:20	HB	K	18	4	18
Sambugaro, R.	2687	EVALUATION OF SOYBEAN LINES WITH PARENTALS BACKGROUND RESISTANT TO STINK BUGS	II	679	23/08/00	16:30	CC		14	PS	14
Samish, M.	2137	MICROBIAL CONTROL OF TICKS	I	539	24/08/00	16:30	CC		11	PS	11
Samoilov, Y. C.	1445	DEVELOPMENT AND ORGANIZATION OF MANUFACTURE VIRUS PREPARATION VIRIN - •••	I	365	22/08/00	14:50	HM	O	8	4	8
Samoilov, Y. C.	1442	THE ENTOMOLOGICAL INDUSTRY IN THE UKRAINE: CONDITIONS AND PROSPECTS FOR DEVELOPMENT	I	364	22/08/00	14:05	HM	O	8	4	8
Sampaio, M. V.	1645	PARASITISM OF APHIDIUS COLEMANI (HYMENOPTERA: APHIDIIDAE) IN DIFFERENT DENSITIES OF MYZUS PERSICAE (HEMIPTERA: APHIDIDAE)	I	415	24/08/00	16:30	CC		8	PS	8
Sampaio, M. V.	1646	HOST PREFERENCE OF APHIDIUS COLEMANI (HYMENOPTERA:APHIDIIDAE) FOR MYZUS PERSICAE AND APHIS GOSSYPII (HEMIPTERA:APHIDIDAE)	I	415	24/08/00	16:30	CC		8	PS	8
Sampaio, R. T. M.	1143	OBSERVATIONS ON THE AQUATIC HEMIPTERA (GERRIDAE) DIVERSITY FAUNA FROM DISTURBED AND NON-DISTURBED ENVIRONMENT OF AMAZÔNIA CENTRAL, BRASIL	I	288	24/08/00	16:30	CC		6	PS	6
Samper, C.	439	THE CONVEBTION ON BIOLOGICAL DIVERSITY	I	111	25/08/00	13:35	HB	C	3	8	3
Samson, M.V.	3421	RECENT TRENDS IN NON-MULBERRY SERICULTURE: VISION FOR THE NEW MILLENNIUM	II	864	22/08/00	15:15	HM	Q	19	3	19
Samson, P. R.	2011	THE DEVELOPMENT OF METARHIZIUM-BASED BIOPESTICIDES FOR USE AGAINST SUGARECANE WHITEGRUBS IN AUSTALIA	I	507	23/08/00	11:05	HM	P	11	5	11
Samsudin, A.	1272	A GLOBAL PERSPECTIVE ON THE BIOLOGY AND FIELD PERFORMANCE OF SPINOSAD	I	321	25/08/00	11:05	HM	N	7	9	7
Samuels, R. I.	2140	SELECTION OF ENTOMOPATHOGENIC FUNGI FOR USE IN COMBINATION WITH SUBLETHAL DOSES OF IMIDACLOPRID: PERSPECTIVES FOR THE CONTROL OF THE LEAF-CUTTING ANT ATTA SEXDENS (HYMENOPTERA: FORMICIDAE)	I	540	21/08/00	16:30	CC		11	PS	11
Samuels, R. I.	2047	THE SPECIFICITY OF METARHIZIUM ANISOPLIAE AND BEAUVERIA BASSIANA IN THE INFECTION OF EGGS OF THE BRAZILIAN CHINCH BUG, BLISSUS ANTILLUS	I	516	21/08/00	16:30	CC		11	PS	11
Samuels, R. I.	2065	SCREENING FOR NEW INSECTICIDAL COMPOUNDS PRODUCED BY ENTOMOPATHOGENIC FUNGI	I	521	22/08/00	16:30	CC		11	PS	11
Samuels, R. I.	2124	MICROBIAL CONTROL OF THE COFFEE BERRY BORER HYPOTHENEMUS HAMPEI	I	536	25/08/00	16:30	CC		11	PS	11
Samuels, R. I.	1382	RESISTANCE TO THE TOMATO PINWORM, TUTA ABSOLUTA, BY INTERSPECIFIC GENETIC CROSSES OF TOMATO PLANTS	I	349	24/08/00	16:30	CC		7	PS	7
Samuels, R. I.	2044	THE SPECIFICITY OF BEAUVERIA BASSIANA FOR THE CONTROL OF MITE PESTS OF PAPAYA	I	516	21/08/00	16:30	CC		11	PS	11
San Román, E.	336	FACTORS AFFECTING QUALITY OF ALFALFA-LEAFCUTTING BEE COCOONS IN SOUTHERN BUENOS AIRES PROVINCE, ARGENTINA	I	85	25/08/00	16:30	CC		2	PS	2
Sanches, A. L.	2861	EFFICIENCY OF THIAMETHOXAM TO CONTROL ONCOMETOPIA FACIALIS (HEMIPTERA: CICADELLIDAE) IN CITRUS	II	722	25/08/00	16:30	CC		14	PS	14
Sanches, F. P. S.	3018	ANTIBODY AND BLOOD LEUKOCYTE RESPONSE IN RHIPICEPHALUS SANGUINEUS TICK INFESTED DOGS AND GUINEA PIGS	II	761	25/08/00	16:30	CC		15	PS	15
Sanches, M. R.	897	DISCRETE TIME MODEL OF POSTFEEDING LARVAL DISPERSAL IN BLOWFLIES	I	227	21/08/00	16:30	CC		6	PS	6
Sanches, N. F.	1647	BIOLOGICAL ASPECTS OF EXOTIC PREDATOR CRYPTOLAEMUS MONTROUZIERI (COLEOPTERA: COCCINELLIDAE), REARED ON PLANOCOCCUS CITRI IN LABORATORY	I	415	24/08/00	16:30	CC		8	PS	8
Sanches, N. F.	1657	EVALUATION OF THE PREDACIOUS CAPACITY OF CRYPTOLAEMUS MONTROUZIERI (COLEOPTERA: COCCINELLIDAE) IN ORTHEZIA PRAELONGA, PLANOCOCCUS CITRI AND DYSMICOCCUS BREVIPES	I	418	24/08/00	16:30	CC		8	PS	8
Sanches, N. F.	3543	CONTROL OF UNDERGROUND TERMITES AMITERMES SP. (ISOPTERA: TERMITIDAE, TERMITINAE) ON PINEAPPLE CROP IN SEMIARID ZONE OF NORTHEAST BRAZIL	II	894	25/08/00	16:30	CC		19	PS	19
Sánchez, A.	549	AN UNEXPLORED STORE OF THE EQUATOGUINEAN BIODIVERSITY IN THE MUSEO NACIONAL DE CIENCIAS NATURALES	I	139	24/08/00	16:30	CC		3	PS	3
Sánchez, A.	3724	THE MORPHOLOGY OF THE IMMATURE STAGE OF PHORACANTHA RECURVA (COLEOPTERA: CERAMBYCIDAE) AND A KEY TO LARVAE OF THE SPECIES OF PHORACANTHA IN URUGUAY	II	940	21/08/00	16:30	CC		21	PS	21
Sánchez, C.	3857	CONTRIBUTION TO THE KNOWLEDGE OF BUTTERFLIES IN THE COIBA NATIONAL PARK, PANAMA. (LEPIDOPTERA: PAPILIONOIDEA)	II	973	24/08/00	16:30	CC		21	PS	21
Sánchez, N.	928	EFFECT OF TOMATO HAIRINESS IN SURVIVAL AND FECUNDITY OF T. URTICAE AND N. CALIFORNICUS [ACARI:TETRANYCHIDAE:PHYTOSEIIDAE	I	234	21/08/00	16:30	CC		6	PS	6
Sánchez, N. E.	272	COMPARATIVE PARASITOID GUILD ANALYSIS OF RACHIPLUSIA NU (LEPIDOPTERA: NOCTUIDAE) LARVAE IN DIFFERENT PLANT HABITATS	I	69	23/08/00	16:30	CC		2	PS	2
Sánchez, N. E.	71	REPELLENCY OF GREEN ONION TO THE TWO-SPOTTED SPIDER MITE	I	18	25/08/00	16:30	CC		1	PS	1
Sanchez, P.	3115	RHYNCOPHORUS PALMARUM A MORPHOLOGICAL AND ULTRASTRUCTURAL STUDY OF FEMALE REPRODUCTOR SYSTEM (COLEOPTERA)	II	786	21/08/00	16:30	CC		16	PS	16
Sánchez, S. E. M.	2138	ENTOMOPHTHORALEAN PATHOGENIC FUNGI (ZYGOMYCOTINA – ZYGOMYCETES) IN THE NATURAL CONTROL OF INSECTS – PROSPECTS IN THE SOUTH OF BAHIA, BRAZIL	I	539	24/08/00	16:30	CC		11	PS	11
Sánchez-Gea, J. F.	3718	PHYLOGENETIC RELATIONSHIPS OF THE GENUS ZABRUS (COLEOPTERA, CARABIDAE) BASED ON MORPHOLOGICAL, KARYOTYPIC, AND MOLECULAR DATA	II	939	21/08/00	16:30	CC		21	PS	21
Sanchez-Martinez, G.	1959	SCOLYTIDAE AND ASSOCIATED INSECTS IN PONDEROSA PINE STANDS UNDER DIFFERENT STRUCTURAL CONDITIONS IN NORTHERN ARIZONA	I	494	25/08/00	16:30	CC		10	PS	10
Sánchez-Serrano, J.	2482	PHYSIOLOGICAL RESPONSES OF COLORADO POTATO BEETLE AND BEET ARMYWORM LARVAE TO ANTISENSE-MEDIATED DEPLETION OF WOUND-INDUCIBLE PROTEINASE INHIBITORS IN POTATO	II	627	25/08/00	16:30	CC		13	PS	13
Sanders I	4102	THE SEASONAL ABUNDANCE AND CONTROL OF CHRYSOMYA MEGACEPHALA INFESTING DRYING FISH IN SOUTH-WEST INDIA	II	1036	24/08/00	16:30	CC		23	PS	23
Sanhudo, C. E. D.	3478	EPIGEIC ANT FAUNA OF AREAS WITH HIGH COPPER CONCENTRATION	II	878	22/08/00	16:30	CC		19	PS	19
Sanmartín, I.	550	PATTERNS OF ANIMAL DISPERSAL, VICARIANCE AND DIVERSIFICATON IN THE HOLARCTIC	I	139	24/08/00	16:30	CC		3	PS	3
Sannino, L.	2139	OBSERVATIONS ON THE VICE-LIKE STRUCTURES IN PUPAE OF PLUSIINAE (LEPIDOPTERA, NOCTUIDAE)	I	539	24/08/00	16:30	CC		11	PS	11
Sannino, L.	2327	LIFE CYCLE, MORPHOLOGICAL AND GENETIC VARIATION IN CLONES OF MYZUS PERSICAE (HOMOPTERA: APHIDIDAE)	I	587	25/08/00	16:30	CC		12	PS	12

Sub-titles: (HB=Hotel Bourbon) - (HM=Hotel Mabu) - (CC=Convention Center) - (Bol=Foz Boulevard) - (PS=Poster Session) - (PL=Plenary Lecturer)

AUTHOR	Nº	TITLE	Book	Page	Date	Time	Local	Room	Session	Symp	New Session
Sant'Ana, A. E. G.	717	FEMALE SEX PHEROMONE OF CASTNIA LICUS (LEPIDOPTERA:CASTNIIDEA): IDENTIFICATION AND FIELD APPLICATION	I	181	24/08/00	16:30	CC		4	PS	4
Sant'Anna, M. R. V.	1065	LIFE CYCLE OF MARTAREGA URUGUAYENSIS (HETEROPTERA: NOTONECTIDAE) UNDER LABORATORY CONDITIONS	I	269	23/08/00	16:30	CC		6	PS	6
Santa-Cecília, L. V. C.	1537	EFFECT OF THE AGE OF APHIDIUS COLEMANI (HYMENOPTERA: APHIDIIDAE) ON THE GREEN APHID SCHIZAPHIS GRAMINUM (HOMOPTERA: APHIDIDAE) PARASITISM	I	388	22/08/00	16:30	CC		8	PS	8
Santa-Cecília, L. V. C.	1648	FUNCTIONAL RESPONSE OF CYCLONEDA SANGUINEA (COLEOPTERA : COCCINELLIDAE) AT DIFFERENT DENSITIES OF THE APHID MYZUS PERSICAE (HOMOPTERA: APHIDIDAE)	I	415	22/08/00	16:30	CC		8	PS	8
Santa-Cecília, L. V. C.	218	DETERMINATION OF INJURY AND DAMAGE OF THE MEALYBUG DYSMICOCCUS BREVIPES (HEMIPTERA: PSEUDOCOCCIDAE) IN PINEAPPLE	I	56	22/08/00	16:30	CC		2	PS	2
Santa-Cecília, L. V. C.	1538	FOOD CONSUMPTION OF CHRYSOPERLA EXTERNA (NEUROPTERA: CHRYSOPIDAE) IN THE DIFFERENT DEVELOPMENTAL PHASES OF DYSMICOCCUS BREVIPES (HEMIPTERA: PSEUDOCOCCIDAE), UNDER LABORATORY CONDITIONS	I	388	22/08/00	16:30	CC		8	PS	8
Santamaría, E. C.	336	FACTORS AFFECTING QUALITY OF ALFALFA-LEAFCUTTING BEE COCOONS IN SOUTHERN BUENOS AIRES PROVINCE, ARGENTINA	I	85	25/08/00	16:30	CC		2	PS	2
Santana, A.	1580	CLASSICAL BIOLOGICAL CONTROL OF SOLANUM VIARUM (SOLANACEAE) IN THE USA	I	398	23/08/00	16:30	CC		8	PS	8
Santana, C. C. de	3543	CONTROL OF UNDERGROUND TERMITES AMITERMES SP. (ISOPTERA: TERMITIDAE, TERMITINAE) ON PINEAPPLE CROP IN SEMIARID ZONE OF NORTHEAST BRAZIL	II	894	25/08/00	16:30	CC		19	PS	19
Santana, D. L. Q.	67	POLIPHAGOTARSONEMUS LATUS (ACARI: TARSONEMIDAE) DAMAGES IN "ERVA-MATE" SEEDLINGS	I	17	25/08/00	16:30	CC		1	PS	1
Santana, D. L. Q.	1960	CTENARYTAINA EUCALYPTI (HEMIPTERA, PSYLLIDAE) HOST EVALUATION	I	494	24/08/00	16:30	CC		10	PS	10
Santana, D. L. Q.	1961	INSECTS ASSOCIATED WITH SEEDS OF THREE NATIVE SPECIES OF BRAZILIAN ATLANTIC FOREST	I	494	24/08/00	16:30	CC		10	PS	10
Santana, D. L. Q.	15	DAMAGE CHARACTERIZATION OF OLIGONYCHUS YOTHERSI (ACARI: TETRANYCHIDAE) TO ERVA-MATE (ILEX PARAGUARIENSIS) (AQUIFOLIACEAE)	I	4	21/08/00	16:30	CC		1	PS	7
Santana, D. L. Q.	1963	SEED PREDATION BY CTENOCOLUM CROTONAE (COLEOPTERA:BRUCHIDAE) IN LONCHOCARPUS MUEHLBERGIANUS (LEGUMINOSAE)	I	495	24/08/00	16:30	CC		10	PS	10
Santana, H. G.	225	EFFECT OF THE INSECT GROWTH REGULATOR DIFLUBENZURON ON REPRODUCTION OF EUSCHISTUS HEROS (FABR.) (HETEROPTERA: PENTATOMIDAE)	I	57	22/08/00	16:30	CC		2	PS	2
Santelli, R. V.	3033	OOCYTE DIFFERENTIATION AND MEIOSIS INITIATION IN RHYNCHOSCIARA AMERICANA: DECISION MAKING IN A TWO CELL MEROISTIC SYSTEM	II	765	21/08/00	10:30	HB	G	16	1	16
Santhalakshmi, G.	2052	STUDIES ON ENTOMOPATHOGENIC FUNGI AGAINST WHITE GRUB HOLOTRICHIA SERRATA (COLEOPTERA : SCARABAEIDAE) IN SUGARCANE	I	518	21/08/00	16:30	CC		11	PS	11
Santiago-Blay, J. A.	1144	AN AQUATIC INSECT FAUNA FROM THE SUNDANCE FORMATION (LATE JURASSIC), NORTHERN WYOMING AND SOUTHERN MONTANA, U.S.A.	I	288	24/08/00	16:30	CC		6	PS	6
Santo Orihuela, P.	668	NITROGENOUS COMPOUNDS AS ATTRACTANTS OF TRIATOMA INFESTANS	I	169	22/08/00	16:30	CC		4	PS	4
Santolamazza, F	2279	ODYSSEUS, A NOVEL TRANSPOSON INVOLVED IN THE GENERATION OF CHROMOSOMAL INVERSIONS IN THE MALARIA MOSQUITO ANOPHELES ARABIENSIS	I	575	23/08/00	16:30	CC		12	PS	12
Santos Fo., H. P.	3232	OCCURRENCE OF SHARPSHOTER IN CITRUS ORCHARDS AFFECTED BY CVC IN NORTH COAST OF BAHIA AND SOUTH OF SERGIPE STATE, BRAZIL	II	816	23/08/00	16:30	CC		17	PS	17
Santos Jr., G. C.	717	FEMALE SEX PHEROMONE OF CASTNIA LICUS (LEPIDOPTERA:CASTNIIDEA): IDENTIFICATION AND FIELD APPLICATION	I	181	24/08/00	16:30	CC		4	PS	4
Santos, A. C.	2809	ESTABLISHMENT OF A ROTATIONAL PROGRAM WITH TRACER (SPINOSAD) FOR SPODOPTERA FRUGIPERDA (FALL ARMYWORM) CONTROL IN CORN	II	709	24/08/00	16:30	CC		14	PS	14
Santos, A. F.	1961	INSECTS ASSOCIATED WITH SEEDS OF THREE NATIVE SPECIES OF BRAZILIAN ATLANTIC FOREST	I	494	24/08/00	16:30	CC		10	PS	10
Santos, A. J. T. dos	2835	EVALUATION OF INSECTICIDES AGAINST THE THRIPS PALMI (THYSANOPTERA, THRIPIDAE) IN BEAN CROP (PHASEOLUS VULGARIS)	II	716	24/08/00	16:30	CC		14	PS	14
Santos, A. J. T. dos	2717	EVALUATION OF INSECTICIDES, IN LABORATORY, AGAINST THE VELVETBEAN CATERPILLAR ANTICARSIA GEMMATALIS (LEPIDOPTERA:NOCTUIDAE) IN SOY BEAN	II	686	24/08/00	16:30	CC		14	PS	14
Santos, A. V.	2140	SELECTION OF ENTOMOPATHOGENIC FUNGI FOR USE IN COMBINATION WITH SUBLETHAL DOSES OF IMIDACLOPRID: PERSPECTIVES FOR THE CONTROL OF THE LEAF-CUTTING ANT ATTA SEXDENS (HYMENOPTERA: FORMICIDAE)	I	540	21/08/00	16:30	CC		11	PS	11
Santos, B.	2141	MASS PRODUCTION OF BACULOVIRUS ANTICARSIA TO CONTROL ANTICARSIA GEMMATALIS IN SOYBEANS: RESEARCH PROGRAM FROM THE AGRICULTURAL COOPERATIVES OF THE PARANÁ STATE	I	540	25/08/00	16:30	CC		11	PS	11
Santos, C. G.	3967	ANALYSIS OF SUPERNATANTS FROM CULTURES OF 'B.t.' STRAINS CONTAINING VIP3A-LIKE GENES AND THEIR RELATIVE EFICIENCY IN THE CONTROL OF TROPICAL FALL ARMYWORM LARVAE	II	1001	23/08/00	16:30	CC		22	PS	22
Santos, C. G.	3968	TEMPORAL PATTERN OF PROTEIN SECRETION AND INSECTICIDAL ACTIVITY AGAINST TROPICAL FALL ARMYWORM IN THE SUPERNATANT OF THE 'B.t.' STRAIN 'HD125'	II	1001	23/08/00	16:30	CC		22	PS	22
Santos, C. M.	514	THE INSECTS COLLECTED BY THE COMISIÓN CIENTÍFICA DEL PACÍFICO: STUDYING BIODIVERSITY THROUGH HISTORICAL COLLECTIONS	I	130					3		3
Santos, C. M.	513	THE INSECTS COLLECTED BY THE COMISIÓN CIENTÍFICA DEL PACÍFICO: STUDYING BIODIVERSITY THROUGH HISTORICAL COLLECTIONS	I	130	23/08/00	16:30	CC		3	PS	3
Santos, C. M.	549	AN UNEXPLORED STORE OF THE EQUATOGUINEAN BIODIVERSITY IN THE MUSEO NACIONAL DE CIENCIAS NATURALES	I	139	24/08/00	16:30	CC		3	PS	3
Santos, D. C.	3180	MORPHOLOGICAL ASPECTS OF THE NURSE CELL DEATH IN THE DIATRAEA SACCHARALIS (LEPIDOPTERA: PYRALIDAE) OVARIAN FOLLICLES	II	802	24/08/00	16:30	CC		16	PS	16
Santos, D. C.	3181	SUB-CELLULAR STRUCTURES OF THE OOCYTE CYTOPLASM IN THE VITELLOGENIC FOLLICLES OF Diatraea saccharalis (LEPIDOPTERA: PYRALIDAE) REVEALED BY ZIO TECHNIQUE	II	802	24/08/00	16:30	CC		16	PS	16
Santos, D. S.	4035	EFFICACY OF PHOSPHINE AND CARBON DIOXIDE TO CONTROL DIFFERENT STAGES OF RHYZOPERTHA DOMINICA	II	1019	23/08/00	11:30	HB	J	23	6	23
Santos, D. S.	4107	EFFICACY OF PHOSPHINE AND CARBON DIOXIDE TO CONTROL ALL LIFE STAGES OF SITOPHILUS ORYZAE	II	1037	25/08/00	16:30	CC		23	PS	23
Santos, E. A. dos	3986	DATA BASE OF QUARANTINE PESTS TO BRAZIL	II	1006	24/08/00	16:30	CC		22	PS	22
Santos, E. M.	337	STUDY OF SIMULIIDAE (DIPTERA: NEMATOCERA) AND ITS BREEDING AREAS IN A STREAM OF THE MUNICIPAL DISTRICT OF "SANTO ANTÔNIO DO TAUÁ", STATE OF PARÁ, EASTERN AMAZONIA, BRAZIL	I	85	25/08/00	16:30	CC		2	PS	2
Santos, F.	1145	THE STUDY OF ABUNDANCE, BITING BEHAVIOR AND PARITY OF ANOPHELINE IN ENDEMIC MALARIA AREA IN PORTO VELHO – RONDONIA – BRAZIL	I	289	24/08/00	16:30	CC		6	PS	6
Santos, F.	1146	COMPARISON OF FOUR METHODS FOR COLLECTING ADULT ANOPHELINE MOSQUITOES IN AN ENDEMIC AREA IN PORTO VELHO – RONDONIA – BRAZIL	I	289	24/08/00	16:30	CC		6	PS	6
Santos, G. B. dos	3605	ARTHROPODS OBTAINED BY CANOPY FOGGING FROM VOCHYSIA DIVERGENS (VOCHYSIACEAE) IN PANTANAL OF BRAZIL	II	910	24/08/00	16:30	CC		20	PS	20
Santos, G. P.	1962	INFLUENCE OF STRIPS OF NATIVE VEGETATION IN PLANTATIONS OF EUCALYPTUS CLOËZIANA ON POPULATION OF OXYDIA VESULIA.	I	494	24/08/00	16:30	CC		10	PS	10
Santos, G. P.	1701	HYMENOPTERAN NATURAL ENEMIES IN A EUCALYPTUS PLANTATION IN IPABA, STATE OF MINAS GERAIS, BRAZIL	I	429	21/08/00	16:30	CC		8	PS	8

Sub-titles: (HB=Hotel Bourbon) - (HM=Hotel Mabu) - (CC=Convention Center) - (Bol=Foz Boulevard) - (PS=Poster Session) - (PL=Plenary Lecturer)

AUTHOR	Nº	TITLE	Book	Page	Date	Time	Local	Room	Session	Symp	New Session
Santos, H. R.	72	POPULATIONAL FLOTATION OF ACARI EDAPHICS ON TILLAGE AND NO TILLAGE SYSTEMS IN THE AREA OF DOURADOS - MS	I	18	25/08/00	16:30	CC		1	PS	1
Santos, H. R.	267	NATURAL AND ARTIFICIAL INFESTATION OF THE SITOPHILUS SPP IN GRAINS OF FIVE CULTIVATE OF CORN	I	68	23/08/00	16:30	CC		2	PS	2
Santos, H. R.	367	POPULATIONAL FLUCTUATION OF ARTROPODS EDAPHICS ON TILLAGE AND NO TILLAGE SYSTEMS IN THE AREA OF DOURADOS - MS	I	93	25/08/00	16:30	CC		2	PS	2
Santos, I. P.	1657	EVALUATION OF THE PREDACIOUS CAPACITY OF CRYPTOLAEMUS MONTROUZIERI (COLEOPTERA: COCCINELLIDAE) IN ORTHEZIA PRAELONGA, PLANOCOCCUS CITRI AND DYSMICOCCUS BREVIPES	I	418	24/08/00	16:30	CC		8	PS	8
Santos, I. P.	1647	BIOLOGICAL ASPECTS OF EXOTIC PREDATOR CRYPTOLAEMUS MONTROUZIERI (COLEOPTERA: COCCINELLIDAE), REARED ON PLANOCOCCUS CITRI IN LABORATORY	I	415	24/08/00	16:30	CC		8	PS	8
Santos, J. C.	1147	ANT-HERBIVORES INTERACTIONS IN TOCOYENA FORMOSA (RUBIACEAE) IN CERRADO VEGETATION	I	289	24/08/00	16:30	CC		6	PS	6
Santos, J. C.	1794	A SILK-NEST WEAVING ANT CAMPONOTUS SENEX (HYMENOPTERA: FORMICINAE) IN A BRAZILIAN SAVANNA	I	452	25/08/00	16:30	CC		9	PS	9
Santos, J. C. C.	2794	USE OF THIAMETHOXAM IN THE BEMISIA SPP (HOMOPTERA: ALEYRODIDAE) CONTROL IN CULTIVATION OF VEGETABLES AND COTTON, IN MONITORED AREAS	II	705	25/08/00	16:30	CC		14	PS	14
Santos, J. M. dos	3157	OVIPOSITION PATTERNS OF PROCONIINI SHARPSHOOTERS (CICADELLIDAE: CICADELLINAE) IN CITRUS	II	796	23/08/00	16:30	CC		16	PS	16
Santos, J. M. dos	3522	MORPHOLOGICAL DESCRIPTION OF THE CATERPILLAR OF BOMBYX MORI (LEPIDOPTERA: BOMBYCIDAE) WITH THE USE OF SCANNING ELECTRONIC MICROSCOPY	II	889	23/08/00	16:30	CC		19	PS	19
Santos, J. M. F. dos	2717	EVALUATION OF INSECTICIDES, IN LABORATORY, AGAINST THE VELVETBEAN CATERPILLAR ANTICARSIA GEMMATALIS (LEPIDOPTERA:NOCTUIDAE) IN SOY BEAN	II	686	24/08/00	16:30	CC		14	PS	14
Santos, J. P.	4021	TRICHOGRAMMA AND PARASITIC MITE AS POTENTIAL AGENTS FOR STORED GRAIN INSECT CONTROL IN BRAZIL	II	1015	22/08/00	11:30	HB	J	23	3	23
Santos, J. P.	4107	EFFICACY OF PHOSPHINE AND CARBON DIOXIDE TO CONTROL ALL LIFE STAGES OF SITOPHILUS ORYZAE	II	1037	25/08/00	16:30	CC		23	PS	23
Santos, J. P.	4060	PLANT EXTRACTS AS POTENTIAL INSECTICIDE TO CONTROL STORED GRAIN PESTS	II	1025	25/08/00	11:35	HB	J	23	10	23
Santos, J. P.	4064	EFFECTS OF THE NUTRITIONAL QUALITY OF THE CORN GRAINS ON THE INFESTATION STORED GRAIN INSECTS AND MOLDS DURING THE STORAGE	II	1026	21/08/00	16:30	CC		23	PS	23
Santos, J. P.	4035	EFFICACY OF PHOSPHINE AND CARBON DIOXIDE TO CONTROL DIFFERENT STAGES OF RHYZOPERTHA DOMINICA	II	1019	23/08/00	11:30	HB	J	23	6	23
Santos, J. P.	4063	INTERATION BETWEEN CROPPING FACTORS AND ACTION OF INSECTS AND MOLDS IN THE DEPRECIATION OF THE NUTRITIONAL QUALITIES OF THE CORN BR 2121-QPM DURING THE STORAGE	II	1026	21/08/00	16:30	CC		23	PS	23
Santos, L. M. dos	3176	DESCRIPTION OF INTERNAL REPRODUCTIVE ORGANS OF COSMOCLOPIUS NIGROANNULATUS (HEMIPTERA, REDUVIIDAE)	II	801	24/08/00	16:30	CC		16	PS	16
Santos, R.	524	FLIES AS A BIOINDICATOR FOR BIODIVERSITY LOSS IN AGRICULTURAL LANDING USE SYSTEMS	I	133	23/08/00	16:30	CC		3	PS	3
Santos, R. C. O.	1795	A NEW RECORD AND BREEDING HOST PLANT FOR A SPECIES OF THE D. FLAVOPILOSA GROUP (DROSOPHILIDAE, DROSOPHILA)	I	452	24/08/00	16:30	CC		9	PS	9
Santos, T. C.	3746	A NEW SPECIES OF CORDULIIDAE FROM RIO DE JANEIRO, BRAZIL AND ITS AFFINITY WITH OTHER SPECIES OF THE SUB-GENUS NEOCORDULIA (ODONATA: ANISOPTERA)	II	946	22/08/00	16:30	CC		21	PS	21
Santos, T. C.	3747	A SYNOPSIS OF THE GENUS STAUROPHLEBIA WITH A REDESCRIPTION OF STAUROPHLEBIA RETICULATA BOSQI NAVÁS, 1927, NEW STATUS (ANISOPTERA: AESHNIDAE)	II	946	22/08/00	16:30	CC		21	PS	21
Santos, T. C.	3748	OCCURRENCE OF TIGRIAGRION AURANTINIGRUM IN PARAGUAY AND BOLIVIA (SOUTH AMERICA) AND NEW SITES IN BRAZIL (ZYGOPTERA: COENAGRIONIDAE)	II	946	22/08/00	16:30	CC		21	PS	21
Santos, T. M. dos	2810	RESISTANCE OF COTTON GENOTYPES (GOSSYPIUM HIRSUTUM) TO ALABAMA ARGILLACEA (LEPIDOPTERA: NOCTUIDAE)	II	709	24/08/00	16:30	CC		14	PS	14
Santos, V. F. dos	262	CONTROL OF DIABROTICA SPECIOSA (COLEOPTERA, CHRYSOMELIDAE) NA CULTURA DA BATATA	I	67	23/08/00	16:30	CC		2	PS	2
Santos, W.	1925	THE ASSOCIATED FAUNA COMPOSITION AT THE EUPHALERUS SP (HEMIPTERA:PSYLLIDAE), IN SEROPÉDICA, RJ, BRAZIL	I	485	22/08/00	16:30	CC		10	PS	10
Santos, W. J. dos	2811	USE OF THE PHEROMONE TRAPS "GRANDLURE" FOR ATTRACTION AND CONTROL OF THE BOLL WEEVIL, ANTHONOMUS GRANDIS IN COTTON	II	710	24/08/00	16:30	CC		14	PS	14
Sanz, M. J.	4077	PARSIMONY ANALYSIS OF ENDEMICITY AND ITS APPLICATION TO DETECT HIGH ENDEMISM AREAS USING COMBINED DATA FROM INSECTS, VERTEBRATES, AND PLANTS, FROM THE IBERIAN PENINSULA	II	1029	21/08/00	16:30	CC		23	PS	23
Sanz, M. J.	1003	PHENOLOGICAL INTERACTIONS BETWEEN THE WEEVILS EXAPION SPP. AND LEPIDAPION SPP. AND THE GENISTEAE IN CENTRAL SPAIN (SW EUROPE)	I	253	22/08/00	16:30	CC		6	PS	6
Sappington, T. W.	1148	INTERPLAY OF VEGETATIONAL FEATURES AND MICROCLIMATE ON BOLL WEEVIL CAPTURE IN PHEROMONE TRAPS	I	289	24/08/00	16:30	CC		6	PS	6
Sapunov, V. B.	551	CHANGE OF INSECT DIVERSITY AS A GREAT MYTH	I	139	24/08/00	16:30	CC		3	PS	3
Saraiva, C.	842	PLANT RESISTANCE AGAINST GALL-FORMING INSECTS: THE ROLE OF PLANT HYPERSENSITIVITY	I	213	23/08/00	15:15	HB	D	6	5	6
Sarath, G.	2442	CHARACTERIZATION OF PROTEIN CHANGES IN BUFFALOGRASSES CHALLENGED BY CHINCH BUG FEEDING	II	617	22/08/00	16:30	CC		13	PS	13
Sargo, H. L. B.	2739	ENVIRONMENT PROTECTION THROUGH RESISTANT POTATO: RESEARCH, EDUCATION AND DELIVERING INFORMATION IN BRAZIL	II	692	23/08/00	16:30	CC		14	PS	14
Sari, L. T.	1963	SEED PREDATION BY CTENOCOLUM CROTONAE (COLEOPTERA:BRUCHIDAE) IN LONCHOCARPUS MUEHLBERGIANUS (LEGUMINOSAE)	I	495	24/08/00	16:30	CC		10	PS	10
Sarro, F. B.	665	EFFICIENCY OF DIFFERENTS LURES AND THEIR PROBABLE INTERACTION IMPROVING RHYNCHOPHORUS PALMARUM ADULTS ATTRACTION TO THE TRAPS	I	168	22/08/00	16:30	CC		4	PS	4
Sarro, F. B.	666	EVALUATION OF THE "PET" TRAP EFFICIENCY ON THE CAPTURE OF ADULTS OF RHYNCHOPHORUS PALMARUM AND THE COST/BENEFIT ANALISYS	I	168	22/08/00	16:30	CC		4	PS	4
Sarro, F. B.	2056	CONIDIAL VIABILITY OF TWO ENTOMOPATHOGENOUS FUNGI KEPT ON AQUEOUS SUSPENSION UNDER DIFFERENTS STORAGE CONDITIONS AND PERIOD	I	519	22/08/00	16:30	CC		11	PS	11
Sarro, F. B.	2057	EFFICIENCY OF THE ENTOMOPATHOGENOUS FUNGUS BEAUVERIA BASSIANA (BBBR057/CPATC) STRAIN ON BLACK COCONUT BUNCH WEEVIL HOMALINOTUS CORIACEUS (COLEOPTERA: CURCULIONIDAE)	I	519	22/08/00	16:30	CC		11	PS	11
Sarro, F. B.	2058	EFFICIENCY OF THE ENTOMOPATHOGENOUS FUNGUS BEAUVERIA BASSIANA (BbDr057/CPATC) STRAIN ON THE AMERICAN PALM WEEVIL RHYNCHOPHORUS PALMARUM (COLEOPTERA:CURCULIONIDAE)	I	519	22/08/00	16:30	CC		11	PS	11
Sartório, R. C.	1814	ENTOMOFAUNA AS A BIOINDICATOR OF THE IMPACTS OF SILVICULTURAL OPERATIONS	I	457	21/08/00	11:20	HB	M	10	1	10
Sasagawa, H.	724	BIOLOGICAL ACTIVITY OF WORKER MANDIBULAR ACIDS IN APIS CERANA AND APIS MELLIFERA	I	183	25/08/00	16:30	CC		4	PS	4
Sasagawa, H.	694	SEMIOCHEMICALS INDUCING DEFENSIVE BEHAVIOR OF APIS CERANA JAPONICA AGAINST VESPA MANDARINA	I	175	23/08/00	16:30	CC		4	PS	4

Sub-titles: (HB=Hotel Bourbon) - (HM=Hotel Mabu) - (CC=Convention Center) - (Bol=Foz Boulevard) - (PS=Poster Session) - (PL=Plenary Lecturer)

AUTHOR	Nº	TITLE	Book	Page	Date	Time	Local	Room	Session	Symp	New Session
Sasaki, H.	3013	BLOOD SOURCES OF THE TRIATOMINE BUGS COLLECTED AT THE RURAL VILLAGES IN GUATEMALA (HEMIPTERA: TRIATOMIDAE)	II	760	24/08/00	16:30	CC		15	PS	15
Sasaki, H.	3503	CHEMICAL STRUCTURE AND PROPERTIES OF SILK PROTEINS PRODUCED BY THE SILKWORMS REARED UNDER ARTIFICIAL DIET/ASEPTIC CONDITIONS	II	884	23/08/00	16:30	CC		19	PS	19
Sasaki, M.	2498	MASKING OF CIRCADIAN ACTIVITY RHYTHM IN BUMBLE BEES: A NOVEL ADAPTATION MECHANISM TO HIGH-LATITUDE CONDITION	II	631	24/08/00	16:30	CC		13	PS	13
Sasaki, M.	4081	HONEY-CROP MODIFIES THE CLASSICAL CONDIGIONING OF PROBOSCIS EXTENTION REFLEX (PER) IN HONEYBEES	II	1030	22/08/00	16:30	CC		23	PS	23
Sasaki, M.	3568	CONTROL OF THE MATING FLIGHT TIME OF HONEYBEES BY PHOTOPERIODIC TREATMENT WITHIN THE HIVE	II	900	25/08/00	16:30	CC		19	PS	19
Sasaki, T.	2142	TRANSINFECTION OF WOLBACHIA ENDOSYMBIONTS AMONG THREE SPECIES OF LEPIDOPTERAN INSECTS	I	540	25/08/00	16:30	CC		11	PS	11
Sastrodihardjo, S.	313	POPULATION DYNAMIC OF SCARLET MITE, BREVIPALPUS PHOENICIS AND ITS PREDATOR IN TEA AREA WHICH TREATED AND NON TREATED BY PESTICIDES	I	79	24/08/00	16:30	CC		2	PS	2
Satar, S.	3228	OVERWINTERING BIOLOGY OF CIRCULIFER HAEMATOCEPS (HOMOPTERA, CICADELLIDAE), A VECTOR OF PROCARYONTS IN CITRUS AND SESAME	II	815	23/08/00	16:30	CC		17	PS	17
Sato, H.	2143	NEW HOST RECORD OF A GUT FUNGUS OF MYRIAPODA, ENTEROBRYUS OXIDI (TRICHOMYCETES; ECCRINALES)	I	540	25/08/00	16:30	CC		11	PS	11
Sato, K.	2144	BACULOVIRUS-MEDIATED EXPRESSION AND ANTIFUNGAL ACTIVITY OF A DIAPAUSE-SPECIFIC PEPTIDE OF THE ADULT LEAF BEETLE	I	541	25/08/00	16:30	CC		11	PS	11
Sato, K.	2515	cDNA AND CHARACTERIZATION OF A SPECIFIC PEPTIDE PRODUCED THROUGHOUT ADULT DIAPAUSE IN THE LEAF BEETLE, GASTROPHYSA ATROCYANEA	II	635	25/08/00	16:30	CC		13	PS	13
Sato, M.	2145	WOLBACHIA ARE DISTRIBUTED THROUGHOUT SOMATIC AND GENITAL ORGANS OF A MULBERRY LEAFHOPPER, HISHIMONOIDES SELLATIFORMIS	I	541	25/08/00	16:30	CC		11	PS	11
Sato, M.	3346	DETECTION OF WOLBACHIA IN A LINE WITH FEMALE-BIASED SEX RATIO OF A BUTTERFLY, HYPOLIMNAS BOLINA	II	845	23/08/00	16:30	CC		18	PS	18
Sato, M. E.	1393	MECHANISMS OF RESISTANCE TO THE INSECTICIDE METHIDATHION IN AMBLYSEIUS WOMERSLEYI (ACARI: PHYTOSEIIDAE)	I	351	22/08/00	16:30	CC		7	PS	7
Sato, M. E.	1156	DISTRIBUTION OF SCAPTOCORIS CASTANEA (HEMIPTERA: CYDNIDAE) POPULATION IN THE SOIL IN FLORÍNEA COUNTY, STATE OF SÃO PAULO, BRAZIL	I	291	22/08/00	16:30	CC		6	PS	6
Sato, M. E.	1167	HOST PLANTS OF ZAPRIONUS INDIANUS IN THE STATE OF SÃO PAULO, BRAZIL	I	294	25/08/00	16:30	CC		6	PS	6
Sato, M. E.	1282	MANAGEMENT OF ACARICIDE RESISTANCE IN JAPAN	I	324	25/08/00	15:35	HM	N	7	10	7
Sato, M.E.	1386	THIAMETHOXAM TO CONTROL CITRUS LEAFMINER IN TANGOR MURCOTT	I	350	24/08/00	16:30	CC		7	PS	7
Sato, S.	1149	INSECTIVOROUS BIRD COMMUNITY DEPENDING ON FORESTS	I	290	24/08/00	16:30	CC		6	PS	6
Sato, S.	1879	IMPACT OF FOREST UTILIZATION ON THE ASSEMBLAGE OF LONGICORN BEETLES (COLEOPTERA: CERAMBYCIDAE) IN THE WARM-TEMPERATE FORESTS OF JAPAN	I	474	25/08/00	16:05	HB	M	10	8	10
Sato, Y.	2312	REPRODUCTIVE ISOLATION AND GENETIC DIFFERENTIATION IN JAPANESE SPECIES OF ADOXOPHYES (LEPIDOPTERA: TORTORICIDAE)	I	583	24/08/00	16:30	CC		12	PS	12
Satou, S.	1150	BIODIVERSITY OF FAGUS GALL MIDGES: COEXITENCE AND LIFE HISTORY STRATEGY	I	290	24/08/00	16:30	CC		6	PS	6
Satou, S.	835	SYNCHRONIZATION OF GALLER'S APPEARANCE WITH HOST PLANT PHENOLOGY	I	211	23/08/00	13:30	HB	D	6	5	6
Satta, A.	3486	SEARCHING FOR AN ACCURATE METHOD TO EVALUATE THE EFFICACY OF AN ACARICIDE IN THE Varroosis CONTROL	II	880	22/08/00	16:30	CC		19	PS	19
Sattabongkok, J.	2924	PREVENTION OF SPOROGONY OF PLASMODIUM VIVAX IN ANOPHELES DIRUS MOSQUITOES BY TRANSMISSION-BLOCKING ANTIMALARIALS	II	738	25/08/00	10:35	Bol	R	15	9	15
Sauer, J. R.	5	A NOVEL ANTI-INFLAMMATORY FACTOR IN THE SALIVA OF THE LONE STAR TICK AMBLYOMMA AMERICANUM	I	2	24/08/00	15:35	HB	F	1	1	1
Sauer, J. R.	6	PROSTAGLANDINS IN TICK SALIVARY GLAND PHYSIOLOGY	I	2	24/08/00	16:05	HB	F	1	1	1
Saulich, A. H.	3352	SUMMER DORMANCY ENSURES UNIVOLTINISM IN THE PREDATORY STINK BUG PICROMERUS BIDENS	II	846	23/08/00	16:30	CC		18	PS	18
Saulich, A. H.	3351	TIMING OF DIAPAUSE INDUCTION OUTSIDE THE NATURAL GEOGRAPHICAL RANGE OF A SPECIES: AN OUTDOOR EXPERIMENT WITH THE BEAN BUG RIPTORTUS CLAVATUS	II	846	23/08/00	16:30	CC		18	PS	18
Saunders, D. S.	3269	THE BLOW FLY, CALLIPHORA VICINA: A CLOCKWORK INSECT	II	826	23/08/00	13:35	HB	K	18	3	18
Saunders, D. S.	3310	GEOGRAPHICAL STRAINS AND SELECTION FOR THE DIAPAUSE TRAIT IN CALLIPHORA VICINA	II	836	25/08/00	11:35	HB	K	18	8	18
Sauphanor, B.	640	NO PLEIOTROPIC EFFECT OF INSECTIDE RESISTANCE ON SEXUAL COMMUNICATION IN CYDIA POMOMELLA	I	162	21/08/00	16:30	CC		4	PS	4
Sauphanor, B.	1304	INVOLVEMENT OF VOLTAGE-DEPENDENT SODIUM CHANNELS IN DELTAMETHRIN RESISTANCE IN A STRAIN OF CYDIA POMONELLA	I	329	21/08/00	16:30	CC		7	PS	7
Sauphanor, B.	1394	MECHANISMS OF AZINPHOS-METHYL RESISTANCE IN A STRAIN OF CYDIA POMONELLA FROM SOUTHERN EUROPE	I	352	21/08/00	16:30	CC		7	PS	7
Sauphanor, B.	2549	INSECTICIDE RESISTANCE IN CODLING MOTH WORLDWIDE: MONITORING, MECHANISMS AND CROSS-RESISTANCES.	II	644	21/08/00	14:50	HB	B	14	2	14
Sauphanor, B.	2812	INSECTICIDE RESISTANCE IN CODLING MOTH WORLDWIDE: MONITORING, MECHANISMS AND CROSS-RESISTANCES.	II	710	24/08/00	16:30	CC		14	PS	14
Sauvion, N.	1649	BEMISIA TABACI BIOTYPE B (HEMIPTERA: ALEYRODIDAE) AND ITS PARASITOIDS: GUADELOUPE ISLAND AS A REPRESENTATIVE SITE OF THE CARIBBEAN	I	416	24/08/00	16:30	CC		8	PS	8
Savage, J.	3834	PHYLOGENETIC RELATIONSHIPS OF THE GENUS THRICOPS RONDANI AND THE STATUS OF ALLOEOSTYLUS SCHNABL (DIPTERA: MUSCIDAE)	II	968	24/08/00	16:30	CC		21	PS	21
Savage, K. E.	1565	OBSERVATIONS ON CULTURING DIADEGMA INSULARE, AN IMPORTANT PARASITOID OF THE DIAMONDBACK MOTH	I	395	22/08/00	16:30	CC		8	PS	8
Savakis, C.	2237	MOLECULAR STUDIES OF SEX-SPECIFIC GENES IN THE INSECTS C. CAPITATA AND BACTROCERA OLEAE	I	565	21/08/00	16:30	CC		12	PS	12
Savakis, C.	2218	THE MINOS TRANSPOSABLE ELEMENT AS A TOOL FOR INSECT TRANSFORMATION	I	560	25/08/00	14:05	HB	L	12	10	12
Savolainen, R.	3544	PARASITE-HOST RELATIONSHIPS IN ANTS: IMPLICATIONS FOR SYMPATRIC SPECIATION	II	894	25/08/00	16:30	CC		19	PS	19
Sawada, S.	3961	INSECTICIDAL ACTIVITY OF A NOVEL INSECT PEST CONTROL AGENT, CHROMAFENOZIDE	II	1000	22/08/00	16:30	CC		22	PS	22
Sawata, M.	3558	IDENTIFICATION AND CHARACTERIZATION OF A NOVEL GENE (KL-1), WHICH IS EXPRESSED PREFERENTIALLY IN LARGE TYPE KENYON CELLS OF THE HONEYBEE BRAIN	II	898	25/08/00	16:30	CC		19	PS	19
Sawata, M.	2336	IDENTIFICATION AND CHARACTERIZATION OF THE KS-1 GENE, WHICH IS EXPRESSED PREFERENTIALLY IN THE SMALL TYPE-KENYON CELLS OF THE HONEYBEE BRAIN	I	589	25/08/00	16:30	CC		12	PS	12
Sawchik, J.	490	EVALUATION OF ECOLOGICAL NETWORK QUALITY FOR BUTTERFLY INDICATOR SPECIES BY COMPARISON OF OBSERVED POPULATION DENSITY AND PREDICTED DENSITY FROM BOTANICAL RELEVÉS	I	124	22/08/00	16:30	CC		3	PS	3
Sawyer, A. J.	87	METHODS FOR ESTIMATING THE SENSITIVITY OF DETECTION TRAPPING SYSTEMS	I	23	21/08/00	14:05	HB	A	2	2	2

Sub-titles: (HB=Hotel Bourbon) - (HM=Hotel Mabu) - (CC=Convention Center) - (Bol=Foz Boulevard) - (PS=Poster Session) - (PL=Plenary Lecturer)

AUTHOR	Nº	TITLE	Book	Page	Date	Time	Local	Room	Session	Symp	New Session
Sayama, K.	3545	COLONY SURVIVAL AND FAILURE IN THE SOCIAL WASP POLISTES SNELLENI (HYMENOPTERA: VESPIDAE)	II	894	25/08/00	16:30	CC		19	PS	19
Sbordoni, V.	3705	PHYLOGENY, EVOLUTIONARY RATES, AND MORPHOLOGICAL ADAPTATION TO CAVE LIFE IN BATHYSCIINE BEETLES: CALIBRATING THE CLOCK FROM THE MITOCHONDRIAL COI GENE	II	935	26/08/00	15:35	HB	E	21	10	21
Scalercio, S.	1100	FIRST RECORD OF SETINA IRRORELLA IN SOUTHERN ITALY AND OF SETINA ROSCIDA IN ABRUZZO (CENTRAL ITALY) WITH SOME CONSIDERATIONS ON EUROPEAN SPECIES OF GENUS SETINA (LEPIDOPTERA ARCTIIDAE LITHOSIINAE)	I	277	24/08/00	16:30	CC		6	PS	6
Scalise, M.	223	OCCURRENCE AND DAMAGES OF ONCIDERES SAGA (COLEOPTERA, CERAMBYCIDAE) IN MIMOSA CAESALPINAEFOLIA (LEGUMINOSAE, CAESALPINOIDAE)	I	57	22/08/00	16:30	CC		2	PS	2
Scandiani, M. M.	2131	INSECTS AFFECTING SWEETPOTATO HARVEST	I	537	24/08/00	16:30	CC		11	PS	11
Scanlan, J. C.	1020	USE OF THE FUNGUS METARHIZIUM ANISOPLIAE TO CONTROL LOCUSTS IN AUSTRALIA	I	257	23/08/00	16:30	CC		6	PS	6
Scarpassa, V. M.	2313	MITOCHONDRIAL DNA COI SEQUENCES DIFFERENTIATE TWO CLOSELY-RELATED SPECIES, ANOPHELES DUNHAMI AND ANOPHELES NUNEZTOVARI (DIPTERA: CULICIDAE)	I	584	24/08/00	16:30	CC		12	PS	12
Scarpellini, J. R.	2813	EFFECT OF EMAMECTIN BENZOATE ON SEVERAL LARVAL STAGES OF COTTON LEAF WORM ALABAMA ARGILLACEA (LEPIDOPTERA: NOCTUIDAE)	II	710	24/08/00	16:30	CC		14	PS	14
Scarpellini, J. R.	2814	EFFECT OF THIAMETHOXAM ON NYMPHS OF WHITE FLY BEMISIA ARGENTIFOLII (HOMOPTERA: ALEYRODIDAE) ON TOMATO	II	710	24/08/00	16:30	CC		14	PS	14
Scarpellini, J. R.	2815	EFFECT OF THIAMETHOXAM ON SEED TREATMENT ON NYMPHS OF ENNEOTHRIPS FLAVENS (THYSANOPTERA: THRIPIDAE) ON PEANUTS	II	711	24/08/00	16:30	CC		14	PS	14
Scarpellini, J. R.	2816	EFFECT OF THIAMETHOXAM ON NYMPHS OF WHITE FLY BEMISIA ARGENTIFOLII (HOMOPTERA: ALEYRODIDAE) IN SUMMER SQUASH	II	711	24/08/00	16:30	CC		14	PS	14
Scarpellini, J. R.	2817	EFFECT OF THIAMETHOXAM AND DIAFENTHIURON ON NINPHS OF WHITE FLY BEMISIA ARGENTIFOLII (HOMOPTERA: ALEYRODIDAE) ON BEANS	II	711	25/08/00	16:30	CC		14	PS	14
Scarpellini, J. R.	2818	EFFECT OF THIAMETHOXAM AND DIAFENTHIURON IN THE CONTROL OF APHIDS MYZUS PERSICAE (HOMOPTERA: APHYDIDAE) AND THRIPS FRANLINIELLA SCHULTZEI (THYSANOPTERA: THRIPIDAE) ON TOMATO	II	711	25/08/00	16:30	CC		14	PS	14
Scarpellini, J. R.	2819	CHEMICAL CONTROL OF BOWL WEEVIL ANTHONOMUS GRANDIS (COLEOPTERA: CURCULIONIDAE) AND ALABAMA ARGILLACEA (LEPIDOPTERA: NOCTUIDAE)	II	712	25/08/00	16:30	CC		14	PS	14
Scataglini, M. A.	2241	ORIGIN AND DISPERSAL OF THE COTTON BOLL WEEVIL (COLEOPTERA: CURCULIONIDAE) IN SOUTH AMERICA: A mtDNA PHYLOGEOGRAPHIC STUDY	I	566	21/08/00	16:30	CC		12	PS	12
Schaefer, C. W.	437	HETEROPTERA	I	111	25/08/00	11:20	HB	C	3	7	3
Schaefer, C. W.	2603	WHY AND HOW HETEROPTERANS ARE DIFFERENT AS PESTS	II	658	26/08/00	9:35	HB	B	14	9	14
Schaefer, C. W.	2820	WHY AND HOW HETEROPTERANS ARE DIFFERENT AS PESTS	II	712	24/08/00	16:30	CC		14	PS	14
Schaefer, C. W.	3835	THE CLASSIFICATION AND DISTRIBUTION OF HYDARINAE (HEMIPTERA: COREIDAE), AND THE SYSTEMATIC POSITION OF THE GENUS HAIDARA DISTANT	II	968	25/08/00	16:30	CC		21	PS	21
Schaefer, C. W.	3836	THE SUBFAMILIAL PLACEMENT OF THE INDIAN GENUS LINSICOSTEUS (HEMIPTERA: REDUVIIDAE: TRIATOMINAE	II	968	25/08/00	16:30	CC		21	PS	21
Schaefer, C. W.	3837	PHYLOGENY AND THE CONTROL OF PESTS ON NEW CROPS IN THE TROPICS	II	968	25/08/00	16:30	CC		21	PS	21
Schaefer, T.	2483	THE DESIGN AND APPLICATION OF AN ACTIGRAPH TO STUDY THE CIRCADIAN RHYTHM OF THE DUMP FLY, HYDROTAEA AENESCENS	II	627	24/08/00	16:30	CC		13	PS	13
Schaeffer, V.	3073	BICOID AS A PHYLOGENETIC ADDITION TO THE INSECT BODY PLAN	II	775	24/08/00	14:00	HB	G	16	6	16
Schaffner, U.	1597	HOST SELECTION CUES OF A POTENTIAL BIOLOGICAL CONTROL AGENT FOR THE LILY LEAF BEETLE, LILIOCERIS LILII	I	403	23/08/00	16:30	CC		8	PS	8
Schal, C.	600	SYNTHESIS OF HYDROCARBONS AND SEX PHEROMONES AND THEIR TRANSPORT THROUGH THE HEMOLYMPH IN INSECTS	I	152	23/08/00	10:50	Bol	S	4	4	4
Schal, C.	599	ENDOCRINE REGULATION AND MECHANISM OF HYDROCARBON PHEROMONE PRODUCTION IN THE HOUSEFLY, MUSCA DOMESTICA	I	152	23/08/00	10:35	Bol	S	4	4	4
Schang, M. M.	3838	DESCRIPTION OF THE FIVE INSTARS OF DYSDERCUS RUFICOLLIS (HETEROPTERA: PYRRHOCORIDAE)	II	969	25/08/00	16:30	CC		21	PS	21
Schapaugh, W.	254	SOYBEAN STEM BORER IN KANSAS: LIFE HISTORY, SAMPLING, AND SEVERITY OF RECENT INFESTATIONS	I	65	23/08/00	16:30	CC		2	PS	2
Scharf, M. E.	160	INSECTICIDE RESISTANCE IN THE WESTERN CORN ROOTWORM: IMPLICATIONS TO CURRENT AND FUTURE MANAGEMENT STRATEGIES	I	41	26/08/00	14:35	HB	A	2	11	2
Scheffer, S. J.	2314	INVASION GENETICS OF THE PEA LEAFMINER LIRIOMYZA HUIDOBRENSIS (DIPTERA: AGROMYZIDAE): CRYPTIC SPECIES AND GEOGRAPHIC ORIGINS OF PEST POPULATIONS	I	584	24/08/00	16:30	CC		12	PS	12
Scheffer, S. J.	3839	MOLECULAR SYSTEMATICS OF FERGUSONINA SPP. (DIPTERA: FERGUSONINIDAE): HOST SPECIFICITY, HOST-USE EVOLUTION, AND IMPLICATIONS FOR BIOCONTROL OF MELALEUCA QUINQUENERVA IN THE FLORIDA EVERGLADES	II	969	25/08/00	16:30	CC		21	PS	21
Scheibler, E. E.	3603	VARIATIONS IN GROUND-DWELLING ARTHROPOD COMMUNITIES IN GRAZED AND PROTECTED AREAS IN THE DESERT OF MENDOZA (ARGENTINA)	II	909	23/08/00	16:30	CC		20	PS	20
Schenker,R.	4090	CYTOTOXICITY OF LUFENURON IN UNHATCHED LARVAE OF THE CAT FLEA CTENOCEPHALIDES FELIS	II	1033	23/08/00	16:30	CC		23	PS	23
Scherkenbeck, J.	1793	VARIABILITY IN THE BEHAVIOURAL RESPONSE OF THE ONION FLY TO N-DIPROPYL DISULFIDE	I	452	24/08/00	16:30	CC		9	PS	9
Schermack, V. M.	1964	OCCURRENCE OF WOOD BORING BEETLES IN THE NATIONAL FOREST MÁRIO XAVIER, RJ, BRASIL	I	495	21/08/00	16:30	CC		10	PS	10
Schermack, V. M.	1965	WOOD BORING BEETLES IN PLANTATION OF SAPUCAIA, LECYTHIS PISONIS (LECYTHIDACEAE), IN THE NATIONAL FOREST MÁRIO XAVIER, SEROPÉDICA, RJ, BRASIL	I	495	24/08/00	16:30	CC		10	PS	10
Schiavetto, M.	2837	INFLUENCE OF PHOSPHORUS GRADES IN DIFFERENT VARIETIES OF CORN (ZEA MAYS) ON THE FALL ARMYWORM (SPODOPTERA FRUGIPERDA) GROWTH	II	716	25/08/00	16:30	CC		14	PS	14
Schiestl, F.	627	IDENTIFICATION OF FEMALE AND MALE SEX PHEROMONES IN THE SOLITARY BEE OSMIA RUFA (HYMENOPTERA: MEGACHILIDAE)	I	159	21/08/00	16:30	CC		4	PS	4
Schiestl, F. P.	725	POLLINATOR ATTRACTION BY PHEROMONE-MIMICKING VOLATILES IN AUSTRALIAN AND EUROPEAN ORCHIDS	I	183	25/08/00	16:30	CC		4	PS	4
Schiff, N. M.	1151	HOST RECOGNITION IN XIPHYDRIID WOODWASPS.	I	290	24/08/00	16:30	CC		6	PS	6
Schiller, L. J.	2512	PALATABILITY OF BAIT MATRICES AND MATRIX/TOXICANT COMBINATIONS TO IRIDOMYRMEX PURPUREUS AND LRUFONIGER GP SP. (HYMENOPTERA: FORMICIDAE)	II	634	25/08/00	16:30	CC		13	PS	13
Schilman, P. E.	1796	THE ENERGETICS OF NECTAR FEEDING IN THE ANT CAMPONOTUS RUFIPES	I	452	24/08/00	16:30	CC		9	PS	9
Schimidt, F. G. V.	299	BIONOMY OF THE BOLL WEVILL REARED ON ARTIFICIAL DIET	I	76	24/08/00	16:30	CC		2	PS	2
Schiøtt, M.	2340	REVERSED PHARMACOLOGY IN INSECTS: FINDING NOVEL ORPHAN G PROTEIN-COUPLED RECEPTORS AND THEIR LIGANDS	II	591	21/08/00	10:55	HB	I	13	1	13
Schlack, A.	2708	COMPARISONS OF INSECTICIDE EFFICACY AGAINST HELICOVERPA ARMIGERA IN CONVENTIONAL VERSUS TRANSGENIC COTTON	II	684	23/08/00	16:30	CC		14	PS	14
Schlein, Y.	3014	THE PLANT DIET OF SAND FLIES IS A MIXED BLESSING FOR THEIR LEISHMANIA PARASITES	II	760	24/08/00	16:30	CC		15	PS	15
Schlesinger, Y.	3259	TMOF BIOTECHNOLOGY: A NEW BIORATIONAL APPROACH TO CONTROL INSECTS WITH PEPTIDE HORMONES	II	823	21/08/00	15:30	HB	K	18	1	18

Sub-titles: (HB=Hotel Bourbon) - (HM=Hotel Mabu) - (CC=Convention Center) - (Bol=Foz Boulevard) - (PS=Poster Session) - (PL=Plenary Lecturer)

AUTHOR	N°	TITLE	Book	Page	Date	Time	Local	Room	Session	Symp	New Session
Schlichting, C. D.	2977	EMERGENCE OF A NEW NEOTROPICAL MALARIA VECTOR FACILITATED BY HUMAN MIGRATION AND CHANGES IN LAND USE	II	751	22/08/00	16:30	CC		15	PS	15
Schlinger, E. I.	451	BIOGEOGRAPHY AND RELATIONSHIPS OF AFROTROPICAL ACROCERIDAE (DIPTERA) TRUE ENDOPARASITOIDS OF SPIDERS	I	114	26/08/00	11:35	HB	C	3	9	3
Schlyter, F.	741	ANTENNAL AND BEHAVIORAL RESPONSES TO NONHOST ANGIOSPERM LEAF AND BARK VOLATILES BY CONIFER INSECT	I	187	25/08/00	16:30	CC		4	PS	4
Schlyter, F.	1966	NON-HOST SIGNALS INHIBITING FEEDING IN HYLOBIUS PINE WEEVILS: LABORATORY ASSAYS AND FIELD TESTS	I	495	24/08/00	16:30	CC		10	PS	10
Schmachtenberg, O.	2348	NITRIC OXIDE: AN UNCONVENTIONAL TRANSMITTER IN INSECT NERVOUS SYSTEMS	II	593	22/08/00	10:20	HB	I	13	3	13
Schmidt Capella, I. C.	3032	A HIGH JUVENILE HORMONE TITER IS REQUIRED FOR ORGANIZING THE ACTIN CYTOSKELETON AND PREVENTING CELL DEATH IN LARVAL OVARIES OF THE HONEY BEE, APIS MELLIFERA	II	765	21/08/00	10:15	HB	G	16	1	16
Schmidt, D. J.	132	ROLE OF SPIDERS IN GRAPE IPM	I	34	24/08/00	14:20	HB	A	2	8	2
Schmidt, E. D.	3092	TESTIS DIFFERENTIATION - ROLE OF APICAL COMPLEX	II	780	26/08/00	10:00	HB	G	16	9	16
Schmidt, F. B.	338	BASELINE SUSCEPTIBILITY OF SPODOPTERA FRUGIPERDA (LEPIDOPTERA: NOCTUIDAE) POPULATIONS TO LUFENURON IN BRAZIL	I	86	25/08/00	16:30	CC		2	PS	2
Schmidt, F. B.	1375	BASES FOR AN INSECTICIDE RESISTANCE MANAGEMENT OF SPODOPTERA FRUGIPERDA IN CORN IN BRAZIL	I	347	24/08/00	16:30	CC		7	PS	7
Schmidt, F. G. V.	2093	FIELD TRIAL WITH THE ENTOMOPATHOGENIC FUNGUS METARHIZIUM ANISOPLIAE VAR. ACRIDUM AGAINST BANDS OF THE GRASSHOPPER RHAMMATOCERUS SCHISTOCERCOIDES IN BRAZIL	I	528	23/08/00	16:30	CC		11	PS	11
Schmidt, J. O.	1797	THIRTEEN HOUR COURTSHIP IN VINEGAROONS: A PRESCRIPTION FOR FEMALE CHOICE AND MALE INVESTMENT	I	453	24/08/00	16:30	CC		9	PS	9
Schmidt, J. O.	3546	USE OF CHEMICAL COMMUNICATION TO CONTROL AFRICANIZED HONEY BEES IN URBAN ENVIRONMENTS	II	895	25/08/00	16:30	CC		19	PS	19
Schmidt, S.	104	IPM OF BEMISIA TABACI IN AUSTRALASIA	I	27	22/08/00	15:30	HB	A	2	4	2
Schmidt-Ott, U.	3072	EVOLUTION OF THE BICOID GENE IN DIPTERAN INSECTS	II	775	24/08/00	13:30	HB	G	16	6	16
Schmit, J-P.	3963	INSECTICIDAL EFFECTS OF THUJA OCCIDENTALIS (CUPRESSACEAE) ESSENTIAL OIL ON CALLOSOBRUCHUS MACULATUS [COLEOPTERA: BRUCHIDAE]	II	1000	22/08/00	16:30	CC		22	PS	22
Schmitt, D.	2786	USE AND IMPACT OF MATING DISRUPTION IN COMMERCIAL PEACH INTEGRATED CROP MANAGEMENT PROGRAMS IN NEW JERSEY, USA	II	703	24/08/00	16:30	CC		14	PS	14
Schmitz, A.	3088	COMPARATIVE MORPHOLOGY OF THE SPIRACLES OF THE PAPILIONIDAE, SPHINGIDAE, AND SATURNIIDAE (INSECTA: LEPIDOPTERA)	II	779	25/08/00	15:05	HB	G	16	8	16
Schmitz, H.	3053	ANTENNAL SMOKE DETECTORS COMBINED WITH THORACIC INFRARED PIT ORGANS GUIDE BUPRESTID BEETLES OF THE GENUS MELANOPHILA TO FOREST FIRES	II	770	22/08/00	15:35	HB	G	16	3	16
Schmitz, H.	736	A NEW AUTOMATIC BIOASSAY TO TEST THE ATTRACTION OF HOST STIMULI IN CRAWLING INSECTS	I	186	25/08/00	16:30	CC		4	PS	4
Schmitzova, J.	2322	FROM GENE OF HONEY BEE (APIS MELLIFERA) TO MOLECULAR PROPERTIES AND FUNCTION OF MAJOR PROTEINS OF ROYAL JELLY	I	586	25/08/00	16:30	CC		12	PS	12
Schmutzler, K.	3999	ECOLOGICAL STUDIES ACCOMPANYING THE CULTIVATION OF TRANSGENIC RAPE AND MAIZE IN THURINGIA (GERMANY)	II	1009	25/08/00	16:30	CC		22	PS	22
Schnee, M. E.	1222	MODE OF ACTION OF INDOXACARB IN PEST INSECTS AND IMPLICATIONS FOR CONTROL	I	309	21/08/00	9:35	HM	N	7	1	7
Schneider, M. O.	3547	OBSERVATIONS ON BROOD CARE BEHAVIOR OF THE LEAF-CUTTING ANT ATTA SEXDENS (HYMENOPTERA: FORMICIDAE)	II	895	25/08/00	16:30	CC		19	PS	19
Schneider, P.	3015	LOCAL POPULATION DYNAMICS OF ANOPHELES MOSQUITOES AND MALARIA TRANSMISSION IN WESTERN KENYA	II	761	24/08/00	16:30	CC		15	PS	15
Schnell, R. J.	2256	EXPLORING THE MITOCHONDRIAL GENOME OF ANASTREPHA SUSPENSA	I	569	22/08/00	16:30	CC		12	PS	12
Schoeller, M.	4014	FECUNDITY AND HOST FINDING ABILITY OF LARIOPHAGUS DISTINGUENDUS (HYMENOPTERA: PTEROMALIDAE), A POTENTIAL CANDIDATE TO CONTROL THE GRANARY WEEVIL SITOPHILUS GRANARIUS (COLEOPTERA: CURCULIONIDAE)	II	1014	22/08/00	9:35	HB	J	23	3	23
Schoeman, A. S.	233	OVO-LARVICIDAL EFFECTS OF LUFENURON TO POTATO TUBER MOTH, PHTHORIMAEA OPERCULELLA (ZELLER) (LEPIDOPTERA: GELECHIIDAE)	I	59	22/08/00	16:30	CC		2	PS	2
Schoereder, J. H.	1701	HYMENOPTERAN NATURAL ENEMIES IN A EUCALYPTUS PLANTATION IN IPABA, STATE OF MINAS GERAIS, BRAZIL	I	429	21/08/00	16:30	CC		8	PS	8
Schoereder, J. H.	365	SCARABAEIDAE S. STR. (COLEOPTERA: SCARABAEOIDEA) FROM VIÇOSA, MINAS GERAIS STATE, BRAZIL	I	92	25/08/00	16:30	CC		2	PS	2
Schofield, C. J.	2992	HYDROCARBONS OF THE CHAGAS DISEASE VECTOR RHODNIUS PROLIXUS	II	755	23/08/00	16:30	CC		15	PS	15
Schöller, M.	4017	BIOLOGICAL CONTROL OF EPHESTIA ELUTELLA IN BULK GRAIN	II	1014	22/08/00	10:15	HB	J	23	3	23
Scholten, J.	3076	PROXIMAL-DISTAL PATTERNING IN TRIBOLIUM CASTANEUM, AN INSECT WITH EMBRYONIC LIMB FORMATION	II	776	24/08/00	15:30	HB	G	16	6	16
Scholtz, C. H.	3670	THE EVOLUTION OF HABITAT USE AND DIET IN THE SCARABAEOIDEA: A PHYLOGENETIC APPROACH	II	927	24/08/00	14:20	HB	E	21	7	21
Scholtz, C. H.	3497	A NATIONAL PERSPECTIVE OF FOREST TREE PESTS IN SOUTH AFRICA	II	883	23/08/00	16:30	CC		19	PS	19
Schöning, M. J.	2499	INSECT ANTENNAE AS BIOSENSORS	II	631	24/08/00	16:30	CC		13	PS	13
Schöning, M. J.	3054	INSECT ANTENNAE AS A BASIS OF EARLY WARNING SYSTEMS IN AGRICULTURE AND INDUSTRY	II	771	22/08/00	16:05	HB	G	16	3	16
Schoofs, L.	3250	TESTIS ECDYSIOTROPIN, AN INSECT GONADOTROPIN THAT INDUCES SYNTHESIS OF ECDYSTEROID	II	821	21/08/00	9:50	HB	K	18	1	18
Schoofs, L.	3258	NEUROPEPTIDES IN LOCUSTS: PROGRESS IN THE SEARCH FOR FUNCTIONS	II	823	21/08/00	15:00	HB	K	18	1	18
Schoofs, L.	3249	MALE-FEMALE DIFFERENCES IN NEUROPEPTIDE PROFILES IN LOCUSTS	II	821	21/08/00	9:35	HB	K	18	1	18
Schowalter, T. D.	1875	CONNECTION BETWEEN THE FLORA AND LEPIDOPTERA FAUNA OF AMERICAN NORTHWEST FORESTS	I	473	25/08/00	14:05	HB	M	10	8	10
Schowalter, T. D.	3585	SEASONAL AND DISTURBANCE-INDUCED VARIATION IN CANOPY INVERTEBRATE COMMUNITIES IN NEOTROPICAL RAIN FORESTS	II	905	24/08/00	15:30	Bol	U	20	2	20
Schraag, R.	300	PROSPECTS FOR BIOLOGICAL CONTROL OF THE WHITEFLY BEMISIA TABACI WITH PHYTOSEIID PREDATORS	I	76	24/08/00	16:30	CC		2	PS	2
Schramm, G.	2433	FUNCTION-SPECIFIC TRANSCRIPTION IN THE NERVOUS SYSTEM AND SENSE ORGANS OF INSECTS	II	615	22/08/00	16:30	CC		13	PS	13
Schreiber, S. J.	1650	COEVOLUTION OF CONTRARY CHOICES IN HOST-PARASITOID SYSTEMS	I	416	24/08/00	16:30	CC		8	PS	8
Schreiner, R.	3608	SPATIAL AND TEMPORAL VARIATION OF EFFLAGITATUS FREUDEI (HETEROCERIDAE) POPULATIONS AT THE SUPRALITTORAL OF RONDINHA SANDY BEACH, RS, BRAZIL, BETWEEN AUTUMN AND SPRING	II	910	25/08/00	16:30	CC		20	PS	20
Schroeder, A.	872	THE MIGRATORY LOCUST IN AFRICA	I	220	26/08/00	10:50	HB	D	6	9	6
Schroeder, A.	3943	THE ROLE OF ENVIRONMENTAL POLICY AND PROCEDURES IN MITIGATING IMPACTS OF ACRIDID CONTROL IN SAHELIAN AFRICA	II	995	21/08/00	16:30	CC		22	PS	22
Schroeder, A. C.	339	CHANGING POLICIES AND PRIORITIES: THE EVOLUTION OF LOCUST MANAGEMENT PRACTICES FOR AFRICA	I	86	25/08/00	16:30	CC		2	PS	2
Schroeder, H. E.	3989	RESPONSE OF TRANSGENIC PEAS CONTAINING A SEED SPECIFIC ALPHA-AMYLASE INHIBITOR GENE TO HEAT AND WATER STRESSES	II	1007	24/08/00	16:30	CC		22	PS	22
Schroeder, M.	1152	ATTACK DYNAMICS OF THE SPRUCE BARK BEETLE IPS TYPOGRAPHUS IN STANDS WITH AND WITHOUT REMOVAL OF WINDTHROWN TREES AFTER A STORM FELLING	I	290	24/08/00	16:30	CC		6	PS	6
Schroth, P.	2499	INSECT ANTENNAE AS BIOSENSORS	II	631	24/08/00	16:30	CC		13	PS	13

Sub-titles: (HB=Hotel Bourbon) - (HM=Hotel Mabu) - (CC=Convention Center) - (Bol=Foz Boulevard) - (PS=Poster Session) - (PL=Plenary Lecturer)

AUTHOR	N°	TITLE	Book	Page	Date	Time	Local	Room	Session	Symp	New Session
Schroth, P.	3054	INSECT ANTENNAE AS A BASIS OF EARLY WARNING SYSTEMS IN AGRICULTURE AND INDUSTRY	II	771	22/08/00	16:05	HB	G	16	3	16
Schubiger, M.	2522	POSSIBLE MOLECULAR STRATEGIES THAT UNDERLIE THE EVOLUTION OF METAMORPHIC DEVELOPMENT	II	637	25/08/00	16:30	CC		13	PS	13
Schubiger, M.	3296	POSSIBLE MOLECULAR STRATEGIES THAT UNDERLIE THE EVOLUTION OF METAMORPHIC DEVELOPMENT	II	832	25/08/00	14:35	HB	K	18	6	18
Schuermann, F.	1224	MODE OF ACTION OF THIAMETHOXAM, A NOVEL LIGAND OF NICOTINIC ACETYLCHOLINE RECEPTORS – A COMPARATIVE STUDY OF NEONICOTINOIDS AND INSECTS	I	309	21/08/00	10:35	HM	N	7	1	7
Schuermann, F.	1226	PYMETROZINE, A SELECTIVE FEEDING INHIBITOR FOR SUCKING INSECTS. ACTS THROUGH A NOVEL MECHANISM	I	310	21/08/00	11:35	HM	N	7	1	7
Schuh, R. T.	3630	FAMILY-GROUP RELATIONSHIPS WITHIN THE CIMICOMORPHA BASED ON DNA SEQUENCES AND MORPHOLOGY	II	917	22/08/00	10:20	HB	E	21	3	21
Schuler, T. H.	1243	INTERACTIONS BETWEEN TRANSGENIC OILSEED RAPE AND PARASITOIDS	I	314	23/08/00	10:20	HM	N	7	5	7
Schuler, T. H.	1418	TRANSGENIC INSECT RESISTANT PLANTS AND NATURAL ENEMIES	I	358	21/08/00	9:50	HM	O	8	1	8
Schultz, T. R.	3425	THE ORIGIN AND EVOLUTION OF FUNGUS-GROWING: CLUES FROM THE PHYLOGENY OF THE FUNGUS-GROWING ANTS	II	865	23/08/00	9:35	HM	Q	19	4	19
Schultz, T. R.	3429	USURPERS AND MARAUDERS: THE SOCIAL PREDATOR MEGALOMYRMEX SP. NOV. (FORMICIDAE: SOLENOPSIDINI) PILLAGES BOTH GARDEN AND BROOD FROM FUNGUS-GROWING ANTS (ATTINI)	II	866	23/08/00	10:35	HM	Q	19	4	19
Schulze, C. H.	458	DIVERSITY OF PYRALOIDEA MOTHS ALONG A GRADIENT OF RAINFOREST DISTURBANCE IN NORTHERN BORNEO	I	116	26/08/00	15:05	HB	C	3	10	3
Schumaker, T. T. S.	3794	INVESTIGATION OF THE VALIDITY OF SPECIES STATUS OF IXODES DIDELPHIDIS (ACARI: IXODIDAE) USING THE SECOND INTERNAL TRANSCRIBED SPACER (ITS2) OF RIBOSOMAL DNA	II	958	23/08/00	16:30	CC		21	PS	21
Schütte, C.	1420	PLANTS CRY FOR HELP: DO PLANT BREEDERS AND BIOCONTROL COMPANIES LISTEN?	I	358	21/08/00	10:20	HM	O	8	1	8
Schütz, S.	2499	INSECT ANTENNAE AS BIOSENSORS	II	631	24/08/00	16:30	CC		13	PS	13
Schütz, S.	3054	INSECT ANTENNAE AS A BASIS OF EARLY WARNING SYSTEMS IN AGRICULTURE AND INDUSTRY	II	771	22/08/00	16:05	HB	G	16	3	16
Schütz, S.	3053	ANTENNAL SMOKE DETECTORS COMBINED WITH THORACIC INFRARED PIT ORGANS GUIDE BUPRESTID BEETLES OF THE GENUS MELANOPHILA TO FOREST FIRES	II	770	22/08/00	15:35	HB	G	16	3	16
Schwarz, M. P.	1041	SOCIAL EVOLUTION IN THRIPS: LACK OF REPRODUCTIVE SKEW IN A GALL FORMING THRIPS WITH 'SOLDIERS'	I	263	23/08/00	16:30	CC		6	PS	6
Schwarz, M. P.	3548	COMPLEXITY, NOT GROUP SIZE: A VERTEBRATE ANALOGUE IN THE LONG TERM SOCIAL EVOLUTION OF AUSTRALIAN ALLODAPINE BEES	II	895	25/08/00	16:30	CC		19	PS	19
Schwarz, M. P.	3471	INSURANCE AGAINST ORPHANING: A SOURCE OF FEMALE BIASED SEX ALLOCATION IN AN ALLODAPINE BEE	II	876	22/08/00	16:30	CC		19	PS	19
Schwarz, M. P.	3561	RIGHT-WING BEES? PHYLOGENETIC CONSERVATISM IN AUSTRALIAN ALLODAPINES AND IMPLICATIONS FOR SOCIAL EVOLUTION	II	898	25/08/00	16:30	CC		19	PS	19
Schwarz, M. P.	3729	MOLECULAR PHYLOGENY, ECOLOGY AND SOCIAL EVOLUTION IN ALLODAPINE BEES	II	941	21/08/00	16:30	CC		21	PS	21
Schweigmann, N.	3024	POTENTIAL GEOGRAPHIC RANGE OF AEDES ALBOPICTUS (DIPTERA: CULICIDAE) IN ARGENTINA	II	763	23/08/00	16:30	CC		15	PS	15
Schweigmann, N.	4086	ANALYSIS OF VARIATION OF SPECIFIC CHARACTERS OF CULEX (CULEX) IN TWO ENVIROMENTS AND DETECTION OF NEW SPECIES IN THE CITY OF BUENOS AIRES	II	1032	23/08/00	16:30	CC		23	PS	23
Schwertner, C. F.	3840	DESCRIPTION OF THE NYMPHS AND ADULT GENITALIA OF ACROSTERNUM (CHINAVIA) UBICUM (HETEROPTERA, PENTATOMIDAE)	II	969	25/08/00	16:30	CC		21	PS	21
Sciarretta , A.	4003	WHEAT KERNELS STATUS AND HOST SELECTION IN SOME STORED PRODUCT INSECTS	II	1011	21/08/00	10:00	HB	J	23	1	23
Scioscia, C. L.	2309	CYTOGENETIC HETEROGENEITY IN COMMON ARGENTINE HAPLOGINE SPIDERS	I	583	24/08/00	16:30	CC		12	PS	12
Scoble, M. J.	552	MUSEUM COLLECTIONS FOR ASSESSING INSECT BIODIVERSITY IN THE 21ST CENTURY: NEW METHODS AND TRADITIONAL ANALYSIS	I	140	25/08/00	16:30	CC		3	PS	3
Scoble, M.J.	376	NEW APPROACHES TO CREATING GLOBAL SPECIES DATABASES IN ENTOMOLOGY	I	96	21/08/00	9:35	HB	C	3	1	3
Scoble, M.J.	775	NEW APPROACHES TO CREATING GLOBAL SPECIES DATABASES IN ENTOMOLOGY	I	196	24/08/00	13:30	Bol	T	5	5	5
Scofield, A.	3248	SEROLOGY FOR BABESIA BOVIS IN HUMAN PATIENTS WITH LYME- LYKE DISEASE SYNDROME, SYPHILIS, SEPTICEMIA AND AUTOIMMUNE DISEASES	II	820	25/08/00	16:30	CC		17	PS	17
Scomparin, H. J.	30	SPACIAL AND TEMPORAL DISTRIBUTION OF CALACARUS HEVEAE ON RUBBER TREES IN BRAZIL	I	8	22/08/00	16:30	CC		1	PS	1
Scott, T.	2903	SPATIAL AND TEMPORAL HETEROGENEITY IN DENGUE VIRUS TRANSMISSION AND AEDES AEGYPTI POPULATION DENSITIES IN IQUITOS, PERU	II	733	23/08/00	14:35	Bol	R	15	6	15
Scott, T. W.	2887	FEEDING BEHAVIOR OF AEDES AEGYPTI AND DENGUE VIRUS TRANSMISSION	II	729	22/08/00	13:50	Bol	R	15	4	15
Scott, T. W.	2889	BIODEMOGRAPHIC AND EPIDEMIOLOGIC CONSEQUENCES OF MORTALITY IN THE YELLOW FEVER MOSQUITO	II	729	22/08/00	14:20	Bol	R	15	4	15
Seaman, M. T.	450	BIODIVERSITY MEASUREMENT: THE SOUTH AFRICAN GRASSLAND INSECT EXAMPLE	I	114	26/08/00	11:20	HB	C	3	9	3
Sebastiani, F.	2316	SPECIES DIAGNOSTIC DIFFERENCES IN RIBOSOMAL DNA INTERNAL TRANSCRIBED SPACER 2 FROM SEVEN CRYPTIC SPECIES OF THE CULICOIDES IMICOLA COMPLEX (DIPTERA: CERATOPOGONIDAE)	I	584	25/08/00	16:30	CC		12	PS	12
Sebastiani, F.	2315	FROM SEVEN CRYPTIC SPECIES OF THE CULICOIDES IMICOLA COMPLEX (DIPTERA: CERATOPOGONIDAE)	I	584	24/08/00	16:30	CC		12	PS	12
Sebastiani, F.	2230	POLYMORPHIC MICROSATELLITE MARKERS TO ASSESS THE GENETIC VARIABILITY IN THE MEDITERRANEAN FRUIT FLY, CERATITIS CAPITATA, SPECIES RANGE	I	563	21/08/00	16:30	CC		12	PS	12
Secher, T.	2341	STRATEGIES FOR FINDING NOVEL INSECT NEUROHORMONE RECEPTORS AND THEIR LIGANDS, USING THE POTENTIALS OF THE BERKELEY "DROSOPHILA GENOME PROJECT".	II	591	21/08/00	11:30	HB	I	13	1	13
Seem, R. C.	2581	INTERACTIONS BETWEEN MITES AND PLANT PATHOGENS AND IMPLICATIONS FOR BIOLOGICAL CONTROL IN GRAPES	II	652	24/08/00	10:35	HB	B	14	6	14
Seffrin, R. C. A. S.	340	SURVEY OF ARTHROPODS IN TWO SEEDING SYSTEMS OF SORGHUM (SORGHUM BICOLOR)	I	86	25/08/00	16:30	CC		2	PS	2
Segal, D.	2069	IMPROVEMENT OF INSECTICIDAL NEMATODES- A GENETIC APPROACH	I	522	22/08/00	16:30	CC		11	PS	11
Segraves, W. A.	3301	ECDYSTEROID-TRIGGERED REGULATORY HIERARCHIES IN INSECT REPRODUCTION	II	834	25/08/00	14:05	HB	K	18	7	18
Segura, D. F.	366	ASSESSING AREAS OF CLIMATIC STRESS FOR CERATITIS CAPITATA (DIPTERA: TEPHRITIDAE) IN ARGENTINA	I	93	25/08/00	16:30	CC		2	PS	2
Segura, M. O.	2977	EMERGENCE OF A NEW NEOTROPICAL MALARIA VECTOR FACILITATED BY HUMAN MIGRATION AND CHANGES IN LAND USE	II	751	22/08/00	16:30	CC		15	PS	15
Sehgal, A.	3270	PHOTIC ENTRAINMENT OF THE DROSOPHILA CIRCADIAN CLOCK	II	826	23/08/00	13:50	HB	K	18	3	18
Sehnal, F.	3422	SILK COMPOSITION IN LEPIDOPTERA	II	864	22/08/00	15:30	HM	Q	19	3	19
Seidel, C.	2348	NITRIC OXIDE: AN UNCONVENTIONAL TRANSMITTER IN INSECT NERVOUS SYSTEMS	II	593	22/08/00	10:20	HB	I	13	3	13

Sub-titles: (HB=Hotel Bourbon) - (HM=Hotel Mabu) - (CC=Convention Center) - (Boi=Foz Boulevard) - (PS=Poster Session) - (PL=Plenary Lecturer)

AUTHOR	Nº	TITLE	Book	Page	Date	Time	Local	Room	Session	Symp	New Session
Seifers, D. L.	1334	EFFECT OF WHEAT CURL MITE SOURCES ON TRANSMISSION OF HIGH PLAINS VIRUS	I	337	22/08/00	16:30	CC		7	PS	7
Seifert, K.	3340	A FACTOR FROM THE CRICKET TESTIS THAT INHIBITS OVARIAN ECDYSTEROID BIOSYNTHESIS	II	843	22/08/00	16:30	CC		18	PS	18
Seifulina, R. R.	1153	SPIDER COMMUNITY OF AGRICULTURAL ECOSYSTEMS IN CENTRAL AND SOUTH RUSSIA	I	291	25/08/00	16:30	CC		6	PS	6
Seifulina, R. R.	362	ALLOCATION OF ARTHROPODS IN WINTER WHEAT CROP AND AROUND IT	I	92	25/08/00	16:30	CC		2	PS	2
Sekihara, M.	3568	CONTROL OF THE MATING FLIGHT TIME OF HONEYBEES BY PHOTOPERIODIC TREATMENT WITHIN THE HIVE	II	900	25/08/00	16:30	CC		19	PS	19
Sekimizu, K.	2263	CONCENTRATED EXPRESSION OF THE GENES FOR PROTEINS INVOLVED IN CALCIUM SIGNALING IN THE MUSHROOM BODIES OF THE BRAIN OF THE WORKER HONEYBEE APIS MELLIFERA	I	571	22/08/00	16:30	CC		12	PS	12
Sekimizu, K.	3558	IDENTIFICATION AND CHARACTERIZATION OF A NOVEL GENE (KL-1), WHICH IS EXPRESSED PREFERENTIALLY IN LARGE TYPE KENYON CELLS OF THE HONEYBEE BRAIN	II	898	25/08/00	16:30	CC		19	PS	19
Sekimizu, K.	2448	CONCENTRATED EXPRESSION OF THE GENES FOR PROTEINS INVOLVED IN CALCIUM SIGNALING IN THE MUSHROOM BODIES OF THE BRAIN OF THE WORKER HONEYBEE APIS MELLIFERA	II	618	23/08/00	16:30	CC		13	PS	13
Sekimizu, K.	2336	IDENTIFICATION AND CHARACTERIZATION OF THE KS-1 GENE, WHICH IS EXPRESSED PREFERENTIALLY IN THE SMALL TYPE-KENYON CELLS OF THE HONEYBEE BRAIN	I	589	25/08/00	16:30	CC		12	PS	12
Sekutowski, D. G.	113	PARTICLE PROCESSING	I	29	23/08/00	13:35	HB	A	2	6	2
Selikhovkin, A. V.	1039	INCREASED INCIDENCE OF BOREAL FOREST PEST OUTBREAKS: HERALD OF GLOBAL CHANGE?	I	262	23/08/00	16:30	CC		6	PS	6
Selivon, D.	2193	GENETICAL AND MORPHOLOGICAL DIFFERENCES IN ANASTREPHA FRUIT FLIES: RACES OR SPECIES?	I	554	23/08/00	10:35	HB	L	12	5	12
Selivon, D.	2317	CHARACTERIZATION OF CRYPTIC SPECIES OF THE ANASTREPHA FRATERCULUS COMPLEX	I	585	25/08/00	16:30	CC		12	PS	12
Selivon, D.	3043	DEVELOPMENTAL RESTRICTIONS AND UNUSUAL MECHANISMS IN THE EMBRYOGENESIS OF THE FRUIT FLY ANASTREPHA	II	768	21/08/00	16:00	HB	G	16	1	16
Selivon, D.	3177	EARLY EMBRYOLOGY AND SEGMENTATION GENES EXPRESSION IN THE TEPHRITID FLY ANASTREPHA SP. 2 (DIPTERA: TEPHRITIDAE)	II	801	24/08/00	16:30	CC		16	PS	16
Sempruch, C.	2411	INTERACTION OF SOME PROTEINS ON BIOLOGY OF GRAIN APHID (SITOBION AVENAE /F./)	II	609	21/08/00	16:30	CC		13	PS	13
Sene, F. M.	2191	COMPLEX PATTERNS OF DIFFERENTIATION IN FRAGMENTED HABITATS	I	553	23/08/00	9:35	HB	L	12	5	12
Sene, F. M.	2236	MALE COURTSHIP SONG PATTERN OF THE DROSOPHILA SERIDO AND DROSOPHILA SP D (REPLETA GROUP) IN A HYBRID ZONE AREA	I	564	21/08/00	16:30	CC		12	PS	12
Sene, F. M.	2266	DROSOPHILA BUZZATII EVOLUTION IN BRAZIL REVISITED: HIGH SATELLITE DNA HOMOGENEITY AMONG POPULATIONS	I	572	22/08/00	16:30	CC		12	PS	12
Sene, F. M.	2290	STUDY OF HYBRID ZONE AMONG DROSOPHILA SERIDO AND DROSOPHILA SP D, SPECIES OF THE CLUSTER BUZZATII	I	578	23/08/00	16:30	CC		12	PS	12
Sene, F. M.	1055	DROSOPHILA FAUNA (DIPTERA, DROSOPHILIDAE) IN THREE XEROPHYTIC AREAS OF SÃO PAULO STATE (BRAZIL)	I	266	23/08/00	16:30	CC		6	PS	6
Sene, F. M.	1073	OCURRENCE AND FLUCTUATION IN POPULATION SIZE OF A RECENTLY INTRODUCED DROSOPHILIDAE SPECIES IN BRAZIL	I	271	23/08/00	16:30	CC		6	PS	6
Senn, R.	341	THIAMETHOXAM USED AS SEED TREATMENT (CRUISER/ADAGE®), OR AS SOIL APPLICATION (ACTARA/PLATINUM®)	I	86	25/08/00	16:30	CC		2	PS	2
Senn, R.	1269	THIAMETHOXAM: NEW INNOVATIVE APPLICATION OPPORTUNITIES FOR A SYSTEMIC PRODUCT	I	320	25/08/00	10:05	HM	N	7	9	7
Senn, R.	1279	PRO-ACTIVE RESISTANCE MANAGEMENT OF THIAMETHOXAM	I	323	25/08/00	14:50	HM	N	7	10	7
Senô, K. C. A.	1651	PREDATORS OF FRUIT FLY ANASTREPHA SPP (DIPTERA, TEPHRITIDAE) COLLECTED WITH PIT FALL TRAPS IN PSIDIUM GUAJAVA ORCHARDS UNDER REGULAR APPLICATION OF INSECTICIDE	I	416	24/08/00	16:30	CC		8	PS	8
Senô, K. C. A.	1524	ACARICIDES SELETIVITY EVALUATION ON CHRYSOPERLA EXTERNA (NEUROPTERA: CHRYSOPIDAE)	I	384	23/08/00	16:30	CC		8	PS	8
Senô, K. C. A.	1122	SURVEYS ON BEMISIA ARGENTIFOLII WITH STICK TRAPS IN COTTON CULTIVATIONS IN MIGUELÓPOLIS - S.P. - BRAZIL	I	283	24/08/00	16:30	CC		6	PS	6
SenthilKumar, N.	2287	MOLECULAR CHARACTERIZATION OF RICE BROWN PLANTHOPPER POPULATION	I	577	24/08/00	16:30	CC		12	PS	12
SenthilKumar, N.	3886	MOLECULAR CHARACTERIZATION OF RICE BROWN PLANTHOPPER POPULATION	II	981	22/08/00	15:05	HB	H	22	3	22
Seo, M. J.	1652	EFFECTIVE PRESERVATION METHODS OF THE ASIAN LADYBIRD, HARMONIA AXYRIDIS (COLEOPTERA: COCCINELLIDAE), AS APPLICATION STRATEGY FOR BIOLOGICAL CONTROL OF APHIDS	I	416	21/08/00	16:30	CC		8	PS	8
Seo, M. J.	2862	TOXICAL RESPONSES OF THE ASIAN LADYBIRDS, HARMONIA AXYRIDIS (COLEOPTERA: COCCINELLIDAE), AGAINST SEVERAL INSECTICIDES, ACARICIDES AND FUNGICIDES FOR INTEGRATED PEST MANAGEMENT OF APHIDS IN THE GREENHOUSES	II	722	23/08/00	16:30	CC		14	PS	14
Seo, S. J.	2491	OOCYTE RECEPTORS FOR THE SPECIFIC ACCUMULATION OF YOLK PROTEINS	II	629	24/08/00	16:30	CC		13	PS	13
Seo, S. J.	2445	COMPARATIVE ANALYSIS OF STORAGE PROTEIN GENE OF FALL WEBWORM, HYPHANTRIA CUNEA	II	618	22/08/00	16:30	CC		13	PS	13
Seo, S. J.	3305	OOCYTE RECEPTORS FOR THE SPECIFIC ACCUMULATION OF YOLK PROTEINS	II	835	25/08/00	16:05	HB	K	18	7	18
Seo, Y.-S.	2765	COTTON HOST PLANT RESISTANCE TO THE SILVERLEAF WHITEFLY TRANSMITTED COTTON LEAF CRUMPLE DISEASE	II	698	24/08/00	16:30	CC		14	PS	14
Sequeira, A. S.	3841	THE PHYLOGENESIS OF CONIFER/ ANGIOSPERM HOST SHIFT AND DIVERSIFICATION IN GONDWANAN BARK BEETLES	II	969	25/08/00	16:30	CC		21	PS	21
Sequeira, A. S.	3623	HIGHER PHYLOGENY OF THE CURCULIONIDAE: EVIDENCE FROM A MOLECULAR AND MORPHOLOGICAL STUDY	II	915	21/08/00	15:20	HB	E	21	2	21
Seraj, A. A.	342	COMPARISON OF CITRUS SPECIES AS HOSTS FOR CITRUS LEAF MINER PHYLLOCNISTIS CITRELLA (LEPIDOPTERA: GRACILLARIDAE)	I	87	25/08/00	16:30	CC		2	PS	2
Seraj, A. A.	343	EFFECTS OF SOME INSECTICIDS AND PETROLEUM SPRAY OILS ON THE CONTROL OF CITRUS LEAF MINER IN KHUZESTAN STATE AND REVIEW OF ITS IPM	I	87	25/08/00	16:30	CC		2	PS	2
Seraj, A. A.	344	STALKBORER DAMAGE AND ESTIMATION OF LOSSES CAUSED BY SESAMIA SPP. (LEPIDOPTERA: NOCTUIDAE) IN KHUZESTAN SUGARCANE INDUSTRY	I	87	25/08/00	16:30	CC		2	PS	2
Seraj, A. A.	345	USE OF PETROLEUM SPRAY OILS FOR CONTROL OF CITRUS LEAF MINER AND SAP-SUCKING PESTS OF CITRUS IN SOUTHERN IRAN	I	87	24/08/00	16:30	CC		2	PS	2
Seraj, A. A.	1395	INJECTION OF INSECTICIDES INTO TREE TRUNK FOR CONTROL OF CITRUS PESTS	I	352	23/08/00	16:30	CC		7	PS	7
Seraj, A. A.	2821	STUDY OF BIOLOGY, DAMAGE AND CULTURAL CONTROL OF CITRUS LEAF MINER IN KHUZESTAN STATE	II	712	22/08/00	16:30	CC		14	PS	14
Seraj, A. A.	3609	COMPARISON OF PLANT SPECIES AS HOST FOR CABBAGE LEAF MINER (SCAPTOMYZA FLAVA) (DIPTERA: DROSOPHILIDAE)	II	911	21/08/00	16:30	CC		20	PS	20
Serra, G.	346	BIOLOGY AND REPRODUCTIVE ASPECTS OF PIEZODORUS GUILDINII (HEMIPTERA: PENTATOMIDAE) UNDER LABORATORY CONDITIONS	I	88	25/08/00	16:30	CC		2	PS	2
Serra, G.	1702	EXPLORATION IN ARGENTINA FOR POTENTIAL BIOLOGICAL CONTROL AGENTS OF HELIOTROPIUM AMPLEXICAULE, AN INVASIVE WEED IN EASTERN AUSTRALIA	I	429	25/08/00	16:30	CC		8	PS	8

Sub-titles: (HB=Hotel Bourbon) - (HM=Hotel Mabu) - (CC=Convention Center) - (Bol=Foz Boulevard) - (PS=Poster Session) - (PL=Plenary Lecturer)

AUTHOR	N°	TITLE	Book	Page	Date	Time	Local	Room	Session	Symp	New Session
Serrano, A. R. M.	2304	PATTERNS OF rDNA LOCALIZATION IN TIGER BEETLES (COLEOPTERA: CICINDELIDAE)	I	581	24/08/00	16:30	CC		12	PS	12
Serrano, A. R. M.	952	PHYLOGEOGRAPHY AND ECOLOGICAL DIVERSIFICATION OF CICINDELA LUSITANICA (CICINDELIDAE: COLEOPTERA)	I	240	22/08/00	16:30	CC		6	PS	6
Serrano, A. R. M.	2500	NEW STRIDULATORY STRUCTURES IN A TIGER BEETLE (COLEOPTERA, CICINDELIDAE): MORPHOLOGY AND SOUND CHARACTERIZATION	II	631	24/08/00	16:30	CC		13	PS	13
Serrano, J.	3718	PHYLOGENETIC RELATIONSHIPS OF THE GENUS ZABRUS (COLEOPTERA, CARABIDAE) BASED ON MORPHOLOGICAL, KARYOTYPIC, AND MOLECULAR DATA	II	939	21/08/00	16:30	CC		21	PS	21
Serrano, M. S.	1653	EFFECT OF ANT TENDING ON BIOLOGICAL CONTROL OF THE PINK HIBISCUS MEALYBUG ON ST. CROIX, US VIRGIN ISLANDS	I	417	24/08/00	16:30	CC		8	PS	8
Serrão, J. E.	3156	A COMPARATIVE STUDY OF THE SPERMATHECA IN BEES (HYMENOPTERA, APOIDEA)	II	796	23/08/00	16:30	CC		16	PS	16
Serrão, J. E.	3170	A COMPARATIVE STUDY OF THE CARDIAC VALVE AND CARDIA IN CORBICULATED BEES (HYMENOPTERA, APINAE)	II	800	23/08/00	16:30	CC		16	PS	16
Serrão, J. E.	3184	MORPHOMETRIC ANALYSIS OF THE BRAIN IN THE CASTES OF ACROMYRMEX SUBTERRANEUS (HYMENOPTERA, FORMICIDAE) DURING THE POST-EMBRYONIC DEVELOPMENT	II	803	23/08/00	16:30	CC		16	PS	16
Serrão, J. E.	3532	DIGESTIBILITY OF POLLEN GRAINS COLLECTED BY HONEYBEE, APIS MELLIFERA (HYMENOPTERA, APINI), IN THE MICROREGION OF VIÇOSA, MG, BRAZIL	II	891	24/08/00	16:30	CC		19	PS	19
Serrão, J. E.	180	SUBLETHAL EFFECTS OF ABAMECTIN SUPPRESSING COLONIES OF THE LEAF-CUTTING ANT ACROMYRMEX SUBTERRANEUS SUBTERRANEUS	I	46	21/08/00	16:30	CC		2	PS	2
Serrão, J. E.	1293	EFFECTS OF IVERMECTIN ON THE FAT BODY MORPHOLOGY OF CULEX QUINQUEFASCIATUS LARVAE	I	326	21/08/00	16:30	CC		7	PS	7
Serrão, M.	1685	BIOLOGICAL CONTROL OF GONIPTERUS SCUTELLATUS (COLEOPTERA: CURCULIONIDAE) IN PORTUGAL	I	425	25/08/00	16:30	CC		8	PS	8
Seth, R. K.	1654	COMPATIBILITY OF ENTOMOPATHOGENIC NEMATODES AND F-1 STERILITY FOR MANAGING SPODOPTERA LITURA (LEPIDOPTERA, NOCTUIDAE) : PARASITOID RESPONSES AND HOST SUITABILITY	I	417	24/08/00	16:30	CC		8	PS	8
Seth, R. K.	3368	SPERM TRANSFER AND PRECEDENCE IN THE COMMON CUTWORM, SPODOPTERA LITURA: AN IMPORTANT FACTOR IN OPTIMIZATION OF F-1 STERILITY TECHNIQUE FOR PEST SUPPRESSION	II	850	21/08/00	16:30	CC		18	PS	18
Seth, R. K.	3369	ANTIREPRODUCTIVE EFFECTS OF THE ECDYSTEROID AGONISTS ON THE COMMON CUTWORM, SPODOPTERA LITURA	II	851	21/08/00	16:30	CC		18	PS	18
Settembrini, B. P.	2501	DISTRIBUTION OF FMRF-AMIDE LIKE IMMUNOREACTIVITY IN THE BRAIN OF TRIATOMA INFESTANS.	II	632	24/08/00	16:30	CC		13	PS	13
Settembrini, B. P.	2502	THE DISTRIBUTION OF NPY AND NPY-Y1 RECEPTOR LIKE IMMUNOREACTIVITIES IN THE BRAIN OF TRIATOMA INFESTANS.	II	632	24/08/00	16:30	CC		13	PS	13
Sewify, G.	492	WHITE FLIES FAUNA OF WILD PLANTS AND THEIR ABUNDANCE IN EGYPT	I	125	22/08/00	16:30	CC		3	PS	3
Sexton, S. B.	1128	THE BLACK LIGHT TRAP FOR MONITORING OF CODLING MOTH CYDIA POMONELLA (LEPIDOPTERA: TORTRICIDAE) IN POME FRUIT ORCHARD UNDER MATING DISRUPTION	I	284	24/08/00	16:30	CC		6	PS	6
Seybold, S. J.	602	MOLECULAR STUDIES ON THE ENDOCRINE REGULATION AND TISSUE LOCALIZATION OF DE NOVO MONOTERPENOID PHEROMONE COMPONENT BIOSYNTHESIS IN PINE BARK BEETLES	I	152	23/08/00	11:25	Bol	S	4	4	4
Seymour, S. M.	3256	FMRFAMIDE-LIKE MATERIAL IN THE EARWIG, EUBORELLIA ANNULIPES, AND ITS FUNCTIONAL SIGNIFICANCE	II	822	21/08/00	14:00	HB	K	18	1	18
Sforzi, A.	3842	CHECKLIST OF THE BRENTIDAE (INSECTA, COLEOPTERA, CURCULIONOIDEA) OF THE WORLD	II	970	25/08/00	16:30	CC		21	PS	21
Shaaya, E.	4056	CHANCES OF BOTANICAL CHEMICALS TO REPLACE CLASSICAL INSECTICIDES	II	1024	24/08/00	14:45	HB	J	23	9	23
Shafer, O.	2523	THE USE OF DROSOPHILA TO STUDY THE CONTROL PATHWAYS FOR EXOGENOUS AND ENDOGENOUS COMPONENTS OF THE ECDYSIS RHYTHM	II	637	25/08/00	16:30	CC		13	PS	13
Shafer, O.	3273	THE USE OF DROSOPHILA TO STUDY THE CONTROL PATHWAYS FOR EXOGENOUS AND ENDOGENOUS COMPONENTS OF THE ECDYSIS RHYTHM	II	827	23/08/00	14:50	HB	K	18	3	18
Shaltiel, L.	863	PLANT SPATIAL HETEROGENEITY AND HERBIVORE-ENEMY INTERACTIONS: THE UNDERLYING MECHANISMS WHEN THE ENEMY IS A PLANT-FEEDING OMNIVORE	I	218	25/08/00	14:35	HB	D	6	8	6
Shamsan, A. D.	885	LIFE HISTORY AND LIFE TABLES OF CITRUS LEAF MINERPHYLLOCNISTIS CITRELLA (LEPIDOPTERA:GRACILLARIIDAE)	I	224	21/08/00	16:30	CC		6	PS	6
Shanmugasundaram, P.	2286	MARKER-ASSISTED SELECTION AS A STRATEGY FOR SELECTING INSECT RESISTANT BREEDING LINES WITH IMPROVED EFFICIENCY	I	577	24/08/00	16:30	CC		12	PS	12
Shanmugasundaram, P.	2287	MOLECULAR CHARACTERIZATION OF RICE BROWN PLANTHOPPER POPULATION	I	577	24/08/00	16:30	CC		12	PS	12
Shanmugasundaram, P.	3886	MOLECULAR CHARACTERIZATION OF RICE BROWN PLANTHOPPER POPULATION	II	981	22/08/00	15:05	HB	H	22	3	22
Shanmugavelu, M.	2503	JUVENILE HORMONE ESTERASE BINDING PROTEINS IN MANDUCA SEXTA	II	632	24/08/00	16:30	CC		13	PS	13
Shanower, T. G.	803	BIOLOGICAL CONTROL OF WHEAT STEM SAWFLIES: PAST AND FUTURE	I	203	21/08/00	11:05	HB	D	6	1	6
Shao, L.	2390	THE MOSQUITO PERITROPHIC MATRIX	II	604	26/08/00	11:05	HB	I	13	10	13
Shapiro, D. I.	1579	PARASITISM AND PERSISTENCE IN THE FIELD OF ENTOMOPATHOGENIC NEMATODES AND OTHER NATURAL ENEMIES OF THE LARVAE DIAPREPES ABBREVIATUS (COLEOPTERA: CURCULIONIDAE).	I	398	23/08/00	16:30	CC		8	PS	8
Sharkey, M. J.	3686	PHYLOGENY OF THE HYMENOPTERA: A REVIEW OF THE SUPPORT FOR CURRENT HYPOTHESES	II	931	25/08/00	15:20	HB	E	21	8	21
Sharma, D. K.	785	HOW MIGRATION AFFECTS ECOLOGICAL DIVERSIFICATION OF APIS DORSATA POPULATION. AN APPROACH BY SELF-ORGANIZING MAPS PROCESSING	I	198	21/08/00	16:30	CC		5	PS	5
Sharma, P. D.	2085	BIOEFFICACY AND PERSISTENCE OF NPV AGAINST SPODOPTERA LITURA ON COTTON SPRAYED AT DIFFERENT TIMINGS OF THE DAY	I	526	23/08/00	16:30	CC		11	PS	11
Sharma, V. P.	3368	SPERM TRANSFER AND PRECEDENCE IN THE COMMON CUTWORM, SPODOPTERA LITURA: AN IMPORTANT FACTOR IN OPTIMIZATION OF F-1 STERILITY TECHNIQUE FOR PEST SUPPRESSION	II	850	21/08/00	16:30	CC		18	PS	18
Shatters Jr., R. G.	2146	IDENTIFICATION OF ENDOPHYTIC BACTERIA IN CITRUS WITH BIOCONTROL ACTIVITY AGAINST DIAPREPES ABBREVIATUS (COLEOPTERA: CURCULIONIDAE)	I	541	25/08/00	16:30	CC		11	PS	11
Shattuck, S. O.	790	SPECIES, SPECIMENS AND SOCIETY: CONTRIBUTIONS FROM BIOLOGICAL COLLECTIONS	I	199	23/08/00	16:30	CC		5	PS	5
Shaw, A.	1035	THE ROLE OF LEARNING AND MEMORY IN LEAF CUTTING ANT FORAGING ECOLOGY.	I	261	23/08/00	16:30	CC		6	PS	6
Shaw, S. R.	3760	CLADISTICS OF THE ALEIODES LINEAGE OF THE SUBFAMILY ROGADINAE (HYMENOPTERA: BRACONIDAE)	II	949	22/08/00	16:30	CC		21	PS	21
Shaw, S. R.	3862	A NEW SPECIES OF LEIOPHRON (HYMENOPTERA: BRACONIDAE) FROM ARGENTINA	II	975	25/08/00	16:30	CC		21	PS	21
Sheehan, K. A.	614	PHEROMONE TECHNOLOGIES FOR MANAGING DOUGLAS-FIR TUSSOCK MOTH IN WESTERN NORTH AMERICA	I	155	24/08/00	14:00	Bol	S	4	6	4
Shellie, K. C.	3903	POSTHARVEST INSECT CONTROL: TEMPERATURE AND CONTROLLED ATMOSPHERE TREATMENTS	II	985	24/08/00	10:05	HB	H	22	6	22

Sub-titles: (HB=Hotel Bourbon) - (HM=Hotel Mabu) - (CC=Convention Center) - (Bol=Foz Boulevard) - (PS=Poster Session) - (PL=Plenary Lecturer)

AUTHOR	Nº	TITLE	Book	Page	Date	Time	Local	Room	Session	Symp	New Session
Shelly, T. E.	1798	LEK ATTRACTIVENESS IN CERATITIS CAPITATA	I	453	24/08/00	16:30	CC		9	PS	9
Shelly, T. E.	3354	UTILIZATION OF SPECIFIC PLANT VOLATILES IN MATING STRATEGIES IN THE ORIENTAL FRUIT FLY AND MEDFLY	II	847	23/08/00	16:30	CC		18	PS	18
Shelton, A. M.	3895	BT AND THE TRANSGENICS' FUTURE IN IPM PROGRAMS-INTEGRATION AND RESISTANCE	II	983	24/08/00	14:30	HB	J	22	4	22
Shelton, A. M.	1316	RESPONSE OF PLUTELLA XYLOSTELLA (LEPIDOPTERA: PLUTELLIDAE) TO THE SELECTION WITH BACILLUS THURINGIENSIS	I	332	22/08/00	16:30	CC		7	PS	7
Shen, X.	599	ENDOCRINE REGULATION AND MECHANISM OF HYDROCARBON PHEROMONE PRODUCTION IN THE HOUSEFLY, MUSCA DOMESTICA	I	152	23/08/00	10:35	Bol	S	4	4	4
Sheppard, A. W.	1154	MODELLING THE POPULATION INTERACTIONS BETWEEN THE CROWN WEEVIL MOGULONES LARVATUS AND ITS HOST PLANT ECHIUM PLANTAGINEUM	I	291	25/08/00	16:30	CC		6	PS	6
Sheppard, A. W.	3913	ECOLOGICAL RISK-BENEFIT ASSESSMENT FOR BIOLOGICAL CONTROL INTRODUCTIONS: AN AUSTRALASIAN PERSPECTIVE	II	988	25/08/00	10:15	HB	H	22	7	22
Sheppard, D. C.	4118	HIGH PROTEIN, HIGH ENERGY FEED AND CHITIN PRODUCTION FROM MANURE AND FOOD WASTE BY INSECTS	II	1040	25/08/00	10:35	HM	Q	24	1	24
Sheppard, D. C.	1336	DIAZINON AND PYRETHROID RESISTANCE TO THE HORN FLY IN TEXAS	I	337	22/08/00	16:30	CC		7	PS	7
Sheppard, W. S.	2178	PHYLOGEOGRAPHY OF APIS MELLIFERA: SUBSPECIFIC DIVERSITY AND THE IMPLICATION FOR INTRODUCED POPULATIONS	I	550	22/08/00	10:05	HB	L	12	3	12
Sheppard, W. S.	2281	THE MEDITERRANEAN FRUIT FLY IN THE US: POPULATION STRUCTURE INFERRED FROM MITOCHONDRIAL DNA AND MICROSATELLITE ANALYSES	I	576	23/08/00	16:30	CC		12	PS	12
Sherratt, T. N.	1396	POPULATION DYNAMICS OF ODONATES IN AGRICULTURAL LANDSCAPES:A LARGE-SCALE ECOTOXICOLOGICAL PERSPECTIVE	I	352	22/08/00	9:35	HM	N	7	3	7
Sherwood, J. L.	3243	HOW AND WHY DO THRIPS TRANSMIT TOSPOVIRUSES, A CELLULAR APPROACH TO UNDERSTANDING	II	819	25/08/00	16:30	CC		17	PS	17
Shetty, N. J.	553	BIO-DIVERSITY OF MOSQUITOES IN THE RIVER CAUVERY BASIN, KARNATAKA STATE INDIA	I	140	25/08/00	16:30	CC		3	PS	3
Shi, B.	2822	A STUDY ON LIRIMYZA SATIVAE	II	712	25/08/00	16:30	CC		14	PS	14
Shi, G.	1693	RESOURCE PARTITIONING BY TWO ICHNEUMOND PARASITOID SPECIES (HYMENOPTERA) OF A LONGICORN PEST, OEMONA HIRTA (COLEOPTERA: CERAMBYCIDAE), IN NEW ZEALAND	I	427	25/08/00	16:30	CC		8	PS	8
Shiga, S.	3260	ANATOMY AND FUNCTIONS OF BRAIN NEUROSECRETORY NEURONS WITH REGARD TO REPRODUCTIVE DIAPAUSE IN PROTOPHORMIA TERRAENOVAE	II	823	21/08/00	16:00	HB	K	18	1	18
Shiga, S.	3327	THE EFFECTS OF EGG AND ADULT TEMPERATURES ON INDUCTION OF EMBRYONIC DIAPAUSE IN DIANEMOBIUS NIGROFASCIATUS (ORTHOPTERA: GRYLLIDAE)	II	840	21/08/00	16:30	CC		18	PS	18
Shigenobu, S.	2504	THE GENOME ORGANIZATION OF BUCHNERA, AN INTRACELLULAR BACTERIAL SYMBIONT OF APHIDS	II	632	24/08/00	16:30	CC		13	PS	13
Shiino, T.	3167	ISOLATION AND COMPARISON OF MARINER-LIKE SEQUENCES (MLSS) AMONG SOME LEPIDOPTERAN INSECTS AND INVERTEBRATES	II	799	24/08/00	16:30	CC		16	PS	16
Shim, M. H.	1155	INSECT COMMUNITY ON RUMEX OBTUSIFOLIUS AS A HOST PLANT	I	291	25/08/00	16:30	CC		6	PS	6
Shima, H.	1655	A MICRO-OVIPAROUS TACHINID PEXOPSIS PILOSA (DIPTERA: TACHINIDAE) PARASITIC ON SCARABAEID BEETLES IN JAPAN	I	417	24/08/00	16:30	CC		8	PS	8
Shima, S. N.	3529	MORPHOLOGICAL CASTE DIFFERENCES IN SYNOECA CYANEA (HYMENOPTERA, VESPIDAE, EPIPONINI), ACCORDING TO ONTOGENETIC DEVELOPMENT OF THE COLONIES WITH SPECIAL REFERENCES ON MULTIVARIATE ANALYSIS	II	890	24/08/00	16:30	CC		19	PS	19
Shimada, T.	3267	GENOMICS OF REPRODUCTION AND DIAPAUSE IN BOMBYX MORI	II	825	22/08/00	11:35	HB	K	18	2	18
Shimada, T.	3510	STRUCTURAL ANALYSIS OF THE Z CHROMOSOME IN BOMBYX MORI BY USING THE BAC LIBRARY	II	886	23/08/00	16:30	CC		19	PS	19
Shimada, T.	564	RELATION BETWEEN THE DIVERSITY OF CARABID BEETLES AND DEER, MICE, AND DWARF BAMBOO IN A DECLINING ALPINE FOREST	I	143	25/08/00	16:30	CC		3	PS	3
Shimada, T.	2305	CHARACTERIZATION OF GENOMIC GENE ENCODING KYNURENINE 3-MONOOXYGENASE IN THE SILKWORM BOMBYX MORI	I	582	24/08/00	16:30	CC		12	PS	12
Shimada, T.	3530	CHANGE OF GENE EXPRESSION PATTERN CAUSEDBY COMPOUND EYE METAMORPHOSIS OF BOMBYX MORI	II	891	24/08/00	16:30	CC		19	PS	19
Shimada, T.	2295	A HOMOLOGUE OF THE DROSOPHILA MELANOGASTER SEX- DETERMINING GENE DOUBLESEX IS TRANSCRIBED INTO SEX-SPECIFIC ISOFORMES IN THE SILKWORM, BOMBYX MORI	I	579	24/08/00	16:30	CC		12	PS	12
Shimada, T.	2324	SEX-SPECIFIC ALTERNATIVE SPLICING OF THE LEPIDOPTERAN HOMOLOGS OF THE DROSOPHILA MELANOGASTER SEX DETERMINING GENE DOUBLESEX	I	586	25/08/00	16:30	CC		12	PS	12
Shimada, T.	3266	BOMBYX EST DATABASE, SILKBASE, FOR GENOME ANALYSIS OF BOMBYX MORI	II	825	22/08/00	11:05	HB	K	18	2	18
Shimada, T.	3262	RECENT PROGRESS IN GENOMIC MAPPING IN BOMBYX MORI: WHERE SHOULD WE GO FROM HERE?	II	824	22/08/00	9:35	HB	K	18	2	18
Shimazaki, A.	2257	MORPHOLOGY AND GENETICS OF THE NEWLY DISCOVERED INTERSEX IN THE SILKWORM, BOMBYX MORI	I	570	22/08/00	16:30	CC		12	PS	12
Shimazaki, A.	2516	CDNA CLONING AND EXPRESSION ANALYSIS OF REL PROTEINS FROM BOMBYX MORI	II	635	25/08/00	16:30	CC		13	PS	13
Shimizu, I.	2429	POSSIBLE DIGESTIVE FUNCTION OF LYSOZYME IN A WOOD-FEEDING TERMITE, RETICULITERMES SPERATUS	II	614	22/08/00	16:30	CC		13	PS	13
Shimizu, K.	3265	RECENT PROGRESS IN THE TRANSGENESIS OF SILKWORM, BOMBYX MORI AND APPLICATION TO THE GENOME PROJECT	II	825	22/08/00	10:35	HB	K	18	2	18
Shimizu, T.	2101	DETECTION OF WOLBACHIA FROM ORIUS SP. IN JAPAN	I	530	23/08/00	16:30	CC		11	PS	11
Shimoda, M.	2318	RESTORATION OF CIRCADIAN BEHAVIORAL RHYTHM OF DROSOPHILA DOUBLE-TIME MUTANTS BY GENE TRANFE.	I	585	25/08/00	16:30	CC		12	PS	12
Shin, S. W.	2319	BIOCHEMICAL CHARACTERIZATION AND GENOMIC ORGANIZATION OF H. CUNEA LECTIN	I	585	25/08/00	16:30	CC		12	PS	12
Shin, S. W.	2116	ULTRASTRUCTURAL AND MOLECULAR IDENTIFICATION OF A WOLBACHIA ENDOSYMBIONT IN A SPIDER, NEPHILA CLAVATA.	I	534	24/08/00	16:30	CC		11	PS	11
Shinbo, H.	685	AMINO ACID SECRETION IN DIGESTIVE JUICE: COUNTERADAPTATION OF HERBIVOROUS INSECTS AGAINST PROTEIN-DENATURING ACTIVITY OF PLANT IRIDOID GLYCOSIDES ACTIVATED BY PLANT BETA-GLUCOSIDASE	I	173	23/08/00	16:30	CC		4	PS	4
Shingleton, A. W.	3549	ANT-TENDING INFLUENCES SOLDIER PRODUCTION IN A SOCIAL APHID	II	895	25/08/00	16:30	CC		19	PS	19
Shinoda, T.	2505	CHARACTERIZATION OF A RECOMBINANT INSECT CHITINASE AND A BACULOVIRUS CHITINASE	II	633	24/08/00	16:30	CC		13	PS	13
Shiotsuki, T.	3381	MOLECULAR CLONING OF JUVENILE HORMONE BINDING PROTEINS OF SILKWORM, BOMBYX MORI	II	854	25/08/00	16:30	CC		18	PS	18
Shipp, J. L.	1464	USING GREENHOUSE ENVIRONMENT TO AUGMENT BIOLOGICAL CONTROL	I	369	24/08/00	13:35	HM	O	8	7	8
Shiraishi, K.	4179	TASTE OF NOXIOUS LIPOPHILIC SUBSTANCES: AVERSIVE BEHAVIOR AND TASTE RESPONSE TO LIMONENE IN THE BLOWFLY, PHORMIA REGINA	II	1055	22/08/00	16:30	CC		Erratum	PS	13
Shorey, H. H.	3874	MATING DISRUPTION OF CAROB MOTH IN DATES.	II	978	21/08/00	14:00	HB	H	22	1	22
Shorrocks, B.	1780	AGREGGATION, CLUTCH SIZE AND OVIPOSITION BEHAVIOR IN DROSOPHILA PHALERATA	I	448	24/08/00	16:30	CC		9	PS	9
Shorthouse, J. D.	825	FACTORS INFLUENCING DISTRIBUTION AND ABUNDANCE OF DIPLOLEPIS (CYNIPIDAE) IN CANADA	I	209	23/08/00	9:35	HB	D	6	5	6
Shpitz, A.	680	OLFACTORY RESPONSES TO ISOAMYL ACETATE AND ADULTS OF THE LARGE MILKWEED BUGS (ONCOPELTUS FASCIATUS, HETEROPTERA:LYGAEIDAE) IN MALE AND FEMALE ANTENNAE OF THE SAME SPECIES	I	172	23/08/00	16:30	CC		4	PS	4
Shufran, K. A.	464	BIOTYPIC AND GENOTYPIC DIVERSITY OF GREENBUGS: HOST ADAPTED OR CULTIVAR SELECTED	I	118	21/08/00	16:30	CC		3	PS	3
Shufran, R. A.	374	CORN ROOTWORM AREAWIDE MANAGEMENT IN KANSAS	I	95	25/08/00	16:30	CC		2	PS	2

Sub-titles: (HB=Hotel Bourbon) - (HM=Hotel Mabu) - (CC=Convention Center) - (Bol=Foz Boulevard) - (PS=Poster Session) - (PL=Plenary Lecturer)

AUTHOR	N°	TITLE	Book	Page	Date	Time	Local	Room	Session	Symp	New Session
Shull, V. L.	2330	A MOLECULAR PHYLOGENY OF COLEOPTERA FROM 18S rRNA SEQUENCES	I	588	25/08/00	16:30	CC		12	PS	12
Shute, S. L.	3621	A PHYLOGENY OF THE WEEVIL MAJOR GROUPS: MORPHOLOGICAL AND MOLECULAR EVIDENCE.	II	914	21/08/00	14:50	HB	E	21	2	21
Siegfried, B. D.	1287	BT RESISTANCE SURVEILLANCE AND DETECTION IN MAJOR MAIZE INSECT PESTS	I	325	26/08/00	10:00	HM	N	7	11	7
Siegfried, B. D.	160	INSECTICIDE RESISTANCE IN THE WESTERN CORN ROOTWORM: IMPLICATIONS TO CURRENT AND FUTURE MANAGEMENT STRATEGIES	I	41	26/08/00	14:35	HB	A	2	11	2
Sierpinska, A.	2147	THE LONG-TERM EFFECT OF MICROSPORIDIA (NOSEMA SP., POLISH ISOLATE) ON THE GYPSY MOTH (LYMANTRIA DISPAR, LEPIDOPTERA: LYMANTRIIDAE) IN LABORATORY EXPERIMENTS	I	541	25/08/00	16:30	CC		11	PS	11
Sigsgaard, L.	1656	CONTROL OF PLANTHOPPERS AND LEAFHOPPERS IN RICE BY THE SPIDER ATYPENA FORMOSANA	I	417	24/08/00	16:30	CC		8	PS	8
Sills, C.	186	MORPHOLOGICAL, BIOLOGICAL ASPECTS AND DAMAGE OF TENTHECORIS BICOLOR DISTINTUS (HETEROPTERA: MIRIDAE): AN AMARILLIDACEAE AND ORQUIDACEAE PEST	I	48	21/08/00	16:30	CC		2	PS	2
Siloto, R.C.	1386	THIAMETHOXAM TO CONTROL CITRUS LEAFMINER IN TANGOR MURCOTT	I	350	24/08/00	16:30	CC		7	PS	7
Siloto, R. C.	1156	DISTRIBUTION OF SCAPTOCORIS CASTANEA (HEMIPTERA: CYDNIDAE) POPULATION IN THE SOIL IN FLORÍNEA COUNTY, STATE OF SÃO PAULO, BRAZIL	I	291	22/08/00	16:30	CC		6	PS	6
Siloto, R. C.	2148	EPIZOOTY OF NOMURAEA RILEYI IN SPODOPTERA FRUGIPERDA LARVAE IN THE CORN CROP, ZEA MAYS	I	542	25/08/00	16:30	CC		11	PS	11
Silva de Moraes, R. L. M.	3129	ULTRAMORPHOLOGY OF THE HYPOPHARYNGEAL GLANDS OF POLISTES VERSICOLOR (HYMENOPTERA; VESPIDAE)	II	789	22/08/00	16:30	CC		16	PS	16
Silva de Moraes, R. L. M.	3138	HISTOLOGICAL AND MORPHOMETRICAL ANALYSES ON MANDIBULAR GLANDS OF MONO- AND POLYGYNIC COLONY MELIPONA BICOLOR QUEENS	II	792	22/08/00	16:30	CC		16	PS	16
Silva de Moraes, R. L. M.	3182	SILK SYNTHESIS IN SALIVARY GLANDS OF APIS MELLIFERA (HYMENOPTERA: APIDAE) WORKERS AT THE END OF LARVAL DEVELOPMENT	II	803	24/08/00	16:30	CC		16	PS	16
Silva de Moraes, R. L. M.	3445	CYTOCHEMICAL AND HISTOPHYSICAL ASPECTS OF APIS MELLIFERA (HYMENOPTERA, APIDAE) WORKER VENOM GLAND SECRETION	II	870	21/08/00	16:30	CC		19	PS	19
Silva Jr, P. I.	2351	GOMESIN, AN ANTIMICROBIAL PEPTIDE OF THE SPIDER HEMOCYTES: SPECTRUM OF ACTIVITY AND cDNA CLONING	II	594	23/08/00	10:05	HB	I	13	4	13
Silva, K.	172	EFFICIENCY OF DIFFERENT INSECTICIDES IN THE CONTROL OF THRIPS, FRANKLINIELLA SCHULTZEI, IN LETTUCE	I	44	21/08/00	16:30	CC		2	PS	2
Silva, L. V. F.	2740	RESISTANCE OF STRAWBERRIES TO TETRANYCHUS URTICAE (ACARI: TETRANYCHIDAE)	II	692	23/08/00	16:30	CC		14	PS	14
Silva, T. R. B.	4153	SEASONAL FLUCTUATION OF SHEVTCHENKELLA PETIOLULA FERES AND PHYLLOCOPTRUTA SERINGUEIRAE FERES (ACARI: ERIOPHYIDAE) ON SEVEN CLONES OF RUBBER TREE (HEVEA BRASILIENSIS MUELL. ARG.)	II	1049	21/08/00	16:30	CC		Erratum	PS	6
Silva, A. A.	726	SAPONINS IN THREE ALFALFA (MEDICAGO SATIVA) VARIETIES AND THEIR RELATION TO APHID RESISTANCE	I	183	25/08/00	16:30	CC		4	PS	4
Silva, A. A. L. da	4108	MODELLING POPULATION GROWTH OF RHYZOPERTHA DOMINICA (COLEOPTERA: BOSTRICHIDAE) ON STORED WHEAT	II	1037	25/08/00	16:30	CC		23	PS	23
Silva, A. C.	347	CHEMICAL CONTROL OF "WHITE FLY", BEMISIA ARGENTIFOLII (HEMIPTERA: ALEYRODIDAE) WITH CALYPSO 480 SC (THIACLOPRID), CONFIDOR 700 GRDA (IMIDACLOPRID) E CONFIDOR 200SC (IMIDACLOPRID) IN PAPRIKA CROP, CAPSICUM ANNUUM	I	88	25/08/00	16:30	CC		2	PS	2
Silva, A. C.	348	CHEMICAL CONTROL OF "WHITE FLY", BEMISIA ARGENTIFOLII (HEMIPTERA: ALEYRODIDAE) WITH CALYPSO 480 SC (THIACLOPRID), CONFIDOR 700 GRDA (IMIDACLOPRID0) E CONFIDOR 200SC (IMIDACLOPRID) IN EGG PLANT CROP, SOLANUM MELONGENA	I	88	25/08/00	16:30	CC		2	PS	2
Silva, A. C.	2823	EFFICIENCY OF THE INSECTICIDE LAMBDACYHALOTHRIN 50 CS, 250 CS, 50 EC AND ASSOCIATE WITH CHLORPYRIFOS 480 BR, FOR THE CONTROL OF " LEAF MINER" LEUCOPTERA COFFEELLA, IN COFFEE CROP	II	713	24/08/00	16:30	CC		14	PS	14
Silva, A. C.	283	A DOSE RECOMENDATION AND AN EVALUATION OF THE EFFICIENCY OF THE FARM CHEMICAL CONFIDOR (IMIDACLOPRID) TO CONTROL MYZUS PERSICAE (HOMOPTERA: APHIDIDAE) IN THE POTATO CROP SOLANUM TUBEROSUM	I	72	23/08/00	16:30	CC		2	PS	2
Silva, A. C.	284	CHEMICAL CONTROL OF THIPS TABACI (THYSANOPTERA: THRIPIDAE) WITH INSECTICIDE CONFIDOR (IMIDACLOPRID), IN POTATO CROP, SOLANUM TUBEROSUM	I	72	23/08/00	16:30	CC		2	PS	2
Silva, A. C.	656	CHEMICAL CONTROL OF THE "LEAF MINER", LEUCOPTERA COFFEELLA (LEPIDOPTERA: LYONETIIDAE), WITH FURY 400 CE AND MARSHAL 400 SC IN COFFEE CROP, COFFEA ARABICA	I	166	22/08/00	16:30	CC		4	PS	4
Silva, A. C.	2806	CHEMICAL CONTROL OF "LEAF MINER", LEUCOPTERA COFFEELLA WITH BINFENTHRIN 100 CE LONELY AND ASSOCIATE WITH ANOTHERS INSECTICIDES, IN COFFEE CROP	II	708	24/08/00	16:30	CC		14	PS	14
Silva, A. C.	2807	CHEMICAL CONTROL OF "LITTLE FRUIT BORER", NEOLEUCINODES ELEGANTALLIS WITH LAMBDACYHALOTHRIN 50 CS AND 50 CE IN TOMATO CROP	II	709	24/08/00	16:30	CC		14	PS	14
Silva, A. C. da	2095	LARGE SCALE BACILLUS SPHAERICUS PRODUCTION	I	528	23/08/00	16:30	CC		11	PS	11
Silva, A. C. O.	2149	ENZYME PRODUCTION BY THE FUNGUS SYMBIOTIC WITH THE ANT MYCETAROTES PARALLELUS	I	542	25/08/00	16:30	CC		11	PS	11
Silva, A. F. da	3550	ANTIBIOTIC OLAQUINDOX AS ADDICTIVE IN THE FEEDING OF BOMBYX MORI (LEPIDOPTERA: BOMBYCIDAE)	II	896	25/08/00	16:30	CC		19	PS	19
Silva, A. F. da	3551	FEEDING OF BOMBYX MORI WITH ARTIFICIAL DIET AND ITS EFFECT ON THE LARVAL DEVELOPMENT AND THE SILK PRODUCTION	II	896	25/08/00	16:30	CC		19	PS	19
Silva, A. L. da	1140	THE OCCURENCE AND BIOLOGICAL ASPECTS OF THE JUMPING PLANT LICE (HOMOPTERA:PSYLIDAE) ON GUAVA PLANTS (PSIDIUM GUAYAVA) AND 'SOMBREIRO' TREES (VICTORIA FAIRCHILDIANA) IN THE STATE OF RIO DE JANEIRO, BRAZIL	I	287	23/08/00	16:30	CC		6	PS	6
Silva, A. L. da	225	EFFECT OF THE INSECT GROWTH REGULATOR DIFLUBENZURON ON REPRODUCTION OF EUSCHISTUS HEROS (FABR.) (HETEROPTERA: PENTATOMIDAE)	I	57	22/08/00	16:30	CC		2	PS	2
Silva, A. P. R. A.	4073	MODIFIED ATMOSPHERE IN BRAZILIAN GRAIN STORAGE	II	1028	22/08/00	16:30	CC		23	PS	23
Silva, A.C.	179	PERFORMANCE OF THE INSECTICIDES BUPROFEZIN 250, PYRIPROXIFEN 100 AND BUPROFEZIN 250 + ACEPHATE, IN CONTROL OF "WHITE FLY", BEMISIA ARGENTIFOLII, IN CABBAGE CROP	I	46	21/08/00	16:30	CC		2	PS	2
Silva, A.C.	1397	CONTROL OF "WHITE FLY", BEMISIA ARGENTIFOLII WITE THE INSECTICIDES THIACLOPRID 480 SC; IMIDACLOPRID 700 GRDA AND IMIDACLOPRID 200 SC, IN CUCUMBER PLANTATION	I	352	25/08/00	16:30	CC		7	PS	7
Silva, C. A. M.	1967	COMPOSITION OF SCOLYTIDAE (COLEOPTERA) IN THREE FOREST MACROHABITATS OF SERÓPÉDICA, RJ, BRASIL	I	496	24/08/00	16:30	CC		10	PS	10
Silva, C. A. M.	1968	ECOLOGY OF SCOLYTIDAE (COLEOPTERA) IN FORESTRY REMNANTS BELONGING TO CHAMPION Co. IN MOGI GUAÇU, SP, BRASIL	I	496	24/08/00	16:30	CC		10	PS	10
Silva, C. L. da	217	EFFECT OF PYRIPROXYFEN ON WHITEFLY (BEMISIA ARGENTIFOLII) EGGS, IN THE EGGPLANT (SOLANUM MELOGENA), IN FIELD CONDITIONS	I	55	22/08/00	16:30	CC		2	PS	2
Silva, C. L. da	2043	EFFECT OF BACILLUS THURINGIENSIS, SUBSP. AIZAWAI FOR THE CONTROL OF PLUTELLA XYLOSTELLA ON CAULIFLOWER, BRASSICA OLERACEA	I	515	21/08/00	16:30	CC		11	PS	11
Silva, C. P.	2506	OCCURRENCE OF ALPHA-GLUCOSIDASE AS A BIOCHEMICAL MARKER FOR PERIMICROVILLAR MEMBRANES IN HEMIPTERA AND THYSANOPTERA	II	633	24/08/00	16:30	CC		13	PS	13

Sub-titles: (HB=Hotel Bourbon) - (HM=Hotel Mabu) - (CC=Convention Center) - (Bol=Foz Boulevard) - (PS=Poster Session) - (PL=Plenary Lecturer)

AUTHOR	Nº	TITLE	Book	Page	Date	Time	Local	Room	Session	Symp	New Session
Silva, C. P.	2507	HEME GENERATION AND PROCESSING IN THE MIDGUT LUMEN AND ITS STORAGE IN THE EPITHELIAL CELLS OF THE RHODNIUS PROLIXUS (HEMIPTERA: REDUVIIDAE)	II	633	24/08/00	16:30	CC		13	PS	13
Silva, C. S. A.	2713	CAN THIAMETHOXAM BE ASSOCIATED TO STINKBUG PREDATOR PODISUS NIGRISPINUS NYMPHS IN A COTTON PEST MANAGEMENT PROGRAM ?	II	685	22/08/00	16:30	CC		14	PS	14
Silva, D. F.	1969	A POPULATION SURVEY OF PHLEBOTOMINAE IN REMAINDERS OF RAINFOREST IN NORTHEASTERN BRAZIL	I	496	24/08/00	16:30	CC		10	PS	10
Silva, D. F.	1970	USE OF ATTRACTANTS FOR SURVEYING DIPTERAN POPULATIONS IN A RAINFOREST AREA IN NORTHEASTERN BRAZIL	I	496	24/08/00	16:30	CC		10	PS	10
Silva, D. J. H. da	710	CONVENTIONAL SAMPLING PLAN FOR VECTORIAL INSECTS OF VIROSES, PREDATORS AND PARASITOIDS IN TOMATO	I	179	24/08/00	16:30	CC		4	PS	4
Silva, D. M. P. da	2150	BIOLOGIC CONTROL OF CULEX QUINQUEFASCIATUS IN CITIES FROM PERNAMBUCO STATE APPLYING BACILLUS SPHAERICUS	I	542	25/08/00	16:30	CC		11	PS	11
Silva, D. M. P. da	2095	LARGE SCALE BACILLUS SPHAERICUS PRODUCTION	I	528	23/08/00	16:30	CC		11	PS	11
Silva, E. A.	2739	ENVIRONMENT PROTECTION THROUGH RESISTANT POTATO: RESEARCH, EDUCATION AND DELIVERING INFORMATION IN BRAZIL	II	692	23/08/00	16:30	CC		14	PS	14
Silva, E. A. da	2734	FRUIT BAGGING FOR PROTECTION OF CUCUMBER AGAINST THE PICKLEWORM, DIAPHANIA HYALINATA	II	690	23/08/00	16:30	CC		14	PS	14
Silva, E. C. M.	3182	SILK SYNTHESIS IN SALIVARY GLANDS OF APIS MELLIFERA (HYMENOPTERA: APIDAE) WORKERS AT THE END OF LARVAL DEVELOPMENT	II	803	24/08/00	16:30	CC		16	PS	16
Silva, E. R.	1799	INDIVIDUAL MATERIAL COLLECTION AND FORAGING TRIP DURATION IN MISCHOCYTTARUS DREWSENI (HYMENOPTERA, VESPIDAE)	I	453	25/08/00	16:30	CC		9	PS	9
Silva, E. S.	1647	BIOLOGICAL ASPECTS OF EXOTIC PREDATOR CRYPTOLAEMUS MONTROUZIERI (COLEOPTERA: COCCINELLIDAE), REARED ON PLANOCOCCUS CITRI IN LABORATORY	I	415	24/08/00	16:30	CC		8	PS	8
Silva, E. S.	1657	EVALUATION OF THE PREDACIOUS CAPACITY OF CRYPTOLAEMUS MONTROUZIERI (COLEOPTERA: COCCINELLIDAE) IN ORTHEZIA PRAELONGA, PLANOCOCCUS CITRI AND DYSMICOCCUS BREVIPES	I	418	24/08/00	16:30	CC		8	PS	8
Silva, E. S.	3543	CONTROL OF UNDERGROUND TERMITES AMITERMES SP. (ISOPTERA: TERMITIDAE, TERMITINAE) ON PINEAPPLE CROP IN SEMIARID ZONE OF NORTHEAST BRAZIL	II	894	25/08/00	16:30	CC		19	PS	19
Silva, F. M.	1398	PATTERNS OF ANSWER OF THE ENTOMOFAUNA OF THE CANOPY OF THE BEAN PLANT TO THE IMIDACLOPRID APPLICATION	I	353	25/08/00	16:30	CC		7	PS	7
Silva, F. M. A.	2743	EVALUATION OF INDOXACARB FOR LEPIDOPTEROUS PESTS CONTROL ON VEGETABLES	II	693	22/08/00	16:30	CC		14	PS	14
Silva, F. R. da	2271	THE COMPLETE MITOCHONDRIAL GENOME OF THE PRIMARY SCREWWORM FLY COCHLIOMYIA HOMINIVORAX (DIPTERA: CALLIPHORIDAE)	I	573	22/08/00	16:30	CC		12	PS	12
Silva, G. B.	2138	ENTOMOPHTHORALEAN PATHOGENIC FUNGI (ZYGOMYCOTINA – ZYGOMYCETES) IN THE NATURAL CONTROL OF INSECTS – PROSPECTS IN THE SOUTH OF BAHIA, BRAZIL	I	539	24/08/00	16:30	CC		11	PS	11
Silva, G. J. R.	4096	EFFECT OF VEGETABLE OILS ON THE PREFERENCE FOR OVIPOSITION AND VIABILITY OF IMATURE PHASE OF CALLOSOBRUCHUS MACULATUS (COLEOPTERA: BRUCHIDAE) IN COWPEA GRAINS	II	1034	23/08/00	16:30	CC		23	PS	23
Silva, G.J. R.	1399	REPELLENCY OF VEGETABLE OILS ON ADULTS OF ZABROTES SUBFASCIATUS (COLEOPTERA: BRUCHIDAE) IN BEAN GRAINS	I	353	25/08/00	16:30	CC		7	PS	7
Silva, I. M. M. S.	727	CHARACTERIZATION OF TRICHOGRAMMA FEMALE VOLATILES LIKELY INVOLVED IN COURTSHIP BEHAVIOUR AND THEIR POTENTIAL USE IN TAXONOMY	I	184	25/08/00	16:30	CC		4	PS	4
Silva, J. A. P. da	3183	MORPHOLOGICAL STUDY OF THE ADULT OF MEIBOMEUS CYANIPENNIS (COLEOPTERA:BRUCHIDAE)	II	803	25/08/00	16:30	CC		16	PS	16
Silva, J. B. da	1138	MONITORING AND POPULATION DYNAMICS OF THE ENTOMO-WILDLIFE ASSOCIATED TO THE CULTIVATION OF COCONUT PALM (COCOS NUCIFERA) BY MEANS OF TRAPS MODEL C-47: I. – MUNICIPALITY OF ITAGUAÍ, STATE OF RIO DE JANEIRO, BRAZIL	I	287	24/08/00	16:30	CC		6	PS	6
Silva, J. B. da	1139	A SURVEY OF THE ENTOMO-WILDLIFE ASSOCIATED THE GUAVA ORCHARDS (PSIDIUM GUAYAVA) CULTUVAR OGAWA 2, WITH THE UTILIZATION OF LURING TRAP MODEL C-47 AND THE (BINOMIAL) 'PRESENCE-ABSENCE' SAMPLING METHOD, IN THE STATE OF RIO DE JANEIRO, BRAZIL	I	287	23/08/00	16:30	CC		6	PS	6
Silva, J. B. T.	2093	FIELD TRIAL WITH THE ENTOMOPATHOGENIC FUNGUS METARHIZIUM ANISOPLIAE VAR. ACRIDUM AGAINST BANDS OF THE GRASSHOPPER RHAMMATOCERUS SCHISTOCERCOIDES IN BRAZIL	I	528	23/08/00	16:30	CC		11	PS	11
Silva, J. G.	2281	THE MEDITERRANEAN FRUIT FLY IN THE US: POPULATION STRUCTURE INFERRED FROM MITOCHONDRIAL DNA AND MICROSATELLITE ANALYSES	I	576	23/08/00	16:30	CC		12	PS	12
Silva, J. L.	250	EFFICIENCY OF THE INSECTICIDE TEMIK 150 (ALDICARB) ON CONTROL OF SHARPSHOOTER VECTORS OF XYLELLA FASTIDIOSA ON CITRUS	I	64	22/08/00	16:30	CC		2	PS	2
Silva, J. L.	672	ATTRACTIVITY OF PROTEIN HIDROLISATE AND SUGARCANE MOLASSES ON ADULT FRUIT FLIES ANASTREPHA SP. AND CERATITIS CAPITATA (DIPTERA:TEPHRITIDAE) ON CITRUS ORCHARD	I	170	23/08/00	16:30	CC		4	PS	4
Silva, J. L.	249	EFFICIENCY OF THE INSECTICIDE ACTARA (THIAMETOXAN) ON CONTROL OF SHARPSHOOTER VECTORS OF XYLELLA FASTIDIOSA ON CITRUS	I	63	22/08/00	16:30	CC		2	PS	2
Silva, J. L.	251	EFFICIENCY OF THE INSECTICIDE WINNER (IMIDACLOPRID) ON CONTROL OF SOME CITRUS PESTS AND SELECTIVITY TO NATURAL ENEMIES	I	64	22/08/00	16:30	CC		2	PS	2
Silva, J. L. da	1675	TEN YEARS OF INTERNATIONAL EXCHANGE AND QUARANTINE OF BENEFICIAL ORGANISMS BY THE BRAZILIAN QUARANTINE LABORATORY FOR BIOLOGICAL CONTROL	I	422	25/08/00	16:30	CC		8	PS	8
Silva, J. L. da	1676	NON-SUITABILITY OF THE BRAZILIAN SUGARCANE BORER, DIATRAEA SACCHARALIS, (LEPIDOPTERA: PYRALIDAE) AS A HOST FOR PEDIOBIUS FURVUS (HYMENOPTERA: EULOPHIDAE)	I	422	25/08/00	16:30	CC		8	PS	8
Silva, J. R	2507	HEME GENERATION AND PROCESSING IN THE MIDGUT LUMEN AND ITS STORAGE IN THE EPITHELIAL CELLS OF THE RHODNIUS PROLIXUS (HEMIPTERA: REDUVIIDAE)	II	633	24/08/00	16:30	CC		13	PS	13
Silva, J. R.	2506	OCCURRENCE OF ALPHA-GLUCOSIDASE AS A BIOCHEMICAL MARKER FOR PERIMICROVILLAR MEMBRANES IN HEMIPTERA AND THYSANOPTERA	II	633	24/08/00	16:30	CC		13	PS	13
Silva, J. V.	2998	OCURRENCE OF AEDES ALBOPICTUS IN PORTO VELHO – RONDONIA – BRAZIL	II	756	23/08/00	16:30	CC		15	PS	15
Silva, K. L.	1658	PYRROLIZIDINE ALKALOIDS (PAS) ANTI-PREDATOR ACTIVITY AGAISNT INVERTEBRATE AND VERTEBRATE PREDATORS	I	418	24/08/00	16:30	CC		8	PS	8
Silva, L. C. B. da	2796	INSECTICIDES AND PLASTER USED FOR CONTROLLING BROWNY STINKBUG (SCAPTOCORIS CASTANEA) POPULATIONS IN CORN CROPS IN THE SOUTHWEST REGION OF GOIÁS	II	706	24/08/00	16:30	CC		14	PS	14
Silva, L. C. B. da	2797	EFFICIENCY OF INSECTICIDES AND GYPSUM IN THE CONTROL OF BROWN STINK BUGS (SCAPTOCORIS CASTANEA) IN CORN, IN THE SOUTHEAST OF THE STATE OF GOIÁS	II	706	24/08/00	16:30	CC		14	PS	14
Silva, L. M. S.	3232	OCCURRENCE OF SHARPSHOTER IN CITRUS ORCHARDS AFFECTED BY CVC IN NORTH COAST OF BAHIA AND SOUTH OF SERGIPE STATE, BRAZIL	II	816	23/08/00	16:30	CC		17	PS	17
Silva, M. A.	554	DIVERSITY OF HYMENOPTERA IN AREAS OF PRIMARY FOREST FRAGMENT, REGENERATION FOREST AND PASTURE AT THE SOUTHEAST OF ACRE, BRAZIL	I	140	25/08/00	16:30	CC		3	PS	3
Silva, M. A.	560	DIVERSITY OF COLEOPTERA IN A FOREST FRAGMENT, SECONDARY FOREST AND PASTURE IN THE SOUTHEAST OF ACRE , BRAZIL	I	142	25/08/00	16:30	CC		3	PS	3

Sub-titles: (HB=Hotel Bourbon) - (HM=Hotel Mabu) - (CC=Convention Center) - (Bol=Foz Boulevard) - (PS=Poster Session) - (PL=Plenary Lecturer)

AUTHOR	Nº	TITLE	Book	Page	Date	Time	Local	Room	Session	Symp	New Session
Silva, M. A. N da	2970	EFFECT OF CONSTANT TEMPERATURES ON THE DEVELOPMENT AND VIABILITY OFAEDES ALBOPICTUS IMMATURES STAGES, FROM REGISTRO (SÃO PAULO BRAZIL)	II	749	21/08/00	16:30	CC		15	PS	15
Silva, M. A. N da	2971	TERMICS EXIGENCY, LONGEVITY AND REPRODUCTIVE ASPECTS OF AEDES ALBOPICTUSAT LABORATORY CONDITIONS	II	750	21/08/00	16:30	CC		15	PS	15
Silva, M. A. N.	3008	ANTHROPOPHILIC BEHAVIOUR OF CULICIDAE DURING SUNSET INSIDE FOREST OF IGUAÇU REGIONAL PARK, PARANA STATE, BRAZIL	II	759	24/08/00	16:30	CC		15	PS	15
Silva, M. A. N.	3009	BITING ACTIVITY OF DIURNAL MOSQUITOES INSIDE FOREST OF IGUAÇU REGIONAL PARK, PARANA STATE, BRAZIL.	II	759	24/08/00	16:30	CC		15	PS	15
Silva, M. A. N.	3010	PRODUCTIVITY OF BREEDING ARTIFICIAL OF CULICIDAE, CAMPUS FEDERAL UNIVERSITY OF PARANA, PARANA STATE, BRAZIL	II	759	25/08/00	16:30	CC		15	PS	15
Silva, M. C. L. da	262	CONTROL OF DIABROTICA SPECIOSA (COLEOPTERA, CHRYSOMELIDAE) NA CULTURA DA BATATA	I	67	23/08/00	16:30	CC		2	PS	2
Silva, M. D. R.	188	CONTROL OF ORTHEZIA PRAELONGA IN WEST INDIAN CHERRY, MALPIGHIA GLABRA USING FORMULATIONS AND THREE APPLICATION METHODS OF THIAMETHOXAM	I	48	21/08/00	16:30	CC		2	PS	2
Silva, M. F. G. F.	1309	METANOLIC EXTRACTS FROM DIMORPHANDRA MOLLIS (BARBATIMÃO) AND THEIR ACTIVITY IN WORKERS OF APIS MELLIFERA	I	330	21/08/00	16:30	CC		7	PS	7
Silva, M. F. G. F. da	3433	GROWTH INHIBITION OF THE SYMBIOTIC FUNGUS OF ATTA SEXDENS, BY NATURAL PRODUCTS AND SYNTHETIC COMPOUNDS.	II	867	23/08/00	11:35	HM	Q	19	4	19
Silva, M. L. da	4148	POPULATIONAL DENSITY ADJUSTMENT TO FOOD PLANT RESOURCES IN LEPIDOPTERA: THE EVIDENCE OF CHLOSYNE LACINIA SAUNDERSI	II	1048	21/08/00	16:30	CC		Erratum	PS	6
Silva, M. R.	926	COMPARATIVE BIOLOGY OF URBANUS PROTEUS (LEPIDOPTERA: HESPERIIDAE) IN CENTROSEMA PUBESCENS, CLITORIA FAIRCHILDIANA, GLYCINE MAX AND PHASEOLUS VULGARIS (LEGUMINOSAE)	I	234	22/08/00	16:30	CC		6	PS	6
Silva, M. T. C.	2151	LARVAL PARASITOIDS AND PATHOGENS OF SPODOPTERA FRUGIPERDA (LEPIDOPTERA: NOCTUIDAE) IN FOUR CITIES IN PARAÍBA	I	542	25/08/00	16:30	CC		11	PS	11
Silva, N. M.	1072	GEOGRAPHIC DISTRIBUTION OF CUPUAÇU FRUIT BORER CONOTRACHELUS HUMEROPICTUS ON CUPUAÇU IN THE STATE OF AMAZONAS, BRAZIL	I	270	23/08/00	16:30	CC		6	PS	6
Silva, N. M.	1782	OVIPOSITION BEHAVIOR OF CONOTRACHELUS HUMEROPICTUS (COLEOPTERA: CURCULIONIDAE)	I	449	25/08/00	16:30	CC		9	PS	9
Silva, N. M.	1132	ASSOCIATION BETWEEN ANASTREPHA SPP (DIPTERA: TEPHRITIDAE) AND THEIR PARASITOIDS IN TWO SPECIES OF FRUIT IN AMAZONAS STATE, BRAZIL	I	285	24/08/00	16:30	CC		6	PS	6
Silva, N. M.	1131	POPULATION FLUCTUATION OF ANASTREPHA SPP (DIPTERA: TEPHRITIDAE) IN AMAZONAS STATE, BRAZIL	I	285	24/08/00	16:30	CC		6	PS	6
Silva, O. L.	1145	THE STUDY OF ABUNDANCE, BITING BEHAVIOR AND PARITY OF ANOPHELINE IN ENDEMIC MALARIA AREA IN PORTO VELHO – RONDONIA – BRAZIL	I	289	24/08/00	16:30	CC		6	PS	6
Silva, P. I.	4154	GOMESIN, AN ANTIMICROBIAL PEPTIDE OF THE SPIDER HEMOCYTES: SPECTRUM OF ACTIVITY AND cDNA CLONING	II	1049	21/08/00	16:30	CC		Erratum	PS	13
Silva, P. R. R	1158	DAMAGE CAUSED BY SNOUT BEETLES OF THE GENERA PANTOMORUS AND NAUPACTUS IN THE "TAHITI" TRUE LIME IN ARARUAMA CITY, RJ - BRAZIL	I	292	25/08/00	16:30	CC		6	PS	6
Silva, P. R. R.	1659	PARASITOIDS OF PHYLLOCNISTIS CITRELLA IN RIO DE JANEIRO STATE, BRASIL.	I	418	25/08/00	16:30	CC		8	PS	8
Silva, P. R. R.	237	PEST-INSECTS ASSOCIATED WITH CITRUS IN BOM JESUS DO ITABAPOANA, RJ, BRAZIL	I	60	22/08/00	16:30	CC		2	PS	2
Silva, P. R. R.	2645	CONTROL OF PHYLLOCNISTIS CITRELLA (LEPIDOPTERA, GRACILLARIIDAE) BY THIAMETHOXAM IN CITRUS IN ARARUAMA CITY–RJ	II	668	21/08/00	16:30	CC		14	PS	14
Silva, P. R. R.	2620	USE OF THIAMETHOXIAM IN THE OF CONTROL PINNASPIS ASPIDISTRAE (HOMOPTERA:STERNORHYNCHA) AND ITS ON THE POPULATION OF NATIVE PARASITOIDES IN CITRUS SPP., IN ARARUAMA CITY, RJ, BRAZIL	II	662	21/08/00	16:30	CC		14	PS	14
Silva, P. R. R.	2621	OCCURRENCE OF THE ENTOMOPATHOGENIC FUNGUS ASCHERSONIA SP. INFESTING SELENASPIDUS ARTICULATUS (HOMOPTERA: DIASPIDIDAE), IN THE STATE OF RIO DE JANEIRO, BRAZIL	II	662	21/08/00	16:30	CC		14	PS	14
Silva, P. R. R.	2824	EFFECT OF THIAMETHOXAM ON THE POPULATION OF COCCUS VIRIDIS (HOMOPTERA:COCCIDAE) IN CITURS PLANTS IN ARARUAMA CITY, RJ, BRAZIL	II	713	25/08/00	16:30	CC		14	PS	14
Silva, P. R. R.	2646	USE OF THIAMETHOXAM IN THE CONTROL DE SELENASPIDUS ARTICULATUS (HOMOPTERA:DIASPIDIDAE) AND EFFECT ON THE POPULATION OF THEIR NATIVE PREDATORS IN CITRUS IN SÃO VICENTE DE PAULO (ARARUAMA, RJ), BRAZIL	II	668	21/08/00	16:30	CC		14	PS	14
Silva, P. R. R.	2799	EFFECT OF NITROGENOUS AND POTASSIC FERTILIZATION ON THE POPULATION OF ALEUROTHRIXUS FLOCCOSUS (HOMOPTERA; ALEYRODIDAE), IN SWEET ORANGE (CITRUS SINENSIS), CULTIVAR "FOLHA MURCHA"	II	707	24/08/00	16:30	CC		14	PS	14
Silva, P. R. R.	1138	MONITORING AND POPULATION DYNAMICS OF THE ENTOMO-WILDLIFE ASSOCIATED TO THE CULTIVATION OF COCONUT PALM (COCOS NUCIFERA) BY MEANS OF TRAPS MODEL C-47; L – MUNICIPALITY OF ITAGUAÍ, STATE OF RIO DE JANEIRO, BRAZIL	I	287	24/08/00	16:30	CC		6	PS	6
Silva, P. S. L.	2614	EFFECT OF NITROGEN FERTILIZATION ON THE RESISTANCE OF CORN PLANTS TO THE ATTACK OF FALL ARMYWORM (LEPIDOPTERA: NOCTUIDAE)	II	660	21/08/00	16:30	CC		14	PS	14
Silva, R. A. da	1800	FEEDING PREFERENCE OF PHTHIA PICTA (HEMIPTERA: COREIDAE) BY FRUITS OF THREE CULTIVARS OF TOMATO	I	453	25/08/00	16:30	CC		9	PS	9
Silva, R. A. da	3370	BIOLOGY OF Phthia picta (HEMIPTERA: COREIDAE) IN THREE CULTIVARS OF TOMATO	II	851	25/08/00	16:30	CC		18	PS	18
Silva, R. A. da	1157	FEEDING TIME OF PHTHIA PICTA (HEMIPTERA: COREIDAE) IN DIFFERENTS AGES ON FRUITS OF TWO CULTIVARS OF TOMATO	I	292	25/08/00	16:30	CC		6	PS	6
Silva, R. A. da	3843	DESCRIPTION OF THE IMMATURE AND ADULT PHASES OF PHTHIA PICTA (HEMIPTERA: COREIDAE)	II	970	24/08/00	16:30	CC		21	PS	21
Silva, R. B.	1400	EFFECT OF A NEW FORMULATION OF LAMBDA-CYHALOTHRIN FOR THE CONTROL OF THE BOLL WEEVIL, ANTHONOMUS GRANDIS (COLEOPTERA: CURCULIONIDAE), IN COTTON	I	353	25/08/00	16:30	CC		7	PS	7
Silva, R. B.	338	BASELINE SUSCEPTIBILITY OF SPODOPTERA FRUGIPERDA (LEPIDOPTERA: NOCTUIDAE) POPULATIONS TO LUFENURON IN BRAZIL	I	86	25/08/00	16:30	CC		2	PS	2
Silva, R. B.	1375	BASES FOR AN INSECTICIDE RESISTANCE MANAGEMENT OF SPODOPTERA FRUGIPERDA IN CORN IN BRAZIL	I	347	24/08/00	16:30	CC		7	PS	7
Silva, R. B.	1379	STRATEGIES FOR THE USE OF THIAMETHOXAM ON THE MANAGEMENT OF THE APHID Aphis gossypii IN COTTON	I	348	24/08/00	16:30	CC		7	PS	7
Silva, R. F. da	1515	REMARKS ON THE SEXUAL RATIO OF THE CAMPOLETIS FLAVICINCTA IN LABORATORIAL REARING	I	382	21/08/00	16:30	CC		8	PS	8
Silva, R. F. P. da	349	EVALUATION OF THE THIAMETHOXAN IN THE CONTROL OF "RICE WATER WEEVIL" ORYZOPHAGUS ORYZAE (COLEOPTERA-CURCULIONIDAE)	I	88	25/08/00	16:30	CC		2	PS	2
Silva, R. F. P. da	1800	FEEDING PREFERENCE OF PHTHIA PICTA (HEMIPTERA: COREIDAE) BY FRUITS OF THREE CULTIVARS OF TOMATO	I	453	25/08/00	16:30	CC		9	PS	9
Silva, S. F.	2103	PATHOGENICITY OF NEW ISOLATES OF BACILLUS THURINGIENSIS AGAINST LEPIDOPTERAN AND DIPTERAN PESTS	I	530	23/08/00	16:30	CC		11	PS	11
Silva, S. F.	2102	A CULTURE COLLECTION OF BACILLUS THURINGIENSIS AND BACILLUS SPHAERICUS PATHOGENIC TO INSECTS	I	530	23/08/00	16:30	CC		11	PS	11
Silva, S. R.	2959	ANOPHELES GAMBIAE MIDGUT MICROVILLI: EFFECTS OF INDUCED IMMUNITY ON LONGEVITY, FERTILITY AND TRANSMISSION OF MALARIA	II	747	21/08/00	16:30	CC		15	PS	15
Silva, T. E. F. da	1971	SCOLYTIDAE ASSOCIATED EUCALYPTUS SPP. IN A FRAGMENT OF DECIDUAL SEASONAL FOREST	I	497	25/08/00	16:30	CC		10	PS	10

Sub-titles: (HB=Hotel Bourbon) - (HM=Hotel Mabu) - (CC=Convention Center) - (Bol=Foz Boulevard) - (PS=Poster Session) - (PL=Plenary Lecturer)

AUTHOR	Nº	TITLE	Book	Page	Date	Time	Local	Room	Session	Symp	New Session
Silva, V. E.	181	FRUIT FLIES OF THE GENUS ANASTREPHA IN THE FRUIT PRODUCING REGION OF MOSSORO/ASSU, RIO GRANDE DO NORTE, BRAZIL	I	46	21/08/00	16:30	CC		2	PS	2
Silva, V. E.	905	SURVEY AND IDENTIFICATION OF FRUIT FLY SPECIES IN THE REGION OF BAIXO JAGUARIBE, STATE OF CEARÁ, BRAZIL	I	229	21/08/00	16:30	CC		6	PS	6
Silva, V. S. G.	360	FIRST EVIDENCE OF COPTOTERMES HAVILANDI IN CAMPOS DOS GOYTACAZES (RJ), BRAZIL	I	91	25/08/00	16:30	CC		2	PS	2
Silva, W. C. J.	1121	BIOLOGY OF BEMISIA ARGENTIFOLII ON DRY BEAN (PHASEOLUS VULGARIS)	I	283	24/08/00	16:30	CC		6	PS	6
Silva, W. G. da	192	EFFECT OF DIFFERENT SEED TREATMENTS ON APHID APHIS GOSSYPII CONTROL VEGETATIVE DEVELOPMENT AND YIELD OF COTTON CROP	I	49	22/08/00	16:30	CC		2	PS	2
Silva, W. G. da	193	EFFECT OF DIFFERENT SEED TREATMENTS ON THRIPS FRANKLINIELLA SCHULTZEI CONTROL VEGETATIVE DEVELOPMENT AND YIELD OF COTTON CROP	I	49	22/08/00	16:30	CC		2	PS	2
Silva-Filha, M. H. N. L.	2117	SELECTION OF CULEX QUINQUEFASCIATUS POPULATION RESISTANT TO BACILLUS SPHAERICUS STRAIN 2362	I	534	24/08/00	16:30	CC		11	PS	11
Silva-Filho, R.	1659	PARASITOIDS OF PHYLLOCNISTIS CITRELLA IN RIO DE JANEIRO STATE, BRASIL	I	418	25/08/00	16:30	CC		8	PS	8
Silva-Filho, R.	1158	DAMAGE CAUSED BY SNOUT BEETLES OF THE GENERA PANTOMORUS AND NAUPACTUS IN THE "TAHITI" TRUE LIME IN ARARUAMA CITY, RJ - BRAZIL	I	292	25/08/00	16:30	CC		6	PS	6
Silva-Filho, R.	2824	EFFECT OF THIAMETHOXAM ON THE POPULATION OF COCCUS VIRIDIS (HOMOPTERA:COCCIDAE) IN CITURS PLANTS IN ARARUAMA CITY, RJ, BRAZIL	II	713	25/08/00	16:30	CC		14	PS	14
Silva-Filho, R.	1137	IDENTIFICATION OF THE SPATIAL DISTRIBUTION PATTERNS OF INSECT SPECIES BELONGING TO THE HOMNOPETRA-STERNORHYNCA COMPELX IN CITRUS PLANTS (CITRUS SPP.) IN THE STATE OF RIO DE JANEIRO THROUGH THE USE OF VARIOUS STATISTICAL AND MATHEMATICAL MODELS	I	287	24/08/00	16:30	CC		6	PS	6
Silva-Filho, R.	1140	THE OCCURENCE AND BIOLOGICAL ASPECTS OF THE JUMPING PLANT LICE (HOMOPTERA:PSYLIDAE) ON GUAVA PLANTS (PSIDIUM GUAYAVA) AND 'SOMBREIRO' TREES (VICTORIA FAIRCHILDIANA) IN THE STATE OF RIO DE JANEIRO, BRAZIL	I	287	23/08/00	16:30	CC		6	PS	6
Silva-Filho, R.	2620	USE OF THIAMETHOXIAM IN THE OF CONTROL PINNASPIS ASPIDISTRAE (HOMOPTERA:STERNORHYNCHA) AND ITS ON THE POPULATION OF NATIVE PARASITOIDES IN CITRUS SPP., IN ARARUAMA CITY, RJ, BRAZIL	II	662	21/08/00	16:30	CC		14	PS	14
Silva-Filho, R.	2621	OCCURRENCE OF THE ENTOMOPATHOGENIC FUNGUS ASCHERSONIA SP. INFESTING SELENASPIDUS ARTICULATUS (HOMOPTERA: DIASPIDIDAE), IN THE STATE OF RIO DE JANEIRO, BRAZIL	II	662	21/08/00	16:30	CC		14	PS	14
Silva-Filho, R.	1138	MONITORING AND POPULATION DYNAMICS OF THE ENTOMO-WILDLIFE ASSOCIATED TO THE CULTIVATION OF COCONUT PALM (COCOS NUCIFERA) BY MEANS OF TRAPS MODEL C-47: I. – MUNICIPALITY OF ITAGUAÍ, STATE OF RIO DE JANEIRO, BRAZIL	I	287	24/08/00	16:30	CC		6	PS	6
Silva-Filho, R.	2646	USE OF THIAMETHOXAM IN THE CONTROL DE SELENASPIDUS ARTICULATUS (HOMOPTERA:DIASPIDIDAE) AND EFFECT ON THE POPULATION OF THEIR NATIVE PREDATORS IN CITRUS IN SÃO VICENTE DE PAULO (ARARUAMA, RJ), BRAZIL	II	668	21/08/00	16:30	CC		14	PS	14
Silva-Filho, R.	2799	EFFECT OF NITROGENOUS AND POTASSIC FERTILIZATION ON THE POPULATION OF ALEUROTHRIXUS FLOCCOSUS (HOMOPTERA: ALEYRODIDAE), IN SWEET ORANGE (CITRUS SINENSIS), CULTIVAR "FOLHA MURCHA"	II	707	24/08/00	16:30	CC		14	PS	14
Silva-Filho, R.	1139	A SURVEY OF THE ENTOMO-WILDLIFE ASSOCIATED THE GUAVA ORCHARDS (PSIDIUM GUAYAVA) CULTUVAR OGAWA 2, WITH THE UTILIZATION OF LURING TRAP MODEL C-47 AND THE (BINOMIAL) 'PRESENCE-ABSENCE' SAMPLING METHOD, IN THE STATE OF RIO DE JANEIRO, BRAZIL	I	287	23/08/00	16:30	CC		6	PS	6
Silva-Filho, R.	2645	CONTROL OF PHYLLOCNISTIS CITRELLA (LEPIDOPTERA, GRACILLARIIDAE) BY THIAMETHOXAM IN CITRUS IN ARARUAMA CITY–RJ	II	668	21/08/00	16:30	CC		14	PS	14
Silva-Filho, R.	2800	EFFECT OF DIFFERENT LEVELS OF NITROGENOUS AND POTASSIC FERTILIZATION ON THE POPULATION OF COCCUS VIRIDIS (HOMOPTERA: COCCIDAE) IN SWEET ORANGE (CITRUS SINENSIS), CULTIVAR "FOLHA MURCHA"	II	707	24/08/00	16:30	CC		14	PS	14
Silva-Junior, J. C.	2320	CYTOGENETICS OF SOME SPECIES OF PARASITIC WASPS OF THE FAMILIES PTEROMALIDAE AND EULOPHIDAE	I	585	25/08/00	16:30	CC		12	PS	12
Silva-Werneck, J. O.	2152	CLONING AND HETEROLOGOUS EXPRESSION OF A BACILLUS THURINGIENSIS PROTEIN TOXIC AGAINST THE FALL ARMYWORM	I	543	25/08/00	16:30	CC		11	PS	11
Silva-Werneck, J. O.	2102	A CULTURE COLLECTION OF BACILLUS THURINGIENSIS AND BACILLUS SPHAERICUS PATHOGENIC TO INSECTS	I	530	23/08/00	16:30	CC		11	PS	11
Silva-Werneck, J. O.	2103	PATHOGENICITY OF NEW ISOLATES OF BACILLUS THURINGIENSIS AGAINST LEPIDOPTERAN AND DIPTERAN PESTS	I	530	23/08/00	16:30	CC		11	PS	11
Silveira Neto, S.	982	SURVEY OF INSECTS IN WEEDS DURING THE OFF-SEASON OF CORN CULTURE	I	248	22/08/00	16:30	CC		6	PS	6
Silveira Neto, S.	270	OCCURENCE OF THRIPS ON NIAGARA TABLE GRAPE AND ITS CONTROL WITH THE INSECTICIDES THIACLOPRID AND METHIOCARB ASSOCIATED WITH METARHIZIUM ANISOPLIAE	I	69	23/08/00	16:30	CC		2	PS	2
Silveira Neto, S.	1814	ENTOMOFAUNA AS A BIOINDICATOR OF THE IMPACTS OF SILVICULTURAL OPERATIONS	I	457	21/08/00	11:20	HB	M	10	I	10
Silveira, C. A.	1356	AGRONOMIC EFFICIENCY OF NEW MOLECULES FOR CONTROL OF THE FIELD BEAN WHITE FLY	I	342	23/08/00	16:30	CC		7	PS	7
Silveira, E. B.	2508	MORPHOLOGICAL CHARACTERIZATION OF LARVAL HAEMOCYTES FROM ANTICARSIA GEMMATALIS	II	633	24/08/00	16:30	CC		13	PS	13
Silveira, F. A.	3844	REVISION AND PHYLOGENY OF THE SPECIES OF EXOMALOPSIS (PHANOMALOPSIS) (HYMENOPTERA: APIDAE)	II	970	25/08/00	16:30	CC		21	PS	21
Silveira, L. E. B.	1533	SURVEY OF PARASITOIDS OF THE FALL ARMYWORM, SPODOPTERA FRUGIPERDA (LEPIDOPTERA: NOCTUIDAE), IN FERNANDÓPOLIS REGION, SÃO PAULO STATE, BRAZIL	I	387	22/08/00	16:30	CC		8	PS	8
Silveira, W. D.	3375	SECRETION OF SEXUAL ACCESSORY GLANDS OF FEMALE FLIES: SOME BIOCHEMICAL CHARACTERISTICS AND ANTIBACTERIAL ACTIVITY (DIPTERA, CALLIPHORIDAE, MUSCIDAE)	II	852	25/08/00	16:30	CC		18	PS	18
Silvestre, D.	2249	PHYLOGENETIC RELATIONSHIP AMONG STINGLESS BEE SPECIES INFERRED BY MITOCHONDRIAL DNA RESTRICTION FRAGMENT LENGTH POLYMORPHISM	I	568	21/08/00	16:30	CC		12	PS	12
Silvestre, R.	2169	INSECT GUILDS GUIDE THE EVOLUTION OF MIMETISM	I	548	21/08/00	10:05	HB	L	12	I	12
Simard, J.	658	PHYSIOLOGICAL REGULATION OF PHEROMONE PRODUCTION AND ITS INHIBITION FOLLOWING MATING IN CHORISTONEURA FUMIFERANA AND C. ROSACEANA (LEPIDOPTERA:TORTRICIDAE)	I	166	22/08/00	16:30	CC		4	PS	4
Simbiken, N.	2014	PATHOGENS OF TARO BEETLES AND THEIR POTENTIAL USE IN PEST MANAGEMENT IN THE SW PACIFIC	I	508	23/08/00	14:00	HM	P	11	S	11
Simiczyjew, B.	3036	THE OVARY STRUCTURE AND OOGENESIS IN MECOPTERANS	II	766	21/08/00	11:15	HB	G	16	I	16
Simiczyjew, B.	3371	HISTOLOGICAL AND ULTRASTRUCTURAL INVESTIGATIONS ON THE OVARY STRUCTURE AND OOGENESIS IN HANGING-FLIES (MECOPTERA: BITTACIDAE)	II	851	25/08/00	16:30	CC		18	PS	18
Simiczyjew, B.	3372	THE OVARIES OF NANNOCHORISTA NEOTROPICA (MECOPTERA: NANNOCHORISTIDAE) ARE PANOISTIC	II	851	25/08/00	16:30	CC		18	PS	18
Simmons, A. M.	350	WHITEFLIES (HOMOPTERA: ALEYRODIDAE) ON SPECIES OF MEDICINAL HERBAL PLANTS	I	89	25/08/00	16:30	CC		2	PS	2
Simmons, G.	3959	REVIEWING A MULTI-AGENCY BIOLOGICAL CONTROL PROGRAM FOR BEMISIA ARGENTIFOLII IN THE SOUTHWEST UNITED STATES: ESTABLISHING, CONSERVING & AUGMENTING NEW PARASITOIDS & EVALUATING THEIR IMPACT	II	999	22/08/00	16:30	CC		22	PS	22

Sub-titles: (HB=Hotel Bourbon) - (HM=Hotel Mabu) - (CC=Convention Center) - (Bol=Foz Boulevard) - (PS=Poster Session) - (PL=Plenary Lecturer)

AUTHOR	Nº	TITLE	Book	Page	Date	Time	Local	Room	Session	Symp	New Session
Simmons, L. W.	1713	LEK PARADOX RESOLVED: EMPIRICAL EVIDENCE FOR GENETIC VARIANCE IN CONDITION AND IN CONDITION DEPENDENCE	I	432	21/08/00	13:50	HB	F	9	1	9
Simmons, L. W.	1708	SINGING AND SCALES: VARIATION IN SEXUAL SIGNALS OF CRICKETS SUBJECT TO PHONOTACTIC PARASITOIDS	I	430	21/08/00	10:35	HB	F	9	1	9
Simmons, L. W.	1718	FITNESS BENEFITS OF SPERM COMPETITION FOR FEMALE FIELD CRICKETS	I	433	21/08/00	15:30	HB	F	9	1	9
Simões, Z. L. P.	3316	JUVENILE HORMONE PROMOTES VITELLOGENIN EXPRESSION IN POST-EMBRYONIC STAGES OF APIS MELLIFERA FEMALES	II	837	21/08/00	16:30	CC		18	PS	18
Simões, Z. L. P.	3377	HEXOKINASE ISOENZYME PATTERN IN THE DEVELOPMENT OF APIS MELLIFERA DRONES	II	853	25/08/00	16:30	CC		18	PS	18
Simões, Z. L. P.	3379	EFFECT OF MORPHOGENETIC HORMONES ON THE PROTEIN PROFILE OF TESTES, MUCUS GLANDS AND SEMINAL VESICLES OF APIS MELLIFERA DRONES	II	853	25/08/00	16:30	CC		18	PS	18
Simões, Z. L. P.	3378	CYTOSKELETON DYNAMICS DURING SPERMATOGENESIS IN APIS MELLIFERA DRONES	II	853	25/08/00	16:30	CC		18	PS	18
Simon, C.	3730	THE PHYLOGENY OF BASAL INSECTS: MOLECULAR AND MORPHOLOGICAL DATA COMPARED	II	942	21/08/00	16:30	CC		21	PS	21
Simón, J. C.	4077	PARSIMONY ANALYSIS OF ENDEMICITY AND ITS APPLICATION TO DETECT HIGH ENDEMISM AREAS USING COMBINED DATA FROM INSECTS, VERTEBRATES, AND PLANTS, FROM THE IBERIAN PENINSULA	II	1029	21/08/00	16:30	CC		23	PS	23
Simonet, G.	2321	THE 4-kDa PROTEASE INHIBITOR FAMILY IN THE DESERT LOCUST SCHISTOCERCA GREGARIA: MOLECULAR CLONING AND ANALYSIS OF TISSUE- AND STAGE-DEPENDENT EXPRESSION	I	586	23/08/00	16:30	CC		12	PS	12
Simonet, G.	2509	THE 4-KDA PROTEASE INHIBITOR FAMILY IN THE DESERT LOCUST SCHISTOCERCA GREGARIA: MOLECULAR CLONING AND ANALYSIS OF TISSUE- AND STAGE-DEPENDENT EXPRESSION	II	634	24/08/00	16:30	CC		13	PS	13
Simonet, G.	2259	MOLECULAR CLONING OF NEUROPARSIN PRECURSOR cDNAs IN THE DESERT LOCUST SCHISTOCERCA GREGARIA	I	570	22/08/00	16:30	CC		12	PS	12
Simonet, G.	2447	MOLECULAR CLONING OF NEUROPARSIN PRECURSOR CDNAS IN THE DESERT LOCUST SCHISTOCERCA GREGARIA	II	618	25/08/00	16:30	CC		13	PS	13
Simonet, G.	2528	INSECT G PROTEIN-COUPLED RECEPTORS AND SIGNAL TRANSDUCTION	II	638	25/08/00	16:30	CC		13	PS	13
Simonet, G.	2529	INSECT G PROTEIN-COUPLED RECEPTORS AND SIGNAL TRANSDUCTION	II	639	25/08/00	16:30	CC		13	PS	13
Simons, S. M.	1902	RELATIONSHIP BETWEEN TICKS AND SMALL WILD MAMMALS IN A DISTURBED ATLANTIC FOREST FRAGMENT IN ITAPEVI COUNTY, STATE OF SÃO PAULO, BRAZIL	I	479	21/08/00	16:30	CC		10	PS	10
Simpson, P.	3077	THE DEVELOPMENT AND EVOLUTION OF BRISTLE PATTERNS IN DIPTERA	II	776	24/08/00	16:00	HB	G	16	6	16
Simpson, S. J.	3897	EFFECTS OF GLOBAL CHANGE ON PLANTS, INDIVIDUAL INSECTS AND IMPLICATIONS FOR POPULATION MODELS	II	984	23/08/00	14:05	HB	H	22	5	22
Simpson-Brose, M.	3073	BICOID AS A PHYLOGENETIC ADDITION TO THE INSECT BODY PLAN	II	775	24/08/00	14:00	HB	G	16	6	16
Sims, M. A.	1251	PINK BOLLWORM RESISTANCE TO BT COTTON	I	316	23/08/00	15:05	HM	N	7	6	7
Simuth, J.	2322	FROM GENE OF HONEYBEE (APIS MELLIFERA) TO MOLECULAR PROPERTIES AND FUNCTION OF MAJOR PROTEINS OF ROYAL JELLY	I	586	25/08/00	16:30	CC		12	PS	12
Sinclair, B. J.	3660	A NEW PHYLOGENETIC CLASSIFICATION OF THE EMPIDOIDEA (DIPTERA: EREMONEURA)	II	924	24/08/00	10:20	HB	E	21	6	21
Sinden, R. E.	3017	VACCINE DELIVERY BY TRANSGENIC HAEMATOPHAGOUS INSECTS - A MODEL SYSTEM	II	761	25/08/00	16:30	CC		15	PS	15
Sing, S. E.	4016	ENHANCING THE BIOCONTROL OF BRUCHIDS INFESTING STORED LEGUMES THROUGH THE COMBINED APPLICATION OF A PREDATORY BUG AND LARVAL PARASITOIDS	II	1014	22/08/00	10:00	HB	J	23	3	23
Sing, S. E.	801	IMPACT OF CULTURAL PRACTICES ON POPULATIONS OF THE WHEAT STEM SAWFLY (HYMENOPTERA: CEPHIDAE) AND ITS ASSOCIATED PARASITOIDS	I	203	21/08/00	10:35	HB	D	6	1	6
Singh, A. K.	1080	FEEDING RESPONSES AND GROWTH OF HELICOVERPA ARMIGERA (LEPIDOPTERA: NOCTUIDAE) LARVAE MAINTAINED ON CHICKPEA, COWPEA, BLACKGRAM AND PIGEONPEA DIETS	I	272	23/08/00	16:30	CC		6	PS	6
Singh, A. K.	1159	ORIENTATIONAL RESPONSES OF HELICOVERPA ARMIGERA LARVAE TOWARDS LEAVES OF DIFFERENT LEGUMINOUS CROPS	I	292	25/08/00	16:30	CC		6	PS	6
Singh, A. K.	1160	BIOLOGICAL ATTRIBUTES OF SPOTTED STEM BORER, CHILO PARTELLUS FED ON MAIZE CULTIVARS	I	292	25/08/00	16:30	CC		6	PS	6
Singh, A. K.	1667	SYNOMONAL EFFECT OF CHICKPEA VARIETIES ON THE EGG PARASITOID TRICHOGRAMMA CHILONIS (TRICHOGRAMMATIDAE: HYMENOPTERA)	I	420	24/08/00	16:30	CC		8	PS	8
Singh, A. K.	3349	FEEDING RESPONSES AND GROWTH OF HELICOVERPA ARMIGERA (LEPIDOPTERA: NOCTUIDAE) LARVAE MAINTAINED ON CHICKPEA, COWPEA, BLACKGRAM AND PIGEONPEA DIETS	II	846	23/08/00	16:30	CC		18	PS	18
Singh, D.	1161	FURTHER OBSERVATIONS ON THE NOCTURNAL OVIPOSITION BEHAVIOR OF BLOW FLIES (DIPTERA: CALLIPHORIDAE)	I	293	25/08/00	16:30	CC		6	PS	6
Singh, J.	1280	DEVELOPMENT AND APPLICATION OF AN INSECTICIDE RESISTANCE IMPACT MINIMISATION STRATEGY FOR COTTON PEST CONTROL IN INDIA	I	323	25/08/00	15:05	HM	N	7	10	7
Singh, R. P.	2792	COMPATIBILITY OF NEEM PESTICIDES WITH PARASITOIDS – A REALISTIC APPROACH IN IPM	II	705	24/08/00	16:30	CC		14	PS	14
Singleton, A.	2755	HABITAT DIVERSITY: EFFECT ON POPULATION DENSITIES OF PREDATORY INSECTS OF HELICOVERPA SPP. IN COTTON IN AUSTRALIA	II	696	23/08/00	16:30	CC		14	PS	14
Singleton, A.	3979	IPM PROGRAM IN COTTON IN AUSTRALIA BASED ON BENEFICIAL INSECTS, STRIP-CROPPING AND PROVISION OF SUPPLEMENTARY FOOD	II	1004	24/08/00	16:30	CC		22	PS	22
Sinitsina, E. E.	3120	SENSORY ORGANS OF THE LABIUM AND ANTENNAE IN TERRESTRIAL AND WATER BUGS (HEMIPTERA)	II	787	21/08/00	16:30	CC		16	PS	16
Siqueira, C. G.	728	POLYSACCHARIDASES IN NESTS OF THE LEAF-CUTTING ANT ATTA SEXDENS	I	184	25/08/00	16:30	CC		4	PS	4
Siqueira, H. A. A.	1401	CARTAP RESISTANCE AND SYNERGISM IN POPULATIONS OF TUTA ABSOLUTA (LEPIDOPTERA: GELECHIIDAE)	I	353	25/08/00	16:30	CC		7	PS	7
Siqueira, H. A. A.	1402	INSECTICIDE RESISTANCE IN POPULATIONS OF TUTA ABSOLUTA (LEPIDOPTERA: GELECHIIDAE)	I	354	25/08/00	16:30	CC		7	PS	7
Siqueira, K. M. M.	1294	EFFECT OF CHEMICAL CONTROL OF BEMISIA ARGENTIFOLII (HEMIPTERA: ALEYRODIDAE) ON THE INCIDENCE OF BEAN GOLDEN MOSAIC VIRUS IN COMMON BEANS AND ITS YIELD	I	327	21/08/00	16:30	CC		7	PS	7
Siqueira, K. M. M.	2626	INTEGRATED MANAGEMENT OF THE APHID, APHIS GOSSYPII, IN INDIAN CHERRY TREE, IN IRRIGATED AREAS OF THE SÃO FRANCISCO VALLEY	II	663	22/08/00	16:30	CC		14	PS	14
Sirey, T.	580	PHEROMONE BINDING PROTEINS: STRUCTURAL, FUNCTIONAL AND GENETIC IMPERATIVES IN TORTRICID MOTHS	I	147	21/08/00	15:00	Bol	S	4	1	4
Siscaro, G.	1631	TEN YEARS OF STUDIES ON PARASITOIDS OF THE PEAR PSYLLA, CACOPSYLLA PYRI, IN SICILY (RHYNCHOTA PSYLLOIDEA)	I	411	24/08/00	16:30	CC		8	PS	8
Siscaro, G.	1487	STATUS OF BIOLOGICAL CONTROL OF THE CITRUS LEAFMINER (PHYLLOCNISTIS CITRELLA) IN ITALY	I	375	21/08/00	16:30	CC		8	PS	8
Sithanantham, S.	1544	SURVEY FOR NATIVE TRICHOGRAMMATID SPECIES IN KENYA	I	389	22/08/00	16:30	CC		8	PS	8
Sithanantham, S.	1660	EFFECT OF NEEM PRODUCTS APPLIED AS SPRAYS TO PARASITISED HOST EGGS ON ADULT EMERGENCE AND LONGEVITY OF TRICHOGRAMMA SP. NR. MWANZAI	I	418	25/08/00	16:30	CC		8	PS	8
Sithanantham, S.	2825	SURVEY OF PRACTICES AND PERCEPTIONS OF SMALL HOLDER FARMERS RELATING TO PEST MANAGEMENT ON VEGETABLE CROPS IN EASTERN AFRICA	II	713	23/08/00	16:30	CC		14	PS	14
Sithiprasasna, R.	3016	USE OF A GEOGRAPHICAL INFORMATION SYSTEM TO EVALUATE THE EFFICACY OF A LETHAL OVITRAP FOR THE CONTROL OF THE MOSQUITO VECTORS OF DENGUE IN THAILAND	II	761	25/08/00	16:30	CC		15	PS	15

Sub-titles: (HB=Hotel Bourbon) - (HM=Hotel Mabu) - (CC=Convention Center) - (Bol=Foz Boulevard) - (PS=Poster Session) - (PL=Plenary Lecturer)

AUTHOR	N°	TITLE	Book	Page	Date	Time	Local	Room	Session	Symp	New Session
Sitterz-Bhatkar, H.	4090	CYTOTOXICITY OF LUFENURON IN UNHATCHED LARVAE OF THE CAT FLEA CTENOCEPHALIDES FELIS	II	1033	23/08/00	16:30	CC		23	PS	23
Siva-Jothy, M.	1707	PARASITE RESISTANCE AND SEXUAL SIGNAL TRAITS: DOES UNDERSTANDING INSECT IMMUNITY HELP US UNDERSTAND INSECT MATING SYSTEM?	I	430	21/08/00	10:15	HB	F	9	1	9
Sivinski, J.	1661	FRUIT FLY BIOLOGICAL CONTROL IN LATIN AMERICA: MINIMIZING THE RISKS POSED BY TEPHRITIDAE IN MEXICO AND CENTRAL AMERICA	I	419	25/08/00	16:30	CC		8	PS	8
Sivinski, J.	1615	HYMENOPTERAN PARASITOIDS ON FRUIT – INFESTING TEPHRITIDAE (DIPTERA) IN LATIN AMERICA AND THE SOUTHERN UNITED STATES: DIVERSITY, DISTRIBUTION, TAXONOMIC STATUS AND THEIR USE IN FRUIT FLY BIOLOGICAL CONTROL	I	407	24/08/00	16:30	CC		8	PS	8
Sjursen, H.	462	BIODIVERSITY OF AGROMYZIDAE IN CEREAL AND GRASS FIELDS AND THEIR BOUNDARIES	I	117	21/08/00	16:30	CC		3	PS	3
Skaer, N.	3077	THE DEVELOPMENT AND EVOLUTION OF BRISTLE PATTERNS IN DIPTERA	II	776	24/08/00	16:00	HB	G	16	6	16
Skelley, P. E.	3640	THE INFLUENCE OF DATA BASED ON BEHAVIOR AND THE MORPHOLOGY OF VARIOUS DEVELOPMENTAL STAGES IN A PHYLOGENETIC ANALYSIS OF EROTYLIDAE (COLEOPTERA)	II	919	22/08/00	14:50	HB	E	21	4	21
Skirvin, D. J.	750	SIMULATION OF INSECT MOVEMENT WITH RESPECT TO PLANT ARCHITECTURE AND MORPHOGENESIS	I	189	21/08/00	13:50	Bol	T	5	1	5
Skoda, S.	2311	GENETIC VARIATION OF EUROPEAN CORN BORER (OSTRINIA NUBILALIS) POPULATIONS IN NEBRASKA DETECTED BY RANDOM AMPLIFIED POLYMORPHIC DNA (RAPD)	I	583	24/08/00	16:30	CC		12	PS	12
Skrøppa, T.	1364	RESISTANCE IN NORWAY SPRUCE AGAINST THE GREEN SPRUCE APHID	I	344	23/08/00	16:30	CC		7	PS	7
Skrzecz, I.	2153	BIOLOGICAL ACTIVITY OF NUCLEAR POLYHEDROSIS VIRUS ISOLATED FROM CELERY LOOPER (ANAGRAPHA FALCIFERA) AGAINST NUN MOTH (LYMANTRIA MONACHA)	I	543	25/08/00	16:30	CC		11	PS	11
Sláma, K.	2510	RECORDING OF SPIRACULAR FUNCTIONS BY ARTIFICIALLY GENERATED PRESSURE PULSES	II	634	25/08/00	16:30	CC		13	PS	13
Sláma, K.	3087	RECORDING OF SPIRACULAR FUNCTIONS BY ARTIFICIALLY GENERATED PRESSURE PULSES	II	779	25/08/00	14:35	HB	G	16	8	16
Slaytor, M.	2161	PROTOZOAN AND ENDOGENOUS CELLULASES FROM TERMITES OF THE GENUS COPTOTERMES	I	545	25/08/00	16:30	CC		11	PS	11
Slippers, B.	1972	UNDERSTANDING THE INTRODUCTION AND SPREAD OF SIREX NOCTILIO IN THE SOUTHERN HEMISPHERE	I	497	25/08/00	16:30	CC		10	PS	10
Sloderbeck, P. E.	254	SOYBEAN STEM BORER IN KANSAS: LIFE HISTORY, SAMPLING, AND SEVERITY OF RECENT INFESTATIONS	I	65	23/08/00	16:30	CC		2	PS	2
Sloderbeck, P. E.	911	DISPERSAL OF EUROPEAN AND SOUTHWESTERN CORN BORER MOTHS WITHIN AND BETWEEN CORNFIELDS	I	230	21/08/00	16:30	CC		6	PS	6
Slooff, R.	2875	CLIMATE CHANGE, ECOLOGY AND HUMAN DISEASE	II	726	21/08/00	13:35	Bol	R	15	2	15
Slooff, R.	2877	CLIMATE CHANGE, ECOLOGY AND HUMAN DISEASE	II	726	21/08/00	16:30	CC		15	PS	12
Slovák, M.	34	INTERACTION OF TICK SALIVA WITH THE HOST IMMUNE MECHANISMS AND ITS SIGNIFICANCE FOR PATHOGEN TRANSMISSION	I	9	22/08/00	16:30	CC		1	PS	1
Slovák, M.	2893	TICK-HOST INTERACTIONS IN THE CO-FEEDING TRANSMISSION OF TICK-BORNE ENCEPHALITIS VIRUS: CELL INVOLVEMENT	II	730	22/08/00	15:50	Bol	R	15	4	15
Smagghe, G.	1403	SIGNIFICANCE OF UPTAKE AND BINDING IN LEPIDOPTERA AND COLEOPTERA ON TOXICITY OF DIBENZOYLHYDRAZINE ECDYSONE AGONISTS	I	354	25/08/00	16:30	CC		7	PS	7
Small, G. J.	351	MOLECULAR CHARACTERISATION AND QUANTITATION OF THE AMPLIFIED CARBOXYLESTERASE GENE ASSOCIATED WITH ORGANOPHOSPHORUS INSECTICIDE RESISTANCE IN THE BROWN PLANTHOPPER, NILAPARVATA LUGENS	I	89	25/08/00	16:30	CC		2	PS	2
Smets,K.	567	BEETLE DIVERSITY AND FOREST CHARACTERISTICS IN FLANDERS (BELGIUM)	I	143	25/08/00	16:30	CC		3	PS	3
Smid, H.M.	591	MULTIPLE MATINGS AND EFFECTS ON FECUNDITY AND ATTRACTION IN LYGOCORIS PABULINUS	I	150	22/08/00	11:50	Bol	S	4	2	4
Smirle, M. J.	109	POTENTIAL EFFECTS OF THE UNITED STATES FOOD QUALITY PROTECTION ACT LEGISLATION ON TREE FRUIT PRODUCTION IN BRITISH COLUMBIA, CANADA	I	28	23/08/00	10:35	HB	A	2	5	2
Smith Jr., J. W.	1564	JALISCO FLY (DIPTERA: TACHINIDAE) AS A BIOLOGICAL CONTROL AGAINST MEXICAN RICE BORER (LEPIDOPTERA: PYRALIDAE) IN TEXAS SUGARCANE	I	394	22/08/00	16:30	CC		8	PS	8
Smith, A.	2483	THE DESIGN AND APPLICATION OF AN ACTIGRAPH TO STUDY THE CIRCADIAN RHYTHM OF THE DUMP FLY, HYDROTAEA AENESCENS	II	627	24/08/00	16:30	CC		13	PS	13
Smith, A. B. T.	3672	SYSTEMATICS AND BIOGEOGRAPHY OF ANOPLOGNATHINI (COLEOPTERA: SCARABAEIDAE: RUTELINAE), A TRIBE ENDEMIC TO THE NEOTROPICAL AND AUSTRALIAN REALMS	II	927	24/08/00	14:50	HB	E	21	7	21
Smith, A. D.	743	STUDIES OF FORAGING FLIGHTS WITH HARMONIC RADAR.	I	188	21/08/00	9:35	Bol	T	5	1	5
Smith, A. D.	138	SEASONAL MONITORING OF THE INSECT FAUNA FLYING AT ALTITUDE OVER SOUTHERN ENGLAND: RESULTS FROM A VERTICAL-LOOKING RADAR	I	36	25/08/00	10:25	HB	A	2	9	2
Smith, A. D.	930	VERTICAL-LOOKING RADAR: A POWERFUL NEW TOOL FOR MONITORING INSECT FLIGHT AT ALTITUDE	I	235	21/08/00	16:30	CC		6	PS	6
Smith, A. D.	1212	SPATIO-TEMPORAL DYNAMICS OF AERIAL INSECT POPULATIONS EXAMINED WITH VERTICAL-LOOKING RADAR	I	305	25/08/00	16:30	CC		6	PS	6
Smith, B. H.	605	MOLECULAR, PHYSIOLOGICAL AND ETHOLOGICAL PERSPECTIVES ON INSECT OLFACTION	I	153	23/08/00	14:05	Bol	S	4	5	4
Smith, C. M.	3883	MOLECULAR MARKERS IN WHEAT LINKED TO GENES EXPRESSING RESISTANCE TO THE GREENBUG AND THE RUSSIAN WHEAT APHID	II	980	22/08/00	13:35	HB	H	22	3	22
Smith, D.	2593	INTEGRATION OF BIOLOGICAL CONTROL INTO CITRUS PEST MANAGEMENT	II	655	24/08/00	15:50	HB	B	14	7	14
Smith, D.	2676	CITRUS LEAFHOPPER IPM IN AUSTRALIA - ALTERNATIVE HOSTS FOR ENHANCEMENT OF MYMARID EGG PARASITOIDS?	II	676	22/08/00	16:30	CC		14	PS	14
Smith, D. A. S.	2274	MOLECULAR ANALYSIS OF THE EVOLUTIONARY DYNAMICS OF THE AFRICAN QUEEN BUTTERFLY DANAUS CHRYSIPPUS.	I	574	23/08/00	16:30	CC		12	PS	12
Smith, G. K.	373	EFFECTIVENESS OF METHYL BROMIDE ALTERNATIVES AGAINST POTENTIAL PESTS TO BE IMPORTED TO THE UNITED STATES FROM CHILE	I	94	25/08/00	16:30	CC		2	PS	2
Smith, G. K.	2856	AN IPM APPROACH TO PREVENTION OF POTENTIAL PESTS THAT MIGHT BE IMPORTED TO THE UNITED STATES ON CHILEAN LOGS: PART I, EFFECTIVENESS OF METHYL BROMIDE ALTERNATIVES	II	721	24/08/00	16:30	CC		14	PS	14
Smith, J. L.	1585	EFFECTS OF LARVAL DENSITY AND PREDATION BY TOXORHYNCHITES AMBOINENSIS (DIPTERA; CULICIDAE) UPON AEDES POLYNESIENSIS PRODUCTION	I	400	23/08/00	16:30	CC		8	PS	8
Smith, K. G.	1818	EFFECTS OF A MULTI-YEAR GYPSY MOTH ERADICATION PROGRAM ON DIVERSITY OF NONTARGET FOREST CANOPY ARTHROPODS AND THEIR BIRD PREDATORS IN THE OZARK MOUNTAINS	I	458	21/08/00	14:20	HB	M	10	1	10
Smith, R. H.	2325	COSTS AND BENEFITS OF MULTIPLE MATING IN A BEETLE	I	587	25/08/00	16:30	CC		12	PS	12
Smith, R. L.	1715	EVOLUTION OF CONSPECIFIC EGG-CARRYING BEHAVIOR: ANCIENT AND INFANT EXPRESSIONS IN THE HETEROPTERA	I	432	21/08/00	14:30	HB	F	9	1	9
Smith, S. M.	1136	RESPONSE OF XYLOPHAGOUS BEETLES AND THEIR NATURAL ENEMIES TO INCREASED RESOURCE AVAILABILITY FOLLOWING A SEVERE ENVIRONMENTAL DISTURBANCE	I	286	24/08/00	16:30	CC		6	PS	6
Smith, W.	2733	BIOLOGY OF SWEET POTATO WHITEFLY, (HOMOPTERA: ALEYRODIDAE) ON TRANSGENIC TOBACCO AND INTERACTIONS WITH A PARASITE	II	690	23/08/00	16:30	CC		14	PS	14

Sub-titles: (HB=Hotel Bourbon) - (HM=Hotel Mabu) - (CC=Convention Center) - (Bol=Foz Boulevard) - (PS=Poster Session) - (PL=Plenary Lecturer)

AUTHOR	Nº	TITLE	Book	Page	Date	Time	Local	Room	Session	Symp	New Session
Snyder, W. E.	865	DYNAMIC TROPHIC CASCADES CAUSED BY GENERALIST PREDATORS – FROM PARALLEL TO COUNTERACTIVE EFFECTS	I	219	25/08/00	15:35	HB	D	6	8	6
Soares, A. E. E.	3448	UTILIZATION OF DIFFERENT CULTURE MEDIA FOR BEE SEMEN STORAGE (APIS MELLIFERA; HYMENOPTERA: APOIDEA)	II	870	21/08/00	16:30	CC		19	PS	19
Soares, C.O.	3248	SEROLOGY FOR BABESIA BOVIS IN HUMAN PATIENTS WITH LYME- LYKE DISEASE SYNDROME, SYPHILIS, SEPTICEMIA AND AUTOIMMUNE DISEASES	II	820	25/08/00	16:30	CC		17	PS	17
Soares, L. A.	1162	BIOLOGY OF ISODONTIA FUSCIPENNIS COMPLEX IN TRAP-NESTS (HYMENOPTERA: SPHECIDAE)	I	293	25/08/00	16:30	CC		6	PS	6
Soares, M. I. J.	1163	SOIL MACROFAUNA AND MESO UNDER DIFFERENT VEGETATION COVERING	I	293	21/08/00	16:30	CC		6	PS	6
Soares, M. J.	731	A COMPARATIVE STUDY OF PHEROMONE DISSEMINATING STRUCTURES IN TERGITES OF SOME LUTZOMYIA SPP. (DIPTERA: PSYCHODIDAE)	I	185	24/08/00	16:30	CC		4	PS	4
Soares, M. J.	3161	ULTRASTRUCTURAL STUDIES ON THE SALIVARY GLANDS OF RHODNIUS DOMESTICUS, R. PROLIXUS AND TRIATOMA INFESTANS (HEMIPTERA: REDUVIIDAE)	II	797	23/08/00	16:30	CC		16	PS	16
Soares, P. A. O.	3184	MORPHOMETRIC ANALYSIS OF THE BRAIN IN THE CASTES OF ACROMYRMEX SUBTERRANEUS (HYMENOPTERA, FORMICIDAE) DURING THE POST-EMBRYONIC DEVELOPMENT	II	803	23/08/00	16:30	CC		16	PS	16
Soares, R. A. B.	3483	MONITORING TERMITES IN SUGAR CANE FIELDS IN GOIAS, BRAZIL: A PROFITABLE INVESTIMENT.	II	879	23/08/00	16:30	CC		19	PS	19
Soares, R. M.	3794	INVESTIGATION OF THE VALIDITY OF SPECIES STATUS OF IXODES DIDELPHIDIS (ACARI: IXODIDAE) USING THE SECOND INTERNAL TRANSCRIBED SPACER (ITS2) OF RIBOSOMAL DNA	II	958	23/08/00	16:30	CC		21	PS	21
Soares, S. M.	1973	UTILIZATION OF FLORAL RESOURCES BY MELIPONINEOS (APIDAE:MELIPONINI) IN A FOREST FRAGMENT, BELO HORIZONTE, MG, BRAZIL	I	497	25/08/00	16:30	CC		10	PS	10
Soares, S. S.	1303	EVALUATION OF THE STATUS OF RESISTANCE OF AEDES AEGYPTI TOTEMEPHOS IN THE STATE OF RIO DE JANEIRO - BRAZIL	I	329	21/08/00	16:30	CC		7	PS	7
Soares, S. S.	4076	EVALUATION OF TEMEPHOS SUSCEPTIBILITY IN AEDES AEGYPTI IN RIO DE JANEIRO, BRAZIL	II	1029	22/08/00	16:30	CC		23	PS	23
Soberano, J. L.	1897	PEST INSECT IN EUCALYPTUS FOREST PLANTATION ON TABASCO STATE, MEXICO.	I	478	26/08/00	16:20	HB	M	10	10	10
Sobolevа-Dokuchaeva, I. I.	362	ALLOCATION OF ARTHROPODS IN WINTER WHEAT CROP AND AROUND IT	I	92	25/08/00	16:30	CC		2	PS	2
Socorro Caraciolo, M.	717	FEMALE SEX PHEROMONE OF CASTNIA LICUS (LEPIDOPTERA:CASTNIIDEA): IDENTIFICATION AND FIELD APPLICATION	I	181	24/08/00	16:30	CC		4	PS	4
Socorro, A. P. Del	148	POLLEN AS A MARKER FOR LONG-DISTANCE MIGRATION AND LOCAL MOVEMENT OF HELICOVERPA MOTHS IN AUSTRALIA	I	38	25/08/00	14:45	HB	A	2	9	2
Socorro, A. P. Del	687	THE EFFECTS OF HOST PLANT ODOURS ON THE CALLING BEHAVIOUR, EGG MATURATION AND MATING SUCCESS OF THE COTTON BOLLWORM, HELICOVERPA ARMIGERA (HÜBNER) (LEPIDOPTERA: NOCTUIDAE)	I	174	23/08/00	16:30	CC		4	PS	4
Sugabe, A.	3552	TERMITICIDAL SUBSTANCES FROM THE HEARTWOOD OF CRYPTOMERIA JAPONICA D. DON	II	896	25/08/00	16:30	CC		19	PS	19
Sohi, S. S.	1845	BIOLOGICAL CONTROL OF FOREST PESTS USING INSECT SPECIFIC VIRUSES	I	465	23/08/00	14:35	HB	M	10	4	10
Sohi, S. S.	3325	GLUTATHIONE S-TRANSFERASE FROM THE SPRUCE BUDWORM, CHORISTONEURA FUMIFERANA: IDENTIFICATION, CHARACTER-IZATION, LOCALIZATION, CDNA CLONING, DEVELOPMENTAL EXPRESSION AND INDUCTION BY VARIOUS FACTORS	II	840	21/08/00	16:30	CC		18	PS	18
Soika, G. M.	68	NEW SPECIES OF ERIOPHOID MITES FOR WORLD FAUNA OCCURRING ON ORNAMENTAL PLANTS IN POLAND	I	17	25/08/00	16:30	CC		1	PS	1
Soika, G. M.	2731	STEPHANITIS TAKEYAI DRAKE & MAA AND OTHER LACE BUGS (TINGIDAE) AS PESTS OF ORNAMENTAL PLANTS FROM ERICACEAE FAMILY IN POLAND	II	690	23/08/00	16:30	CC		14	PS	14
Sokolowski, M. B.	2188	CHANGES IN BRAIN EXPRESSION OF cGMP-DEPENDENT PROTEIN KINASE GENE AND DIVISION OF LABOR IN COLONIES OF THE HONEY BEE APIS MELLIFERA	I	552	22/08/00	15:55	HB	L	12	4	12
Solbreck, C.	1210	GALL MIDGE - PARASITOID DYNAMICS AT THE LANDSCAPE SCALE - EFFECTS OF DISTURBANCE AND PROLONGED DIAPAUSE	I	305	25/08/00	16:30	CC		6	PS	6
Solheim, H.	2084	INDUCED DISEASE RESISTANCE IN NORWAY SPRUCE AND ITS IMPLICATIONS FOR BARK BEETLE POPULATION DYNAMICS	I	526	22/08/00	16:30	CC		11	PS	11
Solheim, H.	2410	DEFENCE MECHANISMS OF NORWAY SPRUCE AGAINST BARK BEETLE-FUNGUS ATTACKS	II	609	21/08/00	16:30	CC		13	PS	13
Solinas, M.	834	ASPHONDYLIA SPECIES OF ITALIAN FAUNA (DIPTERA: CECIDOMYIIDAE)	I	211	23/08/00	11:50	HB	D	6	5	6
Solis, A.	69	INTERNATIONAL COOPERATION IN THE INSECT INVENTORY, THE INBIO EXPERIENCE IN COSTA RICA	I	18	25/08/00	16:30	CC		1	PS	1
Solis, A.	771	ENTOMOLOGY IN COSTA RICA INBio	I	195	24/08/00	10:35	Bol	T	5	5	5
Solis, A.	3668	STUDIES ON COSTA RICAN SCARABAEINAE (COLEOPTERA: SCARABAEIDAE)	II	926	24/08/00	13:50	HB	E	21	7	21
Solis, D. R.	3954	TOLERANCE OF BRACON HEBETOR (HYMENOPTERA: BRACONIDAE) TO MICROWAVE RADIATION (2450 MHz).	II	998	22/08/00	16:30	CC		22	PS	22
Solomon, M. G.	1662	THE COMMON EARWIG FORFICULA AURICULARIA: BENEFICIAL OR PEST IN ORCHARDS?	I	419	25/08/00	16:30	CC		8	PS	8
Solulu, T.	3648	MORPHOLOGY AND BIOGEOGRAPHY OF FEMALE MYRMECOLACIDAE PARASITIC IN ORTHOPTERA IN PAPUA NEW GUINEA	II	921	23/08/00	14:20	HB	E	21	5	21
Søndergaard, L.	2340	REVERSED PHARMACOLOGY IN INSECTS: FINDING NOVEL ORPHAN G PROTEIN-COUPLED RECEPTORS AND THEIR LIGANDS	II	591	21/08/00	10:55	HB	I	13	1	13
Song, F.	2921	STUDIES ON THE POSSIBILITY OF TRANSMISSION OF DENGUE VIRUS BY CULEX PIPIENS QUINQUEFASCIATUS IN LABORATORY	II	737	25/08/00	9:50	Bol	R	15	9	15
Song, F.	2920	STUDIES OF WOLBACHIA IN CULEX PIPIENS COMPLEX IN CHINA	II	737	25/08/00	9:35	Bol	R	15	9	15
Song, H. S.	3528	A NOVEL FUNCTION OF THE PARALYTIC PEPTIDE OF THE WILD SILKMOTH ANTHERAEA YAMAMAI (ANY-PARP) FOR DIAPAUSE INDUCTION OF THE SILKWORM BOMBYX MORI	II	890	24/08/00	16:30	CC		19	PS	19
Song, M.G.	1986	KEY FACTORS AFFECTING POPULATIONS OF SCHIZOTETRANYCHUS NANJINGENSIS, APONYCHUS CORPUZAE AND ACULUS BAMBUSAE IN FUJIAN BAMBOO FORESTS DURING DIFFERENT SEASONS: AN ANALYSIS USING METHODS OF GREY SEQUENCE	I	500	21/08/00	16:30	CC		10	PS	10
Song, M.G.	76	CAUSES OF MITE PEST OUTBREAKS IN BAMBOO FORESTS IN FUJIAN, CHINA: ANALYSES OF MITE DAMAGE IN MONOCULTURE VERSUS POLYCULTURE STANDS	I	19	25/08/00	16:30	CC		1	PS	1
Song, S.	2920	STUDIES OF WOLBACHIA IN CULEX PIPIENS COMPLEX IN CHINA	II	737	25/08/00	9:35	Bol	R	15	9	15
Song, W.	3270	PHOTIC ENTRAINMENT OF THE DROSOPHILA CIRCADIAN CLOCK	II	826	23/08/00	13:50	HB	K	18	3	18
Song, Y.	2205	MIGRATION OF RICE PESTS IN ASIA: GENETICS AND GIS	I	557	24/08/00	11:35	HB	L	12	7	12
Song, Y. H.	2596	INTERNATIONAL SURVEILLANCE FOR LONG RANGE MIGRATORY RICE PESTS	II	656	25/08/00	10:35	HB	B	14	8	14
Sorensen, K. A.	2826	STRAWBERY: IMPORTANCE OF PESTICIDES AND NONCHEMICAL CONTROL MEASURES	II	713	25/08/00	16:30	CC		14	PS	14
Sorge, D.	2492	JUVENILE HORMONE BIOSYNTHESIS AND REGULATION OF VITELLOGENESIS IN THE FALL ARMYWORM, SPODOPTERA FRUGIPERDA (LEPIDOPTERA: NOCTUIDAE)	II	629	24/08/00	16:30	CC		13	PS	13
Sosa, A. J.	1663	OCCURRENCE AND REDESCRIPTION OF MEGAMELUS SCUTELLARIS BERG (HEMIPTERA: FULGOROMORPHA: DELPHACIDAE) IN ARGENTINA, A CANDIDATE FOR BIOCONTROL OF WATERHYACINTH	I	419	25/08/00	16:30	CC		8	PS	8
Sosa, C. A.	1164	DIVERSITY OF NATIVE BEES (HYMENOPTERA: APOIDEA) AND USE OF FLORAL RESOURCES IN A SECTION OF THE CHACO SERRANO (BOSQUE SERRANO) IN CENTRAL ARGENTINA.	I	293	25/08/00	16:30	CC		6	PS	6

Sub-titles: (HB=Hotel Bourbon) - (HM=Hotel Mabu) - (CC=Convention Center) - (Bol=Foz Boulevard) - (PS=Poster Session) - (PL=Plenary Lecturer)

AUTHOR	Nº	TITLE	Book	Page	Date	Time	Local	Room	Session	Symp	New Session
Sosa, C. A.	1165	RELATIONSHIP BETWEEN CARPENTER BEES (HYMENOPTERA: APIDAE) AND THE FLORA OF THE CHACO SERRANO IN CENTRAL ARGENTINA.	I	294	25/08/00	16:30	CC		6	PS	6
Sosa, M. E.	729	BIOLOGICAL ACTIVITIES OF PLANT SECONDARY METABOLITES TOWARD INSECTS	I	184	25/08/00	16:30	CC		4	PS	4
Sosa-Gomez, D. R.	4151	ENHANCEMENT OF ANTICARSIA GEMMATALIS (LEPIDOPTERA: NOCTUIDAE) BACULOVIRUS ACTIVITY BY OPTICAL BRIGHTENERS	II	1048	21/08/00	16:30	CC		Erratum	PS	11
Sosa-Gomez, D. R.	2154	INTEGRATED SYSTEM TO SIMULATE THE IMPACT OF THE FUNGUS NOMURAEA RILEYI ON BRAZILIAN ANTICARSIA GEMMATALIS POPULATIONS	I	543	25/08/00	16:30	CC		11	PS	11
Sosa-Gómez, D. R.	1992	MICROBIAL PESTICIDES: DREAM OR REALITY ENTOMOPATHOGENIC FUNGI VS. AGRICULTURAL PESTS	I	503	21/08/00	11:20	HM	P	11	I	11
Sosa-Gómez, D. R.	1116	BIOLOGICAL ASPECTS OF ORYZOPHAGUS ORYZAE (COLEOPTERA: CURCULIONIDAE) IN WATER-SEEDED RICE	I	281	24/08/00	16:30	CC		6	PS	6
Sosa-Gómez, D. R.	1789	ETOLOGICAL ASPECTS OF ORYZOPHAGUS ORYZAE (COLEOPTERA: CURCULIONIDAE) IN WATER- SEEDED RICE	I	451	25/08/00	16:30	CC		9	PS	9
Sosa-Gómez, D. R.	2127	CONTROL ASPECTS OF ORYZOPHAGUS ORYZAE WITH BEAUVERIA BASSIANA, METARHIZIUM ANISOPLIAE AND FIPRONIL IN WATER-SEEDED RICE	I	536	23/08/00	16:30	CC		11	PS	11
Sosa-Gómez, D. R.	2576	ECOLOGY OF ENTOMOPATHOGENS	II	651	23/08/00	14:30	HB	B	14	5	14
Sosa-Gómez, D. R.	2567	ROLE OF NATURAL ENEMIES IN DEVELOPING IPM STRATEGIES	II	649	22/08/00	15:05	HB	B	14	4	14
Soto, M. J.	3214	DO GEMINIVIRUSES LEAD A DUAL LIFE STYLE: MOVEMENT WITHIN THE PLANT VS. PLANT-TO-PLANT	II	811	22/08/00	15:00	Bol	U	17	2	17
Soto, S.	555	PRELIMINARY CHECK LIST OF ISOPODA (ARTHROPODA: CRUSTACEA) IN RÍA DE VIGO (NO ESPAÑA)	I	140	22/08/00	16:30	CC		3	PS	3
Souframanien, J.	2287	MOLECULAR CHARACTERIZATION OF RICE BROWN PLANTHOPPER POPULATION	I	577	24/08/00	16:30	CC		12	PS	12
Souframanien, J.	3886	MOLECULAR CHARACTERIZATION OF RICE BROWN PLANTHOPPER POPULATION	II	981	22/08/00	15:05	HB	H	22	3	22
Souki, M. El	1974	TROPHIC PATTERNS IN AN INSECT COMMUNITY OF PINE FOREST AND SAVANNA ECOSYSTEMS	I	497	25/08/00	16:30	CC		10	PS	10
Soulier-Perkins, A.	3616	THE NEOTROPICAL LOPHOPIDAE (HEMIPTERA) AND THE ENIGMA OF HESTICUS AND SILVANANA	II	913	21/08/00	11:20	HB	E	21	1	21
Sousa Majer, M. J. de	3989	RESPONSE OF TRANSGENIC PEAS CONTAINING A SEED SPECIFIC ALPHA-AMYLASE INHIBITOR GENE TO HEAT AND WATER STRESSES	II	1007	24/08/00	16:30	CC		22	PS	22
Sousa, C. dos R. de	2796	INSECTICIDES AND PLASTER USED FOR CONTROLLING BROWNY STINKBUG (SCAPTOCORIS CASTANEA) POPULATIONS IN CORN CROPS IN THE SOUTHWEST REGION OF GOIÁS	II	706	24/08/00	16:30	CC		14	PS	14
Sousa, C. dos R. de	2797	EFFICIENCY OF INSECTICIDES AND GYPSUM IN THE CONTROL OF BROWN STINK BUGS (SCAPTOCORIS CASTANEA) IN CORN, IN THE SOUTHEAST OF THE STATE OF GOIÁS	II	706	24/08/00	16:30	CC		14	PS	14
Sousa, E. M.	1166	POPULATION BEHAVIOUR CHANGES OF THE PROCESSIONARY MOTH (THAUMETOPOEA PITYOCAMPA) IN PORTUGAL	I	294	25/08/00	16:30	CC		6	PS	6
Sousa, E. M.	1975	DISTRIBUTION OF BARK AND WOOD-BORING INSECTS IN MARITIME PINE TREES INFECTED WITH BURSAPHELENCHUS XYLOPHILUS IN PORTUGAL	I	498	25/08/00	16:30	CC		10	PS	10
Sousa, E. O.	1633	EFFECT OF THE PREY DENSITY ON THE FUNCTIONAL AND NUMERICAL RESPONSE OF TWO SPECIES OF PREDACEOUS MITES	I	412	24/08/00	16:30	CC		8	PS	8
Sousa, F. A. M.	1404	INSECTICIDAL ACTIVITY AND MOLECULAR TARGETS OF LEGUME LECTINS ON THE PEA APHID, ACYRTHOSIPHON PISUM	I	354	25/08/00	16:30	CC		7	PS	7
Sousa, M. V.	1538	FOOD CONSUMPTION OF CHRYSOPERLA EXTERNA (NEUROPTERA: CHRYSOPIDAE) IN THE DIFFERENT DEVELOPMENTAL PHASES OF DYSMICOCCUS BREVIPES (HEMIPTERA: PSEUDOCOCCIDAE), UNDER LABORATORY CONDITIONS	I	388	22/08/00	16:30	CC		8	PS	8
Sousa, M. V.	1648	FUNCTIONAL RESPONSE OF CYCLONEDA SANGUINEA (COLEOPTERA : COCCINELLIDAE) AT DIFFERENT DENSITIES OF THE APHID MYZUS PERSICAE (HOMOPTERA: APHIDIDAE)	I	415	22/08/00	16:30	CC		8	PS	8
Sousa, R. C.	2323	THE USE OF PHENODARBITAL IN STUDIES OF AEDES AEGYPTI RESISTANCE TO INSECTICIDES	I	586	25/08/00	16:30	CC		12	PS	12
Sousa, S. S. P.	1659	PARASITOIDS OF PHYLLOCNISTIS CITRELLA IN RIO DE JANEIRO STATE, BRASIL	I	418	25/08/00	16:30	CC		8	PS	8
Souza Filho, M. F. de	1167	HOST PLANTS OF ZAPRIONUS INDIANUS IN THE STATE OF SÃO PAULO, BRAZIL	I	294	25/08/00	16:30	CC		6	PS	6
Souza Filho, M.F.	1764	DOES THE FRUIT SIZE INFLUENCE THE PARASITISM OF FRUGIVOROUS LARVAE BY EUCOILINAE SPECIES?	I	444	22/08/00	16:30	CC		9	PS	8
Souza Filho, M.F.	1386	THIAMETHOXAM TO CONTROL CITRUS LEAFMINER IN TANGOR MURCOTT	I	350	24/08/00	16:30	CC		7	PS	7
Souza Jr., J. A.	4095	EVALUATION OF INSECTICIDES IN THE CONTROL OF RICE WEEVIL AND LESSER GRAIN BORER ON STORED BARLEY	II	1034	25/08/00	16:30	CC		23	PS	23
Souza Neto, A. M. De	176	EFFICIENCY OF THE FORMULATION 50 SC OF THE PYRETHROID LAMBDA-CYALOTHRIN IN THE CONTROL OF ANTICARSIA GEMMATALIS IN THE SOYBEAN CROP	I	45	21/08/00	16:30	CC		2	PS	2
Souza Neto, A. M. De	177	EFFICIENCY OF THE FORMULATION 50 SC OF THE PYRETHROID LAMBDA-CYALOTHRIN IN THE CONTROL OF PSEUDALETIA SEQUAX (MYTHIMNA SEQUAX) IN THE WHEAT CROP	I	45	21/08/00	16:30	CC		2	PS	2
Souza Neto, A. M. De	178	EFFICIENCY OF THE FORMULATIONS 50 CS AND 250 CS OF THE PYRETHROID LAMBDA-CYALOTHRIN IN THE CONTROL OF DIABROTICA SPECIOSA IN BEAN CROP	I	46	21/08/00	16:30	CC		2	PS	2
Souza, A. A. de	3203	GENOME AND FUNCIONAL GENOMICS OF XYLELLA FASTIDIOSA	II	809	21/08/00	13:35	Bol	U	17	1	17
Souza, A. A. de	2926	PHLEBOTOMINE SANDFLIES TRANSMITTING LEISHMANIA IN CHANGING ENVIRONMENTS IN BRAZIL	II	738	25/08/00	11:05	Bol	R	15	9	15
Souza, A. G.	2028	SETTING UP AN ENTOMOPATHOGENIC MICROORGANISMS COLLECTION AT THE CENTRO EXPERIMENTAL DO INSTITUTO BIOLOGICO/LABORATORIO DE CONTROLE BIOLOGICO, BRAZIL	I	512	21/08/00	16:30	CC		11	PS	11
Souza, B.	1664	INFLUENCE OF ISOLATED OR GROUPED CLIMATIC FACTORS ON CHRYSOPERLA EXTERNA (NEUROPTERA: CHRYSOPIDAE) ADULT POPULATIONS	I	419	25/08/00	16:30	CC		8	PS	8
Souza, B.	1593	A SURVEY OF LACEWINGS (NEUROPTERA: CHRYSOPIDAE), IN COFFEE AGROECOSSYSTEM, IN LAVRAS, MG, BRAZIL	I	402	23/08/00	16:30	CC		8	PS	8
Souza, B.	1576	INFLUENCE OF TEMPERATURE ON THE WEIGHT OF LARVAE AND ADULTS OF CHRYSOPERLA EXTERNA (NEUROPTERA: CHRYSOPIDAE) FED ON SCHIZAPHIS GRAMINUM (HEMIPTERA: APHIDIDAE)	I	397	24/08/00	16:30	CC		8	PS	8
Souza, B.	976	EFFECT OF TEMPERATURE ON THE SEX RATIO AND WEIGHT OF CHRYSOPERLA EXTERNA ADULTS OBTAINED FROM LARVAE FED ON SCHIZAPHIS GRAMINUM	I	246	22/08/00	16:30	CC		6	PS	6
Souza, B.	1529	FUNCTIONAL RESPONSE OF CHRYSOPERLA EXTERNA FED ON SCHIZAPHIS GRAMINUM	I	386	22/08/00	16:30	CC		8	PS	8
Souza, C. E. P.	352	POPULATIONAL STUDIES OF LEPTOGLOSSUS ZONATUS (HETEROPTERA: COREIDAE) ON CORN (ZEA MAYS) IN BRAZIL	I	89	25/08/00	16:30	CC		2	PS	2
Souza, C. E. P.	730	PHEROMONES SYSTEM OF LEPTOGLOSSUS ZONATUS (HETEROPTERA:COREIDAE)	I	184	24/08/00	16:30	CC		4	PS	4
Souza, C. E. P.	3970	A HIGHLY INTEGRATED MONITORING SYSTEM TO SUPPORT ON-TIME, ON-LINE DECISION-MAKING IN AGRICULTURE	II	1002	24/08/00	16:30	CC		22	PS	22
Souza, C. E. P.	1168	EFFECT OF NYMPHAL DENSITY ON DEVELOPMENT AND PERFORMANCE OF LEPTOGLOSSUS ZONATUS, THE LEAF-FOOTED BUG (HETEROPTERA:COREIDAE) ON CORN (ZEA MAYS)	I	294	21/08/00	16:30	CC		6	PS	6

Sub-titles: (HB=Hotel Bourbon) - (HM=Hotel Mabu) - (CC=Convention Center) - (Bol=Foz Boulevard) - (PS=Poster Session) - (PL=Plenary Lecturer)

AUTHOR	Nº	TITLE	Book	Page	Date	Time	Local	Room	Session	Symp	New Session
Souza, C. M. de	1169	CONTRIBUTIONS TO THE BIOLOGY AND ECOLOGY OF NEOLEUCINODES ELEGANTALIS (LEPIDOPTERA: CRAMBIDAE)	I	295	25/08/00	16:30	CC		6	PS	6
Souza, C. M. de	1170	OVIPOSITION PREFERENCE AND DEVELOPMENT OF NEOLEUCINODES ELEGANTALIS (LEPIDOPTETRA: CRAMBIDAE) ON TOMATO GENOTYPES	I	295	25/08/00	16:30	CC		6	PS	6
Souza, C. M. de	1171	TOXICITY OF TOMATO ALLELOCHEMICALS TO EGGS AND NEONATE LARVAE OF NEOLEUCINODES ELEGANTALIS (LEPIDOPTERA: CRAMBIDAE)	I	295	25/08/00	16:30	CC		6	PS	6
Souza, E. A. de	1294	EFFECT OF CHEMICAL CONTROL OF BEMISIA ARGENTIFOLII (HEMIPTERA: ALEYRODIDAE) ON THE INCIDENCE OF BEAN GOLDEN MOSAIC VIRUS IN COMMON BEANS AND ITS YIELD	I	327	21/08/00	16:30	CC		7	PS	7
Souza, E. A. de	2626	INTEGRATED MANAGEMENT OF THE APHID, APHIS GOSSYPII, IN INDIAN CHERRY TREE, IN IRRIGATED AREAS OF THE SÃO FRANCISCO VALLEY	II	663	22/08/00	16:30	CC		14	PS	14
Souza, E. C. A. de	3462	DEVELOPMENT AND COCOON YIELD OF SILKWORM (BOMBYX MORI) FED WITH LEAVES FROM MULBERRY (MORUS ALBA) FERTILIZED WITH LIMESTONE AND GYPSUM ASSOCIATED WITH NPK AND MICRONUTRIENTS	II	874	21/08/00	16:30	CC		19	PS	19
Souza, J. C. de	2827	EFFICIENCY OF THIAMETHOXAM 10 GR IN THE CONTROL OF THE COFFEE LEAF MINER	II	714	25/08/00	16:30	CC		14	PS	14
Souza, J. L. de	482	COLLEMBOLA (ARTHROPODA: HEXAPODA) BIODIVERSITY IN TROPICAL AGRICULTURAL ENVIRONMENTS OF ESPIRITO SANTO, BRAZIL	I	122	21/08/00	16:30	CC		3	PS	3
Souza, L. C. de	24	FLUCTUATION OF BREVIPALPUS PHOENICIS (ACARI, TENUIPALPIDAE) IN CITRIC ORCHARD IN CHAPECÓ, SC	I	6	21/08/00	16:30	CC		1	PS	1
Souza, M. L. de	2040	ANTICARSIA GEMMATALIS NUCLEOPOLYHEDROVIRUS INFECTIVITY IN SEVEN INSECT CELL LINES	I	515	21/08/00	16:30	CC		11	PS	11
Souza, N. A.	2297	GENETIC VARIABILITY OF CACOPHONY GENE IN LUTZOMYIA LONGIPALPIS POPULATIONS	I	580	24/08/00	16:30	CC		12	PS	12
Souza, R. T. L. de	2977	EMERGENCE OF A NEW NEOTROPICAL MALARIA VECTOR FACILITATED BY HUMAN MIGRATION AND CHANGES IN LAND USE	II	751	22/08/00	16:30	CC		15	PS	15
Souza, S. S. P.	1172	OCCURRENCE AND BIOECOLOGICAL ASPECTS OF WHITEFLIES (HOMOPTERA:ALEYRODIDAE) ON CITRUS ORCHARDS IN THE STATE OF RIO GRANDE DO SUL, BRAZIL	I	295	25/08/00	16:30	CC		6	PS	6
Souza, S. S. P.	1173	DETERMINATION OF THE SPATIAL DISTRIBUTION OF CITRUS 'WHITEFLEIS' BY OF TAYLOR'S POWER LAW COEFFICIENTS AND WILSON & ROOM'S MATHEMATICAL MODEL ON 'VALÊNCIA' CITRUS ORCHARDS, STATE OF RIO GRANDE DO SUL, BRAZIL	I	296	25/08/00	16:30	CC		6	PS	6
Souza, S. S. P.	1158	DAMAGE CAUSED BY SNOUT BEETLES OF THE GENERA PANTOMORUS AND NAUPACTUS IN THE "TAHITI" TRUE LIME IN ARARUAMA CITY, RJ - BRAZIL	I	292	25/08/00	16:30	CC		6	PS	6
Souza, S. S. P.	2621	OCCURRENCE OF THE ENTOMOPATHOGENIC FUNGUS ASCHERSONIA SP. INFESTING SELENASPIDUS ARTICULATUS (HOMOPTERA: DIASPIDIDAE), IN THE STATE OF RIO DE JANEIRO, BRAZIL	II	662	21/08/00	16:30	CC		14	PS	14
Souza, S. S. P.	2799	EFFECT OF NITROGENOUS AND POTASSIC FERTILIZATION ON THE POPULATION OF ALEUROTHRIXUS FLOCCOSUS (HOMOPTERA: ALEYRODIDAE), IN SWEET ORANGE (CITRUS SINENSIS), CULTIVAR "FOLHA MURCHA"	II	707	24/08/00	16:30	CC		14	PS	14
Souza, S. S. P.	2800	EFFECT OF DIFFERENT LEVELS OF NITROGENOUS AND POTASSIC FERTILIZATION ON THE POPULATION OF COCCUS VIRIDIS (HOMOPTERA; COCCIDAE) IN SWEET ORANGE (CITRUS SINENSIS), CULTIVAR "FOLHA MURCHA"	II	707	24/08/00	16:30	CC		14	PS	14
Souza, W. N.	2198	MORPHOLOGICAL CORRELATES OF CHROMOSOME INVERSION GENOTYPES	I	555	23/08/00	14:35	HB	L	12	6	12
Sparks, T.C.	1225	SPINOSAD: PROPERTIES OF A SUCCESSFUL REDUCED RISK INSECT CONTROL PRODUCT	I	309	21/08/00	11:05	HM	N	7	1	7
Specht, A.	353	POPULACIONAL APPRAISAL OF OWLET MOTHS (LEPIDOPTERA, NOCTUIDAE) AND THEIR NATURAL ENEMIES IN MORNING AND NIGHT COLLECTIONS IN THE RYEGRASS CULTURE, WITH NET SWEEPING	I	89	25/08/00	16:30	CC		2	PS	2
Specht, A.	556	OWLET MOTH DIVERSITY (LEPIDOPTERA: NOCTUIDAE) COLLECTED WITH BLACK-LIGHT TRAP, IN SALVADOR DO SUL, RS, BRAZIL	I	141	21/08/00	16:30	CC		3	PS	3
Specht, A.	2979	CHARACTERIZATION OF LONOMIA OBLIQUA AND PERIGA CIRCUNSTANS (LEPIDOPTERA, SATURNIIDAE) OCCURING IN RIO GRANDE DO SUL STATE, BRAZIL	II	752	22/08/00	16:30	CC		15	PS	15
Specht, A.	3185	CHARACTERIZATION OF SPODOPTERA SPECIES (LEPIDOPTERA: NOCTUIDAE) OF SOUTHERN BRAZIL	II	803	22/08/00	16:30	CC		16	PS	16
Specht, A.	1186	POPULATIONAL FLUCTUATION OF PANTHERODES PARDALARIA (LEPIDOPTERA: GEOMETRIDAE) IN RIO GRANDE DO SUL STATE, BRAZIL	I	299	25/08/00	16:30	CC		6	PS	6
Specht, A.	1187	POPULATIONAL FLUCTUATION OF PANTHERODES PARDALARIA (LEPIDOPTERA: GEOMETRIDAE) IN RIO GRANDE DO SUL STATE, BRAZIL	I	299	25/08/00	16:30	CC		6	PS	6
Specty, O.	1665	FOOD AND CARCASS ANALYSES OF THE PREDATORY BUG HARMONIA AXYRIDIS (COLEOPTERA: COCCINELLIDAE) AS REFERENCES FOR THE ELABORATION OF ARTIFICIAL DIETS	I	420	25/08/00	16:30	CC		8	PS	8
Spence, J.	418	CARABID BEETLES (COLEOPTERA, CARABIDAE) ACROSS URBAN-RURAL GRADIENTS IN BULGARIA, CANADA AND FINLAND; AN INTERNATIONAL COLLABORATIVE EFFORT	I	106	23/08/00	15:35	HB	C	3	4	3
Spence, J. R.	3573	SEASONAL ASPECTS OF FLIGHT IN WATER STRIDERS (HEMIPTERA: GERRIDAE)	II	902	23/08/00	13:30	Bol	U	20	1	20
Spence, J. R.	1817	ARTHROPODS, THINNING AND INNOVATIVE HARVEST DESIGNS: ECOSYSTEM MANAGEMENT AND BOREAL BIODIVERSITY	I	458	21/08/00	13:35	HB	M	10	1	10
Spencer, A. G.	2993	MULTIPLE ACETYLCHOLINESTERASE PHENOTYPES IN DANISH FIELD POPULATIONS AND LABORATORY STRAINS OF THE HOUSE-FLY MUSCA DOMESTICA	II	755	23/08/00	16:30	CC		15	PS	15
Spencer, J. L.	159	CROP ROTATION COLLAPSES AS A VIABLE PEST MANAGEMENT STRATEGY FOR WESTERN CORN ROOTWORMS, DIABROTICA VIRGIFERA VIRGIFERA LECONTE, IN THE EASTERN CORN BELT OF THE USA	I	41	26/08/00	14:05	HB	A	2	11	2
Sperandio, L. A. A.	4164	WHAT HAPPENS WITH THE OVIPOSITION WHEN THE FEMALES OF ZABROTES SUBFASCIATUS STAY A DETERMINED PERIOD WITHOUT HOST?	II	1052	21/08/00	16:30	CC		Erratum	PS	6
Sperber, C. F.	557	WHY DOES SPECIES RICHNESS INCREASE WITH FRAGMENT SIZE? PASSIVE SAMPLING IN ATLANTIC FOREST CRICKETS	I	141	25/08/00	16:30	CC		3	PS	3
Sperling, F. A. H.	3699	PAPILIONIDAE PHYLOGENY: MOLECULES AND MORPHOLOGY CONVERGE	II	934	26/08/00	11:50	HB	E	21	9	21
Sperling, F. A. H.	3570	MITOCHONDRIAL DNA SEQUENCE VARIATION OF THE WATER STRIDER AQUARIUS REMIGIS (HETEROPTERA, GERRIDAE)	II	901	23/08/00	10:35	Bol	U	20	1	20
Sperling, F. L.	3931	COMPARISON OF (EXTRA) FLORAL NECTAR AND HONEYDEW WITH RESPECT TO THEIR SUITABILITY AS ARTHROPOD FOOD SOURCES	II	992	24/08/00	13:35	HM	Q	22	9	22
Sperling, F.A.H.	4174	PHYLOGENY AND PHYLOGEOGRAPHY OF THE MARINE WATER STRIDER HALOBATES (HETEROPTERA, GERRIDAE)	II	1054	23/08/00	10:05	Bol	U	Erratum	1	20
Spiegel, C. N.	731	A COMPARATIVE STUDY OF PHEROMONE DISSEMINATING STRUCTURES IN TERGITES OF SOME LUTZOMYIA SPP. (DIPTERA: PSYCHODIDAE)	I	185	24/08/00	16:30	CC		4	PS	4
Spielman, A.	2883	THE INFLUENCE OF WATER PROJECTS ON VECTOR-BORNE DISEASES	II	728	22/08/00	10:35	Bol	R	15	3	15
Spielman, A.	3239	MAIZE CULTURE AND THE FORCE OF TRANSMISSION OF MALARIA	II	818	24/08/00	16:30	CC		17	PS	17
Spinelli, G	2969	OBSERVATIONS ON SOME COLEOPTERA DERMESTIDAE SPECIES OF ZOOTECHNICAL INTEREST IN UMBRIA,CENTRAL ITALY	II	749	21/08/00	16:30	CC		15	PS	15
Spinelli, G	2982	EXPERIMENTAL OBSERVATIONS ON THE OUTBREAK OF INFESTATION BY KNEMIDOKOPTES PILAE (ACARINA: KNEMIDOKOPTIDAE) IN PARROTS (MELOPSITTACUS UNDULATUS)	II	752	22/08/00	16:30	CC		15	PS	15
Spinelli, G.	934	EXPERIMENTAL OBSERVATIONS ON THE OUTBREAK OF INFESTATION BY KNEMIDOKOPTES PILAE (ACARINA: KNEMIDOKOPTIDAE) IN PARROTS (MELOPSITTACUS UNDULATUS)	I	236	21/08/00	16:30	CC		6	PS	6

Sub-titles: (HB=Hotel Bourbon) - (HM=Hotel Mabu) - (CC=Convention Center) - (Bol=Foz Boulevard) - (PS=Poster Session) - (PL=Plenary Lecturer)

AUTHOR	Nº	TITLE	Book	Page	Date	Time	Local	Room	Session	Symp	New Session
Spinelli, G. R.	558	A VIEWPOINT ON PATAGONIAN BIOGEOGRAPHY FROM THE CERATOPOGONIDAE CASE (DIPTERA: NEMATOCERA).	I	141	25/08/00	16:30	CC		3	PS	3
Spinelli, G. R.	3179	THE LARVA AND PUPA OF CULICOIDES BAMBUSICOLA LUTZ OBSERVED WITH SEM, AND ADDITIONAL NOTES ON THE ADULTS (DIPTERA: CERATOPOGONIDAE)	II	802	24/08/00	16:30	CC		16	PS	16
Spooner, R. W.	1324	COMPARATIVE LARVICIDAL ACTIVITY OF THE ENDECTOCIDES, DORAMECTIN, EPRINOMECTIN, IVERMECTIN, AND MOXIDECTIN AGAINST THREE SPECIES OF PEST FLIES (DIPTERA: MUSCIDAE) IN DUNG OF TREATED CATTLE	I	334	23/08/00	16:30	CC		7	PS	7
Spooner-Hart, R.	3223	INTERACTIONS BETWEEN INSECT VECTORS OF PLANT DISEASES IN AUSTRALIA	II	814	22/08/00	16:30	CC		17	PS	17
Sprawka, I.	2411	INTERACTION OF SOME PROTEINS ON BIOLOGY OF GRAIN APHID (SITOBION AVENAE F.)	II	609	21/08/00	16:30	CC		13	PS	13
Sprecher-Uebersax, E.	4122	NEPAL AS A CENTER OF SPECIALIZATION FOR HIMALAYAN CHRYSOMELID FAUNA	II	1041	25/08/00	10:20	HM	P	24	2	24
Spring, J. H.	2511	EXCRETION IN THE HOUSE CRICKET, ACHETA DOMESTICUS: EFFECTS OF SECRETAGOGUES ON MALPIGHIAN TUBULE ELECTROPHYSIOLOGY AND SECRETION RATE	II	634	25/08/00	16:30	CC		13	PS	13
Spring, J. H.	2441	MEMBRANE DYNAMICS OF RAPID FLUID TRANSPORT IN THE MALPIGHIAN TUBULES OF THE HOUSE CRICKET, ACHETA DOMESTICUS	II	617	22/08/00	16:30	CC		13	PS	13
Springate, N.D.	3578	HOST PHYLOGENETIC TRAITS AS DETERMINANTS OF TEMPORAL VARIATION IN CANOPY ARTHROPOD ASSEMBLAGES	II	903	24/08/00	10:35	Bol	U	20	2	20
Sreenivasan, D. D.	1666	BIOLOGICAL CONTROL AGENTS: IMPLICATIONS IN HOME AND INTERIOR PLANTSCAPES	I	420	25/08/00	16:30	CC		8	PS	8
Sreenivasan, D. D.	3969	PUBLIC EDUCATION AND DEMONSTRATION OF BIOLOGICAL CONTROL PRINCIPLES IN INDOOR PLANTSCAPES IN MINNESOTA, U.S.A.	II	1002	23/08/00	16:30	CC		22	PS	22
Srikanth, J.	1174	A REGRESSION METHOD FOR IN SITU ESTIMATION OF APHID NUMBERS	I	296	25/08/00	16:30	CC		6	PS	6
Srikanth, J.	2052	STUDIES ON ENTOMOPATHOGENIC FUNGI AGAINST WHITE GRUB HOLOTRICHIA SERRATA (COLEOPTERA : SCARABAEIDAE) IN SUGARCANE	I	518	21/08/00	16:30	CC		11	PS	11
Srinivasan, T.	354	PHOSPHAMIDON 40SL AGAINST SUCKING PESTS OF RICE,COTTON AND BRINJAL	I	90	25/08/00	16:30	CC		2	PS	2
Srivastava, M.	1667	SYNOMONAL EFFECT OF CHICKPEA VARIETIES ON THE EGG PARASITOID TRICHOGRAMMA CHILONIS (TRICHOGRAMMATIDAE: HYMENOPTERA)	I	420	24/08/00	16:30	CC		8	PS	8
Srygley, R. B.	814	INVESTIGATING OPTIMAL MIGRATION STRATEGIES IN BUTTERFLIES: THE USE OF LOCAL AND CELESTIAL CUES TO ADJUST COURSE AND FLIGHT SPEED	I	206	24/08/00	10:45	HB	F	6	3	6
Srygley, R. B.	814	INVESTIGATING OPTIMAL MIGRATION STRATEGIES IN BUTTERFLIES: THE USE OF LOCAL AND CELESTIAL CUES TO ADJUST COURSE AND FLIGHT SPEED	I	206	24/08/00	10:45	HB	F	6	3	6
Sskyewa, C.	2825	SURVEY OF PRACTICES AND PERCEPTIONS OF SMALL HOLDER FARMERS RELATING TO PEST MANAGEMENT ON VEGETABLE CROPS IN EASTERN AFRICA	II	713	23/08/00	16:30	CC		14	PS	14
Staaden, M. J. van	1735	SERAGLIOS AND SIGNALING IN BLADDER GRASSHOPPERS	I	437	23/08/00	9:30	HB	F	9	3	9
Stadler, T.	649	INSECTICIDE ACTIVITY OF COTTON CRUDE OIL ON ADULTS OF CYDIA POMONELLA (LEPIDOPTERA:TORTRICIDAE)	I	164	23/08/00	16:30	CC		4	PS	4
Stamps, W. T.	1048	ARTHROPOD DIVERSITY IN AN AGROFORESTRY SYSTEM OF BLACK WALNUT AND FORAGE CROPS	I	264	23/08/00	16:30	CC		6	PS	6
Stanca, C.	1668	THE ENTOMOPHAGUE TRICHOGRAMMA SPP. (INSECTA, HYMENOPTERA) A CHANCE OF BIOLOGICAL CONTROL IN THE TRID MILLENNIUM, IN ROMANIA	I	420	25/08/00	16:30	CC		8	PS	8
Stanek, D. A.	2402	IDENTIFICATION OF TWO NEW BRAIN/MIDGUT PEPTIDES IN A MOSQUITO	II	607	21/08/00	16:30	CC		13	PS	13
Stanneck, D.	4006	FLEAS (SIPHONAPTERA) – BIOLOGY AND CONTROL	II	1012	21/08/00	11:15	HB	J	23	1	23
Stansly, P.A.	2560	CULTURAL PRACTICES FOR MANAGING WHITEFLIES	II	647	22/08/00	11:35	HB	B	14	3	14
Stanyard,M.J.	1496	PREDATION OF PHYLLOPHAGA (COLEOPTERA: SCARABAEIDAE) EGGS IN NO-TILL AND CONVENTIONAL-TILL MAIZE.	I	377	21/08/00	16:30	CC		8	PS	8
Staples, J. A.	2003	CURRENT STATUS ON MICROBIAL CONTROL OF TERMITES IN AUSTRALIA	I	505	22/08/00	13:35	HM	P	11	4	11
Stappen, F. Van	3600	OVERWINTERING STRATEGY OF APHIDIUS ERVI (HYMENOPTERA: APHIDIIDAE)	II	908	23/08/00	16:30	CC		20	PS	20
Stara, J.	2024	CONTROL OF THE CODLING MOTH WITH CpGV DISSEMINATED BY MEANS OF PHEROMONE STATIONS: 5 YEARS OF FIELD TRIALS	I	511	24/08/00	14:30	HM	P	11	7	11
Starchevsky, I. P.	1441	RESULTS OF THE DEVELOPMENT AND INTRODUCTION OF ENGENEERING TECHNOLOGIES FOR THE MASS REARING OF ENTOMOPHAGES AND ACARIPHAGES IN THE EASTERN PALEARCTIC REAGION	I	364	22/08/00	13:50	HM	O	8	4	8
Starchevsky, I. P.	1442	THE ENTOMOLOGICAL INDUSTRY IN THE UKRAINE: CONDITIONS AND PROSPECTS FOR DEVELOPMENT	I	364	22/08/00	14:05	HM	O	8	4	8
Stark, J. D.	1175	DEMOGRAPHIC ECOTOXICOLOGY: AN ACTUARIAL PERSPECTIVE ON PESTICIDE EFFICACY	I	296	25/08/00	16:30	CC		6	PS	6
Stark, J. D.	1234	DIFFERENTIAL SUSCEPTIBILITY AMONG LIFE STAGES TO TOXICANTS: IMPLICATIONS FOR EFFECTS ON NON-TARGET INVERTEBRATES	I	312	22/08/00	10:05	HM	N	7	3	7
Stark, J. D.	2625	SELECTIVE PESTICIDES AND WEEDY MARGINS: SYNERGISTIC EFFECTS OF INTEGRATED PEST MANAGEMENT	II	663	21/08/00	16:30	CC		14	PS	14
Starr, C. K.	3553	WHY ARE THERE NO PESTICIDE-RESISTANT SOCIAL INSECTS? IN MEMORY OF U. EUGENE BRADY (1933-1989)	II	896	25/08/00	16:30	CC		19	PS	19
Staten, R. T.	2541	REGIONAL MAMANGEMENT AND ERADICATION OF INSECT PESTS IN ANNUAL SYSTEMS	II	642	21/08/00	10:35	HB	B	14	1	14
Stathas, G. J.	1176	THE BLACK SCALE OF GRAPES TARGIONIA VITIS IN GREECE	I	296	25/08/00	16:30	CC		6	PS	6
Stauber, M.	3072	EVOLUTION OF THE BICOID GENE IN DIPTERAN INSECTS	II	775	24/08/00	13:30	HB	G	16	6	16
Staubli, F.	2340	REVERSED PHARMACOLOGY IN INSECTS: FINDING NOVEL ORPHAN G PROTEIN-COUPLED RECEPTORS AND THEIR LIGANDS	II	591	21/08/00	10:55	HB	I	13	1	13
Staudt, J. A.	1313	A SUSTAINABLE AND ECONOMICAL INSECTICIDAL MANAGEMENT PROGRAM ON COTTON IN BRAZIL	I	331	21/08/00	16:30	CC		7	PS	7
Stavisky, J.	2828	EFFECTS OF INFECTION BY THE PARASITIC NEMATODE THRIPINEMA FUSCUM ON FRANKLINIELLA FUSCA POPULATION DYNAMICS AND TOSPOVIRUS EPIDEMIOLOGY IN PEANUT	II	714	25/08/00	16:30	CC		14	PS	14
Stavridis, D. G.	2111	EFFICACY OF SPINOSAD NATURALYTE INSECT CONTROL AGAINST LOBESIA BOTRANA (LEPIDOPTERA: TORTRICIDAE) ON GREEK VINEYARDS	I	532	23/08/00	16:30	CC		11	PS	11
Stay, B.	3047	ALLATOSTATINS AND THE REGULATION OF THE CORPORA ALLATA IN A COCKROACH	II	769	22/08/00	11:05	HB	G	16	2	16
Steele, J. E.	2513	ACTIVATION OF PHOSPHOLIPASE A2 IN COCKROACH (PERIPLANETA AMERICANA) FAT BODY BY HYPERTREHALOSEMIC HORMONE	II	635	25/08/00	16:30	CC		13	PS	13
Steffens, R.	1274	PERFORMANCE OF THIACLOPRID, A NEW FOLIAR APPLIED INSECTICIDE IN THE USA	I	322	25/08/00	11:35	HM	N	7	9	7
Steffey, K. L.	159	CROP ROTATION COLLAPSES AS A VIABLE PEST MANAGEMENT STRATEGY FOR WESTERN CORN ROOTWORMS, DIABROTICA VIRGIFERA VIRGIFERA LECONTE, IN THE EASTERN CORN BELT OF THE USA	I	41	26/08/00	14:05	HB	A	2	11	2
Steger, E.	303	INSECTS RELATED TO BEAN AND CUCUMBER INTERCROPPING CULTURE IN MISIONES, ARGENTINA	I	77	25/08/00	16:30	CC		2	PS	2
Steib, B.	2980	L-LACTIC ACID IS AN IMPORTANT HOST STIMULUS FOR THE ANTHROPOPHILIC ANOPHELES GAMBIAE S.S.	II	752	22/08/00	16:30	CC		15	PS	15
Steidle, J. L. M.	1669	SUITABILITY OF AUSTRALIAN TRICHOGRAMMA SPECIES (HYMENOPTERA: TRICHOGRAMMATIDAE) FOR BIOLOGICAL CONTROL OF STORED PRODUCT MOTHS	I	421	25/08/00	16:30	CC		8	PS	8
Steidle, J. L. M.	1670	FORAGING CUES FROM DIFFERENT HOSTS USED BY THE GENERALIST PARASITOID LARIOPHAGUS DISTINGUENDUS (HYMENOPTERA: PTEROMALIDAE)	I	421	25/08/00	16:30	CC		8	PS	8

Sub-titles: (HB=Hotel Bourbon) - (HM=Hotel Mabu) - (CC=Convention Center) - (Bol=Foz Boulevard) - (PS=Poster Session) - (PL=Plenary Lecturer)

AUTHOR	Nº	TITLE	Book	Page	Date	Time	Local	Room	Session	Symp	New Session
Steidle, J. L. M.	4014	FECUNDITY AND HOST FINDING ABILITY OF LARIOPHAGUS DISTINGUENDUS (HYMENOPTERA: PTEROMALIDAE), A POTENTIAL CANDIDATE TO CONTROL THE GRANARY WEEVIL SITOPHILUS GRANARIUS (COLEOPTERA: CURCULIONIDAE)	II	1014	22/08/00	9:35	HB	J	23	3	23
Stein, C. P.	2739	ENVIRONMENT PROTECTION THROUGH RESISTANT POTATO: RESEARCH, EDUCATION AND DELIVERING INFORMATION IN BRAZIL	II	692	23/08/00	16:30	CC		14	PS	14
Stein, C. P.	1177	BIOLOGICAL ASPECTS OF ZAPRIONUS INDIANUS, A NEW PEST OF FICUS CARICA IN VALINHOS, SÃO PAULO, BRAZIL	I	297	25/08/00	16:30	CC		6	PS	6
Stein, C. P.	1178	SURVEY OF VECTORS SHARPSHOOPERS OF XYLELLA FASTIDIOSA IN COFFEE PLANTATIONS IN SÃO PAULO STATE, BRAZIL	I	297	25/08/00	16:30	CC		6	PS	6
Stein, C. P.	2829	ANTIBIOSIS OF POTATO CLONES TO POTATO TUBER MOTH	II	714	24/08/00	16:30	CC		14	PS	14
Stein, J.	1288	AN INDUSTRY INSECT RESISTANCE MANAGEMENT PLAN FOR BT CORN	I	325	26/08/00	10:25	HM	N	7	11	7
Steinbrecht, R. A.	3051	STRUCTURE AND FUNCTION OF THE ADULT INSECT ANTENNA	II	770	22/08/00	14:35	HB	G	16	3	16
Steindel, M.	3161	ULTRASTRUCTURAL STUDIES ON THE SALIVARY GLANDS OF RHODNIUS DOMESTICUS, R. PROLIXUS AND TRIATOMA INFESTANS (HEMIPTERA: REDUVIIDAE)	II	797	23/08/00	16:30	CC		16	PS	16
Steinemann, A.	1323	UPTAKE AND DISTRIBUTION OF THIAMETHOXAM AFTER SEED TREATMENT	I	334	22/08/00	16:30	CC		7	PS	7
Steiner, J.	1219	UNUSUAL NEST SUBSTRATE OF AN AUGOCHLORINE BEE WITH DESCRIPTION OF NEST STRUCTURE AND POLLEN RESOURCES	I	307	25/08/00	16:30	CC		6	PS	6
Steinke, W. E.	289	DO INVERSIONS INCREASE SPRAY DRIFT	I	73	23/08/00	16:30	CC		2	PS	2
Steinkraus, D. C.	271	DEVELOPMENT OF AN EXTENSION-BASED SAMPLING SERVICE FOR COTTON APHID FUNGUS, NEOZYGITES FRESENII	I	69	23/08/00	16:30	CC		2	PS	2
Stejskal, V.	4109	THE EXTRACTION OF PYRALID EGGS FROM FLOUR: THE EFFECTIVENESS AND IMPACT ON EGG EXTERNAL MORPHOLOGY	II	1037	25/08/00	16:30	CC		23	PS	23
Stejskal, V.	2729	DETERMINATION OF EGGS OF STORED PRODUCT BEETLES (COLEOPTERA: SILVANIDAE, CUCUJIDAE) ACCORDING TO THEIR EXTERNAL MORPHOLOGY	II	689	23/08/00	16:30	CC		14	PS	14
Stelinski, L. S.	264	APPLICATION OF BIODEGRADABLE, SUGAR-STARCH SPHERES TREATED WITH REDUCED-RISK INSECTICIDES FOR MANAGEMENT OF KEY RHAGOLETIS SPECIES	I	67	23/08/00	16:30	CC		2	PS	2
Stephen, F. M.	1818	EFFECTS OF A MULTI-YEAR GYPSY MOTH ERADICATION PROGRAM ON DIVERSITY OF NONTARGET FOREST CANOPY ARTHROPODS AND THEIR BIRD PREDATORS IN THE OZARK MOUNTAINS	I	458	21/08/00	14:20	HB	M	10	1	10
Stevens, J. R.	2939	GENETIC RELATIONSHIPS BETWEEN CALLIPHORIDAE OF FORENSIC IMPORTANCE	II	742	26/08/00	9:35	Bol	R	15	11	15
Stevens, J. R.	1263	A HITCH-HIKER'S GUIDE TO RESISTANCE IN THE SHEEP BLOWFLY	I	319	24/08/00	14:50	HM	N	7	8	7
Stevens, M. M.	2512	PALATABILITY OF BAIT MATRICES AND MATRIX/TOXICANT COMBINATIONS TO IRIDOMYRMEX PURPUREUS AND I.RUFONIGER GP SP. (HYMENOPTERA: FORMICIDAE)	II	634	25/08/00	16:30	CC		13	PS	13
Stevens, M. M.	2602	IPM IN AUSTRALIAN RICE FIELDS – BALANCING AGRICULTURAL AND ENVIRONMENTAL REQUIREMENTS	II	657	25/08/00	15:00	HB	B	14	8	14
Stevenson, P. C.	684	REPELLENT PROPERTIES OF CASSIA SOPHERA (CAESALPINIACEAE) AGAINST THE RICE WEEVIL SITOPHILUS ORYZAE (COLEOPTERA; CURCULIONIDAE); POTENTIAL AS A STORAGE PROTECTANT	I	173	23/08/00	16:30	CC		4	PS	4
Stevenson, R. D.	779	A SOFTWARE ENGINEERING PERSPECTIVE ON DEVELOPING ELECTRONIC FIELD GUIDES: LESSONS FOR BIOINFORMATICS	I	197	24/08/00	15:00	Bol	T	5	5	5
Stevenson, R. D.	791	DEVELOPING ELECTRONIC FIELD GUIDES: FIRST RESULTS USING COSTA RICAN BUTTERFLIES AND MASSACHUSETTS AQUATIC MACROINVERTEBRATES	I	200	23/08/00	16:30	CC		5	PS	5
Stevenson, R. D.	1179	ALTITUDINAL MIGRATIONS OF BUTTERFLIES AND OTHER INSECTS IN NORTHWESTERN COSTA RICA: ECOLOGY AND CONSERVATION	I	297	24/08/00	11:00	HB	F	6	3	6
Stewart, F.	1447	DEVELOPMENT AND IMPLEMENTATION OF AN AUTOMATED SYSTEM FOR MASS REARING PINK BOLLWORM (PECTINOPHORA GOSSYPIELLA)	I	365	22/08/00	15:20	HM	O	8	4	8
Stewart, K.	1642	SURVIVAL AND FECUNDITY OF ANAGYRUS KAMALI (ENCYRTIDAE) UNDER DIFFERENT STORAGE CONDITIONS	I	414	24/08/00	16:30	CC		8	PS	8
Stewart, R. R.	618	REGULATORY ISSUES IN THE COMMERCIAL DEVELOPMENT OF PHEROMONES AND OTHER SEMIOCHEMICALS – GLOBAL ASPECTS	I	156	24/08/00	16:00	Bol	S	4	6	4
Stewart, S.	981	NEST DYNAMICS OF POLYGYNE COLONIES OF THE SOUTHEASTERN YELLOWJACKET.	I	248	23/08/00	16:30	CC		6	PS	6
Stijlemans, B.	2362	EVIDENCE FOR PHENOLOXIDASE ACTIVITY IN EARTHWORMS	II	597	23/08/00	13:50	HB	I	13	5	13
Stimac, J. L.	2007	MICROBIAL CONTROL OF ANTS WITH FUNGI	I	506	22/08/00	15:35	HM	P	11	4	11
Stinner, B.R.	124	CONSERVATION TILLAGE: PHYSICAL CONTROL AT THE LANDSCAPE SCALE	I	32	21/08/00	16:30	CC		2	PS	2
Stoel, C.D. van der	1118	LINKING MULTITROPHIC INTERACTIONS ABOVE-BELOWGROUND	I	282	24/08/00	16:30	CC		6	PS	6
Stoffolano, J.	1033	STRUCTURE OF THE CROP IN THE ADULT QUEEN BLOWFLY, PHORMIA REGINA	I	261	23/08/00	16:30	CC		6	PS	6
Stoffolano, J.	3149	STRUCTURE OF THE CROP IN THE ADULT QUEEN BLOWFLY, PHORMIA REGINA	II	794	24/08/00	16:30	CC		16	PS	16
Stoffolano, J. G.	2370	RELATIONSHIP BETWEEN NUTRITION, ENDOCRINES, INSECT REPRODUCTION AND FEEDING BEHAVIOR	II	599	24/08/00	11:20	HB	I	13	6	13
Stoffolano, J. G.	758	USING INSECTS IN THE CLASSROOM: A DISTANCE LEARNING COURSE	I	191	22/08/00	15:05	Bol	T	5	3	5
Stone, N. D.	652	THE SOUTHERN PINE BEETLE INTERNET CONTROL CENTER: AN INTERACTIVE INTEGRATED PEST MANAGEMENT WEB-SITE	I	165	24/08/00	16:30	CC		4	PS	4
Stork, N.	1812	INSECT DIVERSITY AND TROPICAL RAINFOREST MANAGEMENT	I	457	21/08/00	10:20	HB	M	10	1	10
Stork, N. E.	402	ABUNDANCE, DIVERSITY AND SEASONALITY OF ARTHROPODA ASSOCIATED WITH THE SAPOTACEAE AND LECITHIDACEAE TREE CANOPIES AT THE ADOLPHO DUCKE FOREST RESERVE, MANAUS, AMAZONAS, BRAZIL. PRELIMINARY FINDING.	I	102	22/08/00	16:20	HB	C	3	2	3
Stork, N. E.	1811	INSECTS IN THE TROPICAL LAND-USE MOSAIC – THE IMPACT OF AGRICULTURAL AND FOREST DEVELOPMENT	I	457	21/08/00	9:50	HB	M	10	1	10
Stork, N. E.	391	GROUND BEETLE COMMUNITIES (COLEOPTERA, CARABIDAE) AT FRUIT FALLS IN A TERRA FIRME RAINFOREST NEAR MANAUS (AMAZONIA) - A FIRST REVIEW	I	99	22/08/00	11:35	HB	C	3	2	3
Story, H. M.	3554	NUTRIENT DISTRIBUTION IN SOLENOPSIS INVICTA	II	897	25/08/00	16:30	CC		19	PS	19
Stoughton, T. E.	289	DO INVERSIONS INCREASE SPRAY DRIFT	I	73	23/08/00	16:30	CC		2	PS	2
Stout, J. C.	3555	EFFICIENT FORAGING BY BUMBLEBEES: THE ROLE OF REPELLENT SCENT MARKS	II	897	25/08/00	16:30	CC		19	PS	19
Stout, J. C.	3496	IMPACT OF ALIEN SOCIAL BEES ON TASMANIAN FLORA AND FAUNA	II	882	23/08/00	16:30	CC		19	PS	19
Stouthamer, R.	727	CHARACTERIZATION OF TRICHOGRAMMA FEMALE VOLATILES LIKELY INVOLVED IN COURTSHIP BEHAVIOUR AND THEIR POTENTIAL USE IN TAXONOMY	I	184	25/08/00	16:30	CC		4	PS	4
Stouthamer, R.	1507	MOLECULAR KEY TO SOME BRAZILIAN SPECIES OF TRICHOGRAMMA USING ITS2 SEQUENCES AND RESTRICTION ANALYSIS	I	380	21/08/00	16:30	CC		8	PS	8
Stouthamer, R.	2238	IDENTIFICATION OF TRICHOGRAMMA BASED ON THE SEQUENCE OF THE ITS2 REGION OF THE rDNA, WITH A NEW RECORD FROM BRAZIL	I	565	22/08/00	16:30	CC		12	PS	12
Stowell, S. L.	3017	VACCINE DELIVERY BY TRANSGENIC HAEMATOPHAGOUS INSECTS - A MODEL SYSTEM	II	761	25/08/00	16:30	CC		15	PS	15
Strand, M. R.	2371	THE ROLE OF POLYDNAVIRUSES IN DEFINING PARASITOID HOST RANGES	II	599	24/08/00	13:35	HB	I	13	7	13
Strand, M. R.	2412	REGULATION OF CASTE FATE IN POLYEMBRYONIC WASPS	II	609	21/08/00	16:30	CC		13	PS	13
Strand, M. R.	3069	SHIFTS IN THE LIFE HISTORY OF PARASITIC WASPS CORRELATE WITH ALTERATIONS IN EARLY DEVELOPMENT	II	774	24/08/00	10:45	HB	G	16	6	16
Strand, M. R.	3295	SHIFTS IN THE LIFE HISTORY OF PARASITIC WASPS CORRELATE WITH ALTERATIONS IN EARLY DEVELOPMENT	II	832	25/08/00	14:30	HB	K	18	6	18
Strand, M. R.	1007	ADAPTIVE CASTE MANIPULATION BY A POLEMBRYONIC PARASITOID WASP	I	254	22/08/00	16:30	CC		6	PS	6

Sub-titles: (HB=Hotel Bourbon) - (HM=Hotel Mabu) - (CC=Convention Center) - (Bol=Foz Boulevard) - (PS=Poster Session) - (PL=Plenary Lecturer)

AUTHOR	Nº	TITLE	Book	Page	Date	Time	Local	Room	Session	Symp	New Session
Strand, M. R.	2376	THE ROLE OF PLASMATOCYTE SPREADING PEPTIDE IN REGULATION OF ENCAPSULATION	II	600	24/08/00	16:05	HB	I	13	7	13
Strand, M. R.	3068	REGULATION OF CASTE FATE IN POLYEMBRYONIC WASPS	II	774	24/08/00	10:30	HB	G	16	6	16
Stratikopoulos, E.	3976	A CENTROMERE-SPECIFIC CLONE IN THE MEDFLY, CERATITIS CAPITATA	II	1003	24/08/00	16:30	CC		22	PS	22
Stratikopoulos, E.	787	MICROSATELLITE MARKERS OF TWO AGRICULTURAL PESTS, THE MEDFLY, CERATITIS CAPITATA AND THE OLIVE FLY, BACTROCERA OLEAE	I	199	22/08/00	16:30	CC		5	PS	5
Stravopodisa, D. J.	3042	STAGE SPECIFIC APOPTOTIC PATTERNS DURING DROSOPHILA OOGENESIS	II	768	21/08/00	15:30	HB	G	16	1	16
Strazanac, J.	1877	MACROLEPIDOPTERA OF EASTERN NORTH AMERICAN DECIDUOUS FORESTS: ASSOCIATIONS WITH HOST TREES AND PARASITOIDS IN THE CENTRAL APPALACHIAN MOUNTAINS	I	473	25/08/00	15:05	HB	M	10	8	10
Strey, A.	3251	MIMETIC ANALOGS OF REPRODUCTIVE/DEVELOPMENTAL INSECT NEUROPEPTIDES WITH ENHANCED CUTICLE PENETRABILITY AND/OR PEPTIDASE-RESISTANCE	II	821	21/08/00	10:05	HB	K	18	1	18
Strieder, M. N.	3845	TAXONOMY OF SIMULIUM (PSARONIOCOMPSA) (DIPTERA, SIMULIIDAE) IN THE SOURTHERN REGION OF BRAZIL AND ARGENTINA, WITH A NEW SPECIES DESCRIPTION	II	970	25/08/00	16:30	CC		21	PS	21
Strieder, M. N.	473	THE INFLUENCE OF ORGANIC MATTER ON THE DIVERSITY OF SIMULIDAE ON THE MICROBASIN OF LAGEADO DOS FRAGOSOS IN CONCÓRDIA, SANTA CATARINA STATE, BRAZIL	I	120	21/08/00	16:30	CC		3	PS	3
Strüh, N.	1753	THE LANGUAGE AND DIALECTS OF THE SOUTHERN GREEN STINK BUG NEZARA VIRIDULA, AN INSECT WHICH COMMUNICATES THROUGH PLANTS	I	442	21/08/00	16:30	CC		9	PS	9
Strohm, E.	695	SEX AND CRIME IN A BEETLE: FEMALE CHOICE AND DEADLY MALE - MALE AGGRESSION IN MALACHIUS BIPUSTULATUS	I	176	24/08/00	16:30	CC		4	PS	4
Stroinski, A.	3612	THE NEW WORLD ACHILIXIIDAE & RICANIIDAE (HEMIPTERA: FULGOROMORPHA)	II	912	21/08/00	10:20	HB	E	21	1	21
Strokovskaya, L.	2099	GENETIC CHARACTERIZATION OF BACULOVIRUS SsMNPV, A PATHOGEN OF STILPNOTIA SALICIS (LYMANTRIIDAE) ISOLATED IN POLAND	I	529	23/08/00	16:30	CC		11	PS	11
Stuart, J. J.	2308	MOLECULAR GENETIC MAPPING IN THE HESSIAN FLY	I	582	24/08/00	16:30	CC		12	PS	12
Stülp, M.	174	EFFICIENCY OF INSECTICIDES IN THE CONTROL OF THRIPS, FRANKLINIELLA SCHULZEI, IN COTTON CROP	I	45	22/08/00	16:30	CC		2	PS	2
Stumpf, N.	1405	BIOCHEMICAL MECHANISMS OF RESISTANCE IN TETRANYCHUS URTICAE	I	354	25/08/00	16:30	CC		7	PS	7
Stumpner, A.	1729	PROCESSING OF CARRIER FREQUENCY AND SIGNAL EVOLUTION IN SOME BARBITISTINI (ENSIFERA)	I	436	22/08/00	15:00	HB	F	9	3	9
Styer, L. M.	2889	BIODEMOGRAPHIC AND EPIDEMIOLOGIC CONSEQUENCES OF MORTALITY IN THE YELLOW FEVER MOSQUITO	II	729	22/08/00	14:20	Bol	R	15	4	15
Stys, P.	3186	CORRELATION BETWEEN COMPLEXITY OF MALE AND SIMPLICITY OF FEMALE GENITALIA IN THE TWO BASAL CLADES OF HETEROPTERA (ENICOCEPHALOMORPHA, DIPSOCOROMORPHA)	II	804	25/08/00	16:30	CC		16	PS	16
Stys, P.	3636	THE ENIGMATIC "ARROW-HEADED BUG" FROM AUSTRALIA (HETEROPTERA: PENTATOMOIDEA) AND ITS RELATIONSHIP	II	918	22/08/00	11:50	HB	E	21	3	21
Su, N. Y.	3396	NOVEL TECHNOLOGIES FOR SUBTERRANEAN TERMITE CONTROL	II	857	21/08/00	14:00	HM	Q	19	1	19
Su, N-Y.	1067	AGONISTIC BEHAVIOR BETWEEN COLONIES OF THE FORMOSAN SUBTERRANEAN TERMITE, COPTOTERMES FORMOSANUS (ISOPTERA: RHINOTERMITIDAE), FROM LOUIS ARMSTRONG PARK, NEW ORLEANS, LOUISIANA	I	269	23/08/00	16:30	CC		6	PS	6
Su, Y.C.	2258	DIFFERENTIATION AND IDENTIFICATION OF AEDES AEGYPTI POPULATIONS IN TAIWAN	I	570	22/08/00	16:30	CC		12	PS	12
Suarez, A. A.	228	EFFECT OF PREVENTIVE INSECTICIDES ON SITOPHILUS SPP (COLEOPTERA: CURCULIONIDAE)	I	58	22/08/00	16:30	CC		2	PS	2
Suarez, A. A.	327	IMPACT OF DIURAPHIS NOXIA (HOMOPTERA: APHIDIDAE) ON WHEAT YIELD	I	83	22/08/00	16:30	CC		2	PS	2
Suarez, A. A.	649	INSECTICIDE ACTIVITY OF COTTON CRUDE OIL ON ADULTS OF CYDIA POMONELLA (LEPIDOPTERA:TORTRICIDAE)	I	164	23/08/00	16:30	CC		4	PS	4
Suarez, A. A.	949	REPRODUCTION OF SITOPHILUS SPP. (COLEOPTERA: CURCULIONIDAE) ON DIFFERENT WHEAT CULTIVARS	I	240	25/08/00	16:30	CC		6	PS	6
Suarez, A. A.	1125	REPRODUCTION OF DIURAPHIS NOXIA (HOMOPTERA: APHIDIDAE) ON DIFFERENT WINTER CEREALS	I	284	25/08/00	16:30	CC		6	PS	6
Suarez, A. A.	1314	INSECTICIDES TOXICITY TO DIURAPHIS NOXIA (HOMOPTERA:APHIDIDAE)	I	332	21/08/00	16:30	CC		7	PS	7
Suarez, A. A.	1315	TOXICITY OF DELTAMETRIN TO A STRAIN OF TRIBOLIUM CASTANEUM (COLEOPTERA: TENEBRIONIDAE)	I	332	21/08/00	16:30	CC		7	PS	7
Suárez, M.	702	VOLATILE BIOACTIVE CONSTITUENTS FROM THE FLOWERS OF TAGETES ZYPAQUIRENSIS (ASTERACEAE)	I	177	24/08/00	16:30	CC		4	PS	4
Suasa-ard, W.	1671	UTILIZATION OF EOCANTHECONA FURCELLATA (HEMIPTERA: PENTATOMIDAE) FOR AUGMENTATIVE BIOLOGICAL CONTROL OF COMMON CUTWORM SPODOPTERA LITURA IN TARO FIELD IN THAILAND	I	421	25/08/00	16:30	CC		8	PS	8
Suasa-ard, W.	1672	NATURAL ENEMY COMPLEX OF THRIPS PALMI IN THAILAND	I	421	25/08/00	16:30	CC		8	PS	8
Subramanya, G.	70	TOXIC AND MUTAGENIC EFFECTS OF A FEW CARBAMATE PESTICIDES ON SILKWORM BOMBYX MORI	I	18	25/08/00	16:30	CC		1	PS	1
Subramanyam, B.	4110	MODELING TEMPERATURE CHANGES DURING HEAT TREATMENT OF FLOUR MILLS FOR INSECT CONTROL	II	1038	25/08/00	16:30	CC		23	PS	23
Subramanyam, Bh.	2778	EFFECTS OF AGE AND SEX ON MORTALITY OF TRIBOLIUM CASTANEUM EXPOSED TO WHEAT TREATED WITH DIATOMACEOUS EARTH	II	701	24/08/00	16:30	CC		14	PS	14
Sucheta	3792	BIOSYSTEMATICS OF SOME SPECIES OF AGROTIS OCHSENHEIMER (NOCTUINAE: NOCTUIDAE: LEPIDOPTERA) FROM NORTH INDIA	II	957	23/08/00	16:30	CC		21	PS	21
Suckling, D. M.	3877	LURE AND KILL FOR PEST MANAGEMENT IN ORCHARDS	II	979	21/08/00	15:30	HB	H	22	1	22
Suckling, D. M.	130	TOWARDS INSECTICIDE-FREE VITICULTURE IN AUSTRALIA AND NEW ZEALAND	I	34	24/08/00	13:30	HB	A	2	8	2
Suckling, D. M.	1260	THE IMPACT OF POLYPHAGOUS INSECT DISPERSAL ON DEPLOYMENT DECISIONS FOR TRANSGENIC CROPS	I	318	24/08/00	14:05	HM	N	7	8	7
Suckling, D. M.	1259	EXPLAINING THE NON-COFFEE DRINKERS: DO WE KNOW WHY SOME ORCHARD PESTS EVOLVE RESISTANCE AND SOME DON'T?	I	318	24/08/00	13:50	HM	N	7	8	7
Sudarshana, M. R.	3214	DO GEMINIVIRUSES LEAD A DUAL LIFE STYLE: MOVEMENT WITHIN THE PLANT VS. PLANT-TO-PLANT	II	811	22/08/00	15:00	Bol	U	17	2	17
Suderman, R.	2385	OXIDATIVE CONJUGATION OF CATECHOLS FOR INSECT CUTICLE SCLEROTIZATION	II	603	25/08/00	15:20	HB	I	13	9	13
Suderman, R.	2454	OXIDATIVE CONJUGATION OF CATECHOLS FOR INSECT CUTICLE SCLEROTIZATION	II	620	23/08/00	16:30	CC		13	PS	13
Sugawaki, T.	3267	GENOMICS OF REPRODUCTION AND DIAPAUSE IN BOMBYX MORI	II	825	22/08/00	11:35	HB	K	18	2	18
Sugasaki, T.	3262	RECENT PROGRESS IN GENOMIC MAPPING IN BOMBYX MORI: WHERE SHOULD WE GO FROM HERE?	II	824	22/08/00	9:35	HB	K	18	2	18
Sugasaki, T.	2295	A HOMOLOGUE OF THE DROSOPHILA MELANOGASTER SEX- DETERMINING GENE DOUBLESEX IS TRANSCRIBED INTO SEX-SPECIFIC ISOFORMES IN THE SILKWORM, BOMBYX MORI	I	579	24/08/00	16:30	CC		12	PS	12
Sugayama, R.	693	MANAGING TEMPERATE FRUIT PESTS IN BRAZIL USING SEMIOCHEMICALS	I	175	23/08/00	16:30	CC		4	PS	4
Sugayama, R. L.	2728	TECHNICAL AND ECONOMICAL FEASIBILITY OF ERADICATING THE CODLING MOTH FROM THE BRAZILIAN APPLE GROWING AREA	II	689	24/08/00	16:30	CC		14	PS	14

Sub-titles: (HB=Hotel Bourbon) - (HM=Hotel Mabu) - (CC=Convention Center) - (Bol=Foz Boulevard) - (PS=Poster Session) - (PL=Plenary Lecturer)

AUTHOR	Nº	TITLE	Book	Page	Date	Time	Local	Room	Session	Symp	New Session
Sugie, H.	3875	DEVELOPMENT OF A STRAIN OF THE SMALLER TEA TORTRIX, ADOXOPHYES HONMAI (LEPIDOPTERA: TORTRICIDAE) RESISTANT TO A MATING DISRUPTANT IN JAPAN	II	978	21/08/00	14:30	HB	H	22	1	22
Sugie, H.	259	STICKY NET CYLINDER TRAP FOR THE RICE LEAF BUG, TRIGONOTYLUS CAELESTIALIUM (HETEROPTERA: MIRIDAE)	I	66	23/08/00	16:30	CC		2	PS	2
Sugimoto, A.	559	SPECIES DIVERSITY AND FUNCTIONAL DIVERSITY OF TERMITES IN EASTERN ASIA	I	141	25/08/00	16:30	CC		3	PS	3
Sugimoto, M.	3846	EVOLUTIONAL ASPECTS OF A WINGLESS AND LEGLESS FEMALES IN THE FAMILY PSYCHIDAE (LEPIDOPTERA)	II	971	25/08/00	16:30	CC		21	PS	21
Sugimoto, T.	1673	ATTEMPTS OF USING INDIGENOUS PARASITOIDS AS A CONTROL AGENT TO LIRIOMYZA TRIFOLII IN GREENHOUSES IN JAPAN	I	422	25/08/00	16:30	CC		8	PS	8
Sugiura, T.	1093	AN ENTOMOFAUNA STUDY RELATED TO THE GROWING OF THE JAPANESE PEAR, VARIETIES (HOUSUI, KOUSUI AND NIJISEIKI), IN SANTA CATARINA STATE, BRAZIL	I	276	24/08/00	16:30	CC		6	PS	6
Sugumaran, M.	2384	COMPARATIVE BIOCHEMISTRY OF CUTICLE SCLEROTIZATION AND DEFENSE REACTIONS	II	602	25/08/00	14:50	HB	I	13	9	13
Suinaga, F. A.	732	LIFE TABLES OF THE CULTURES APPLIED TO PESTS OF MAIZE UNDER INTERCROPPED CULTIVATION	I	185	25/08/00	16:30	CC		4	PS	4
Sujazov, A. V.	362	ALLOCATION OF ARTHROPODS IN WINTER WHEAT CROP AND AROUND IT	I	92	25/08/00	16:30	CC		2	PS	2
Sujii, E. R.	2154	INTEGRATED SYSTEM TO SIMULATE THE IMPACT OF THE FUNGUS NOMURAEA RILEYI ON BRAZILIAN ANTICARSIA GEMMATALIS POPULATIONS	I	543	25/08/00	16:30	CC		11	PS	11
Sujii, E. R.	3373	EFFECT OF FOOD QUALITY ON THE FECUNDITY OF SPITTLEBUG	II	852	22/08/00	16:30	CC		18	PS	18
Sujii, E. R.	299	BIONOMY OF THE BOLL WEVILL REARED ON ARTIFICIAL DIET	I	76	24/08/00	16:30	CC		2	PS	2
Sujii, E. R.	1110	DRY-SEASON EMBRIONIC DORMANCY IN DEOIS FLAVOPICTA (HOMOPTERA: CERCOPIDAE): ROLES OF TEMPERATURE AND MOISTURE IN NATURE	I	280	24/08/00	16:30	CC		6	PS	6
Sujii, E. R.	1111	FEEDING BEHAVIOR OF THE SPITTLEBUG DEOIS FLAVOPICTA (HOMOPTERA: CERCOPIDAE) ON WILD AND CULTIVATED HOST PLANT	I	280	24/08/00	16:30	CC		6	PS	6
Sujii, E. R.	977	PHENOTYPIC PLASTICITY IN DEOIS FLAVOPICTA - VARIATION IN THE DRY SEASON DORMANCY AMONG FAMILIES AND AMONG GEOGRAPHICALLY ISOLATED POPULATIONS	I	247	22/08/00	16:30	CC		6	PS	6
Sukirno	1042	DEFORESTATION, DROUGHT AND EXCEPTIONAL OUTBREAKS OF THE ORIENTAL MIGRATORY LOCUST, LOCUSTA MIGRATORIA MANILENSIS (MEYEN 1835) IN INDONESIA	I	263	23/08/00	16:30	CC		6	PS	6
Sullivan, T. J.	963	MUTUALISM GONE AWRY? LACK OF HERBIVORE RESISTANCE IN NEOTYPHODIUM INFECTED GRASSES	I	243	22/08/00	16:30	CC		6	PS	6
Suma, P.	331	SCALE INSECTS OF CITRUS IN ITALY (HOMOPTERA COCCOIDEA)	I	84	24/08/00	16:30	CC		2	PS	2
Sumida, M.	3556	AN INVITATION: MORE FRESH COCOONS FOR A COMPLETELY NEW USE OF SERICIN AND FIBROIN AND SILKWORM PUPAE, AN URGENT NEED FOR A NEW INDUSTRIAL SYSTEM OF SERICULTURE IN THE 21ST CENTURY	II	897	25/08/00	16:30	CC		19	PS	19
Sumner, S. R.	3430	MATING SYSTEM EVOLUTION IN ATTINE FUNGUS GROWING ANTS	II	866	23/08/00	10:50	HM	Q	19	4	19
Sun, D.	2513	ACTIVATION OF PHOSPHOLIPASE A2 IN COCKROACH (PERIPLANETA AMERICANA) FAT BODY BY HYPERTREHALOSEMIC HORMONE	II	635	25/08/00	16:30	CC		13	PS	13
Sun, G.	3301	ECDYSTEROID-TRIGGERED REGULATORY HIERARCHIES IN INSECT REPRODUCTION	II	834	25/08/00	14:05	HB	K	18	7	18
Sun, J.	3305	OOCYTE RECEPTORS FOR THE SPECIFIC ACCUMULATION OF YOLK PROTEINS	II	835	25/08/00	16:05	HB	K	18	7	18
Sun, J.	2491	OOCYTE RECEPTORS FOR THE SPECIFIC ACCUMULATION OF YOLK PROTEINS	II	629	24/08/00	16:30	CC		13	PS	13
Sun, J. H.	1508	CURRENT STATUS OF THE BIOLOGICAL CONTROL PROGRAM FOR THE MEALYBUG, ORACELLA ACUTA, IN THE PEOPLE'S REPUBLIC OF CHINA	I	380	21/08/00	16:30	CC		8	PS	8
Sun, W.	2308	MOLECULAR GENETIC MAPPING IN THE HESSIAN FLY	I	582	24/08/00	16:30	CC		12	PS	12
Sunnucks, P.	2575	APPLICATIONS OF MOLECULAR ECOLOGY TO IPM – WHAT IMPACT?	II	651	23/08/00	14:00	HB	B	14	5	14
Suomalainen, E.	2195	CYTOGENETICS OF NEOTROPICAL BUTTERFLIES: PATTERNS OF EVOLUTIONARY DIVERSIFICATION IN CHROMOSOME NUMBERS	I	554	23/08/00	11:35	HB	L	12	5	12
Surakarn, R.	2650	INSECTICIDE SPRAYING TECHNIQUES FOR CONTROLLING THE DIAMOND BACK MOTH, PLUTELLA XYLOSTELLA ON CHINESE KALE	II	669	21/08/00	16:30	CC		14	PS	14
Surunyi, R. A.	3240	APHID ALERT: RESEARCH/OUTREACH ADDRESSING POTATO VIRUS PROBLEMS IN THE NORTH CENTRAL U.S.	II	818	24/08/00	16:30	CC		17	PS	17
Suresh, S.	354	PHOSPHAMIDON 40SL AGAINST SUCKING PESTS OF RICE,COTTON AND BRINJAL	I	90	25/08/00	16:30	CC		2	PS	2
Suresh, S.	1406	NEEM DERIVATIVES AGAINST CRAWLERS AND ADULT COCCIDS	I	355	24/08/00	16:30	CC		7	PS	7
Suresh, S.	2830	PEST AND DISEASE MANAGEMANT IN HYBRID RICE	II	714	22/08/00	16:30	CC		14	PS	14
Suresh, S.	2831	RICE CULTURES AGAINST MAJOR PESTS UNDER PROTECTED AND UNPROTECTED CONDITION	II	715	22/08/00	16:30	CC		14	PS	14
Surulivelu, T.	1280	DEVELOPMENT AND APPLICATION OF AN INSECTICIDE RESISTANCE IMPACT MINIMISATION STRATEGY FOR COTTON PEST CONTROL IN INDIA	I	323	25/08/00	15:05	HM	N	7	10	7
Šustr, V.	1180	FEEDING AND METABOLIC RATE OF GALUMNA ELIMATA (ACARI: ORIBATIDA) UNDER DIFFERENT TEMPERATURES	I	297	25/08/00	16:30	CC		6	PS	6
Šustr, V.	1181	INTERACTIONS OF MICROFLORA AND LARVAE OF BIBIONIDS IN TRANSFORMATION OF PLANT LITTER	I	298	25/08/00	16:30	CC		6	PS	6
Šustr, V.	43	THE EFFECT OF STARVATION ON METABOLIC RATE AND MICROANATOMY OF GALUMNA ELIMATA (ACARI: ORIBATIDA)	I	11	23/08/00	16:30	CC		1	PS	1
Sutherland, J. P.	2832	TOWARDS THE INTEGRATED PEST MANAGEMENT OF THE SMALL RICE STINK BUG IN GUYANA: MONITORING	II	715	25/08/00	16:30	CC		14	PS	14
Sutherland, J. P.	2833	THE EFFICACY OF NEEM SEED EXTRACTS AND COMMERCIAL NEEM PRODUCTS IN CONTROLLING THE SMALL RICE STINK BUG	II	715	25/08/00	16:30	CC		14	PS	14
Sutherst, R. W.	762	PEST MANAGEMENT INFORMATION IN AUSTRALIA	I	192	23/08/00	10:35	Bol	T	5	4	5
Sutherst, R. W.	782	MINING GEOGRAPHICAL DATA FOR BIOLOGICAL INFORMATION	I	197	25/08/00	10:05	Bol	T	5	6	5
Sutherst, R. W.	2876	VULNERABILITY OF LIVESTOCK TO ARTHROPOD PARASITES AND VECTOR-BORNE DISEASES UNDER GLOBAL CHANGE	II	726	21/08/00	14:05	Bol	R	15	2	15
Sutherst, R. W.	3990	INTEGRATION OF GLOBAL CHANGE IMPACTS	II	1007	24/08/00	16:30	CC		22	PS	22
Suzuki, Y.	2615	GROWTH STAGE-DEPENDENT RESISTANCE OF RICE PLANT TO THE WHITEBACKED PLANTHOPPER	II	661	21/08/00	16:30	CC		14	PS	14
Suzuki, H.	3789	MOLECULAR PHYLOGENY OF THE JAPANESE AND NEW ZEALAND MICROPTERIGIDAE (LEPIDOPTERA) BASED ON MITOCHONDRIAL GENE SEQUENCES	II	956	23/08/00	16:30	CC		21	PS	21
Suzuki, K.	4128	SYSTEMATIC POSITION OF THE SUBFAMILIES MEGAPODINAE AND MEGASCELINAE (CHRYSOMELIDAE) BASED ON THE COMPARATIVE MORPHOLOGY OF THE INTERNAL REPRODUCTIVE SYSTEM	II	1043	25/08/00	14:00	HM	P	24	2	24
Suzuki, K.	2514	STRUCTURE AND FUNCTION OF SPECIFIC PEPTIDES PRODUCED THROUGHOUT DIAPAUSE OF PHARATE FIRST-INSTAR LARVAE AND ADULTS	II	635	25/08/00	16:30	CC		13	PS	13
Suzuki, K.	3281	STRUCTURE AND FUNCTION OF SPECIFIC PEPTIDES PRODUCED THROUGHOUT DIAPAUSE OF PHARATE FIRST-INSTAR LARVAE AND ADULTS	II	829	23/08/00	10:35	HB	K	18	4	18
Suzuki, K.	2144	BACULOVIRUS-MEDIATED EXPRESSION AND ANTIFUNGAL ACTIVITY OF A DIAPAUSE-SPECIFIC PEPTIDE OF THE ADULT LEAF BEETLE	I	541	25/08/00	16:30	CC		11	PS	11
Suzuki, K.	2515	cDNA AND CHARACTERIZATION OF A SPECIFIC PEPTIDE PRODUCED THROUGHOUT ADULT DIAPAUSE IN THE LEAF BEETLE, GASTROPHYSA ATROCYANEA	II	635	25/08/00	16:30	CC		13	PS	13

Sub-titles: (HB=Hotel Bourbon) - (HM=Hotel Mabu) - (CC=Convention Center) - (Bol=Foz Boulevard) - (PS=Poster Session) - (PL=Plenary Lecturer)

AUTHOR	Nº	TITLE	Book	Page	Date	Time	Local	Room	Session	Symp	New Session
Suzuki, K.	3528	A NOVEL FUNCTION OF THE PARALYTIC PEPTIDE OF THE WILD SILKMOTH ANTHERAEA YAMAMAI (ANY-PARP) FOR DIAPAUSE INDUCTION OF THE SILKWORM BOMBYX MORI	II	890	24/08/00	16:30	CC		19	PS	19
Suzuki, M. G.	2324	SEX-SPECIFIC ALTERNATIVE SPLICING OF THE LEPIDOPTERAN HOMOLOGS OF THE DROSOPHILA MELANOGASTER SEX DETERMINING GENE DOUBLESEX	I	586	25/08/00	16:30	CC		12	PS	12
Suzuki, M. G.	2295	A HOMOLOGUE OF THE DROSOPHILA MELANOGASTER SEX- DETERMINING GENE DOUBLESEX IS TRANSCRIBED INTO SEX-SPECIFIC ISOFORMES IN THE SILKWORM, BOMBYX MORI	I	579	24/08/00	16:30	CC		12	PS	12
Suzuki, M. G.	3510	STRUCTURAL ANALYSIS OF THE Z CHROMOSOME IN BOMBYX MORI BY USING THE BAC LIBRARY	II	886	23/08/00	16:30	CC		19	PS	19
Suzuki, M. G.	3267	GENOMICS OF REPRODUCTION AND DIAPAUSE IN BOMBYX MORI	II	825	22/08/00	11:35	HB	K	18	2	18
Suzuki, M. G.	3266	BOMBYX EST DATABASE, SILKBASE, FOR GENOME ANALYSIS OF BOMBYX MORI	II	825	22/08/00	11:05	HB	K	18	2	18
Suzuki, T.	694	SEMIOCHEMICALS INDUCING DEFENSIVE BEHAVIOR OF APIS CERANA JAPONICA AGAINST VESPA MANDARINA	I	175	23/08/00	16:30	CC		4	PS	4
Suzuki, Y.	1058	ASYMMETRIC INTERSPECIFIC INTERACTION ON WING DIMORPHISM BETWEEN RICE PLANTHOPPERS, SOGATELLA FURCIFERA AND NILAPARVATA LUGENS	I	267	23/08/00	16:30	CC		6	PS	6
Suzuki, Y.	1783	CHARACTERISTICS OF COURTSHIP SONGS IN SEVERAL JAPANESE GREEN LACEWINGS (CHRYSOPIDAE) AND THE CROSSING EXPERIMENTS BETWEEN SOME STRAINS WITH DIFFERENT SONGS	I	449	23/08/00	16:30	CC		9	PS	9
Svane, P.	2340	REVERSED PHARMACOLOGY IN INSECTS: FINDING NOVEL ORPHAN G PROTEIN-COUPLED RECEPTORS AND THEIR LIGANDS	II	591	21/08/00	10:55	HB	I	13	1	13
Svatos, A.	733	IDENTIFICATION OF CAMERARIA OHRIDELLA SEX PHEROMONE AND ITS POSSIBLE USE IN HORSE CHESTNUT PROTECTION	I	185	25/08/00	16:30	CC		4	PS	4
Sved, J. A.	2337	TRACKING AUSTRALIAN FRUIT FLIES USING MICROSATELLITES	I	590	25/08/00	16:30	CC		12	PS	12
Svensson, G. P.	734	PHEROMONE-BASED MATING DISRUPTION OF THE INDIAN MEAL MOTH PLODIA INTERPUNCTELLA (LEPIDOPTERA: PYRALIDAE) USING SINGLE- AND MULTI-COMPONENT BLENDS	I	185	25/08/00	16:30	CC		4	PS	4
Švestka, M.	2128	POINT CONTAMINATION OF GYPSY MOTHS POPULATION BY LdNPV BY MEANS OF PHEROMONE TRAPS	I	537	24/08/00	16:30	CC		11	PS	11
Swai, I.	2825	SURVEY OF PRACTICES AND PERCEPTIONS OF SMALL HOLDER FARMERS RELATING TO PEST MANAGEMENT ON VEGETABLE CROPS IN EASTERN AFRICA	II	713	23/08/00	16:30	CC		14	PS	14
Swallow, J.	1717	MEIOTIC DRIVE, SPERM COMPETITION AND THE EVOLUTION OF MULTIPLE MATING BY FEMALE STALK-EYED FLIES (DIOPSIDAE)	I	433	21/08/00	15:10	HB	F	9	1	9
Swan, K. S.	3916	ASSESSING HOST RANGE OF A GYPSY MOTH PARASITOID: APHANTORHAPHOPSIS SAMARENSIS (DIPTERA: TACHINIDAE)	II	988	25/08/00	14:00	HB	H	22	7	22
Swanson, W. J.	3300	CONTROL OF DROSOPHILA REPRODUCTION BY MALE-DERIVED PROTEINS IN THE SEMINAL FLUID	II	833	25/08/00	13:35	HB	K	18	7	18
Swarbrick, S. L.	1182	RESPONSE OF APHYTIS MELINUS TO AN EXPERIMENTALLY-INDUCED OUTBREAK OF CALIFORNIA RED SCALE	I	298	25/08/00	16:30	CC		6	PS	6
Swarbrick, S. L.	820	INTERSPECIFIC INTERACTIONS, POPULATION DYNAMICS & COMMUNITY STRUCTURE	I	207	22/08/00	13:35	HB	D	6	4	6
Swart, W. J.	3604	PISTACHIO NUT CULTIVATION IN AN ATYPICAL ENVIRONMENT – PATTERN AND PROCESS IN PEST AND DISEASE PREDICTION	II	909	24/08/00	16:30	CC		20	PS	20
Swart, W. J.	3625	WEEVILS AS VECTORS OF PLANT PATHOGENS: A CASE STUDY ON AMARANTH IN SOUTH AFRICA	II	915	21/08/00	15:50	HB	E	21	2	21
Swevers, L.	3304	GENE REGULATION DURING OVARIAN DEVELOPMENT IN THE SILKMOTH	II	834	25/08/00	15:35	HB	K	18	7	18
Swevers, L.	2222	INSECT TRANSGENESIS: BACULOVIRUSES MEET TRANSPOSONS FOR BENEFICIAL INVASIONS	I	561	25/08/00	16:05	HB	L	12	10	12
Swietoslawski, J.	4082	CONTROL OF HOUSE FLIES WITH LARVICIDE AND POISON BAITS	II	1031	22/08/00	16:30	CC		23	PS	23
Sykes, B. D.	3283	WHEN YOU CAN'T FLY TO BRAZIL: SURVIVING WINTER WITH ANTIFREEZE PROTEIN GENES	II	829	23/08/00	11:05	HB	K	18	4	18
Szabó, M. P. J.	3018	ANTIBODY AND BLOOD LEUKOCYTE RESPONSE IN RHIPICEPHALUS SANGUINEUS TICK INFESTED DOGS AND GUINEA PIGS	II	761	25/08/00	16:30	CC		15	PS	15
Szabó, M. P. J.	2985	IXODID TICKS COLLECTED FROM ARMADILLO EUPHRACTUS SEXCINCTUS AND ANTEATER MYRMECOPHAGA TRIDACTYLA AT EMAS NATIONAL PARK, STATE OF GOIÁS, BRAZIL.	II	753	22/08/00	16:30	CC		15	PS	15
Szklarzewicz, T.	3030	OOGENESIS IN SCALE INSECTS (HEMIPTERA, COCCINEA)	II	765	21/08/00	9:45	HB	G	16	1	16
Szklarzewicz, T.	3187	ONTOGENESIS OF THE OVARY OF PORPHYROPHORA POLONICA (INSECTA, HEMIPTERA, COCCINEA: MARGARODIDAE)	II	804	25/08/00	16:30	CC		16	PS	16
Szklarzewicz, T.	3188	STRUCTURE OF OVARIOLES IN ADELGES LARICIS (INSECTA, HEMIPTERA, APHIDINEA: ADELGIDAE)	II	804	25/08/00	16:30	CC		16	PS	16
Szlendak, E.	1467	LIFE HISTORY OF PARASITUS CONSANGUINEUS FED ON THREE SPECIES OF PESTS OCCURRING IN MUSHROOM HOUSES	I	370	24/08/00	14:50	HM	O	8	7	8
Szlendak, E.	4111	MORPHOLOGICAL DESCRIPTION OF HYBRIDS FROM INTER-SPECIFIC CROSSES BETWEEN A. FARRIS AND A. SIRO	II	1038	25/08/00	16:30	CC		23	PS	23
Szolajska, E.	2099	GENETIC CHARACTERIZATION OF BACULOVIRUS SsMNPV, A PATHOGEN OF STILPNOTIA SALICIS (LYMANTRIIDAE) ISOLATED IN POLAND	I	529	23/08/00	16:30	CC		11	PS	11
Szucsich, N. U.	3082	FLIES THAT TAP CONCEALED NECTAR: MORPHOLOGICAL INNOVATIONS OF THE PROBOSCIS IN BOMBYLIIDAE (DIPTERA)	II	778	25/08/00	11:00	HB	G	16	7	16
Szumik, C. A.	3847	PHYLOGENY OF EMBIOPTERA (INSECTA) REVISITED	II	971	25/08/00	16:30	CC		21	PS	21
Szwejda, J.	1183	DYNAMICS OF OCCURRENCE OF CRIOCERIS ASPARAGI (COL., CHRYSOMELIDAE) AS OBSERVED AT AN ASPARAGUS PLANTATION WITHIN A 15 YEARS' LASTING TIME LAPSE	I	298	25/08/00	16:30	CC		6	PS	6
Szyma•ska, B.	3108	THE OVARIES OF CHAULIODIDS, AS THOSE OF CORYDALIDS, ARE PANOISTIC (SECONDARY PANOISTIC)	II	784	21/08/00	16:30	CC		16	PS	16
Szynkarczyk, S.	735	FEEDING BEHAVIOUR OF PEA APHID ON ALFALFA	I	186	23/08/00	16:30	CC		4	PS	4
Szyszko, J.	4157	MALE-TO-FEMALE RATIO IN PTEROSTICHUS OBLONGOPUNCTATUS (CARABIDAE, COL.) AS A INDICATOR OF FOOD CONDITION IN FOREST HABITATS	II	1050	21/08/00	16:30	CC		Erratum	PS	6
Szyszko, J.	4158	TIMBER HARVESTING IN MANAGED FORESTS AND THE POSSIBILITIES FOR RAISING THE RESISTANCE OF PINE STANDS AND PROTECTING THREATENED SPECIES	II	1050	22/08/00	16:30	CC		Erratum	PS	10
Tabaru, Y.	3013	BLOOD SOURCES OF THE TRIATOMINE BUGS COLLECTED AT THE RURAL VILLAGES IN GUATEMALA (HEMIPTERA: TRIATOMIDAE)	II	760	24/08/00	16:30	CC		15	PS	15
Tabashnik, B. E.	1251	PINK BOLLWORM RESISTANCE TO BT COTTON	I	316	23/08/00	15:05	HM	N	7	6	7
Tabashnik, B. E.	1262	RESISTANCE IN DIAMONDBACK MOTH: LESSONS FROM THE HELIOTHINES	I	319	24/08/00	14:35	HM	N	7	8	7
Taboada, M. T.	240	ABUNDANCE OF MESO AND MACROFAUNA IN PAMPEAN HAPLUDOLLS AND ARGIUDOLLS: THE INFLUENCE OF TOPSOIL MACROPOROSITY	I	61	22/08/00	16:30	CC		2	PS	2
Tabone, E.	1626	COEXISTENCE IN ONE FIELD OF DIFFERENT TRICHOGRAMMA SPECIES SHOWING DIFFERENT MODES OF REPRODUCTION AND DIFFERENT LEVELS OF WOLBACHIA INFECTION	I	410	24/08/00	16:30	CC		8	PS	8
Tabunoki, H.	2525	PURIFICATION AND PROPERTIES OF TWO CAROTENOIDS BINDING PROTEINS FROM SILK GLAND OF BOMBYX MORI	II	638	25/08/00	16:30	CC		13	PS	13
Tachuchi, O.	792	SPECIES INFORMATION DATABASE KONCHU ON JAPANESE, EAST ASIAN AND PACIFIC INSECTS, SPIDERS AND MITES ON INTERNET	I	200	23/08/00	16:30	CC		5	PS	5
Taddei, A. R.	3136	BIOLOGY AND FUNCTIONAL MORPHOLOGY OF PACHYTELES LARVAE (COLEOPTERA: CARABIDAE: PAUSSINAE	II	791	22/08/00	16:30	CC		16	PS	16
Tadei, W. P.	1635	EVALUATION OF BIOLOGICAL CONTROL – BACILLUS SPHAERICUS 2362, EFFECTIVENESS AGAINST MALARIA VECTORS IN AMAZONIA	I	412	24/08/00	16:30	CC		8	PS	8

Sub-titles: (HB=Hotel Bourbon) - (HM=Hotel Mabu) - (CC=Convention Center) - (Bol=Foz Boulevard) - (PS=Poster Session) - (PL=Plenary Lecturer)

AUTHOR	Nº	TITLE	Book	Page	Date	Time	Local	Room	Session	Symp	New Session
Tadei, W. P.	3019	ANOPHELES DARLINGI AND MALARIA IN AREAS OF SETTLEMENT IN AMAZÔNIA – MUNICÍPIO DE NOVO AIRÃO (AM)	II	762	25/08/00	16:30	CC		15	PS	15
Tadei, W. P.	3005	DENGUE CONTROL IN MANAUS: LARVAL DENSITY AND PREFERRED CONTAINERS FOR AEDES AEGYPTI	II	758	24/08/00	16:30	CC		15	PS	15
Tadler, A.	3058	SELECTION OF MALE GENITALIA IN THE SEEDBUG LYGAEUS SIMULANS	II	772	23/08/00	10:50	HB	G	16	4	16
Tagami, Y.	2101	DETECTION OF WOLBACHIA FROM ORIUS SPP. IN JAPAN	I	530	23/08/00	16:30	CC		11	PS	11
Tagheri, P. H.	2339	PEPTIDERGIC OUTPUT OF THE CIRCADIAN CLOCK IN DROSOPHILA.	II	591	21/08/00	10:10	HB	I	13	1	13
Taglianti, A. V.	447	CARABIDS OF AFRICA: THE STATE OF THE ART, WITH BIOGEOGRAPHICAL HIGHLIGHTS (COLEOPTERA)	I	113	26/08/00	10:35	HB	C	3	9	3
Taglianti, A. V.	3136	BIOLOGY AND FUNCTIONAL MORPHOLOGY OF PACHYTELES LARVAE (COLEOPTERA: CARABIDAE: PAUSSINAE	II	791	22/08/00	16:30	CC		16	PS	16
Tak sokhan, M.	234	FIRST REPORT ON THE PRESENCE OF MULBERRY THRIPS PSEUDODENDROTHRIPS MORI (THYS., THRIPIDAE) AS A NEW SPECIES FOR INSECT FAUNA OF MULBERRY FIELD OF NORTH OF IRAN	I	60	22/08/00	16:30	CC		2	PS	2
Tak sokhan, M.	962	INVESTIGATION ON HOST PREFERENCE OF PSUEDODENDROTHRIPS MORI (THYS; THRIPIDAE) ON FOUR VARIETIES OF MULBERRY IN THE FIELD AND LABORATORY	I	243	23/08/00	16:30	CC		6	PS	6
Takada, N.	3167	ISOLATION AND COMPARISON OF MARINER-LIKE SEQUENCES (MLSS) AMONG SOME LEPIDOPTERAN INSECTS AND INVERTEBRATES	II	799	24/08/00	16:30	CC		16	PS	16
Takada, N.	3264	RELATIONSHIPS BETWEEN THE LOCATION AND THE RADIATION SENSITIVITY OF RETROTRANSPOSONS IN THE GENOME AND THE INSERTION MECHANISM	II	824	22/08/00	10:20	HB	K	18	2	18
Takahashi	3550	ANTIBIOTIC OLAQUINDOX AS ADDICTIVE IN THE FEEDING OF BOMBYX MORI (LEPIDOPTERA: BOMBYCIDAE)	II	896	25/08/00	16:30	CC		19	PS	19
Takahashi	3551	FEEDING OF BOMBYX MORI WITH ARTIFICIAL DIET AND ITS EFFECT ON THE LARVAL DEVELOPMENT AND THE SILK PRODUCTION	II	896	25/08/00	16:30	CC		19	PS	19
Takahashi, A.	371	MIGRATION-RELATED CHARACTERS OF THE BROWN PLANT-HOPPER, NILAPARVATA LUGENS, COLLECTED IN EAST AND SOUTHEAST ASIA	I	94	25/08/00	16:30	CC		2	PS	2
Takahashi, K. M.	3189	MORPHOMETRIC STUDY OF THE GREEN LACEWING'S WING	II	804	25/08/00	16:30	CC		16	PS	16
Takahashi, M.	3388	RECENT DEVELOPMENT IN THE CONTROL OF JAPANESE SUBTERRANEAN TERMITES	II	855	21/08/00	10:20	HM	Q	19	1	19
Takahashi, O.	1184	THE INFLUENCE OF INCREASED ATMOSPHERIC CO2 AND TEMPERATURE ON NEPHOTETTIX CINCTICEPS LIFE CYCLES ANDECOSYSTEMS	I	298	25/08/00	16:30	CC		6	PS	6
Takahashi, R.	3462	DEVELOPMENT AND COCOON YIELD OF SILKWORM (BOMBYX MORI) FED WITH LEAVES FROM MULBERRY (MORUS ALBA) FERTILIZED WITH LIMESTONE AND GYPSUM ASSOCIATED WITH NPK AND MICRONUTRIENTS	II	874	21/08/00	16:30	CC		19	PS	19
Takahashi, R.	3461	BIOLOGICAL PERFORMANCE OF SILKWORM (BOMBYX MORI) FED WITH LEAVES FROM THREE MULBERRY HYBRIDS (MORUS SP.) FERTILIZED WITH ORGANIC MATTER OR ORGANIC MATTER PLUS GYPSUM	II	874	21/08/00	16:30	CC		19	PS	19
Takahashi, R.	3463	NUTRITIONAL INDICES OF SILKWORM (BOMBYX MORI) FED WITH LEAVES FROM THREE MULBERRY HYBRIDS (MORUS SP.) FERTILIZED WITH ORGANIC MATTER OR ORGANIC MATTER PLUS GYPSUM	II	874	21/08/00	16:30	CC		19	PS	19
Takahashi, R.	3519	EFFECTS OF METHOPRENE ON SILKWORM, BOMBYX MORI (LEPIDOPTERA: BOMBYCIDAE)	II	888	24/08/00	16:30	CC		19	PS	19
Takahashi, R.	3520	EFFECTS OF PYRIPROXYFEN ON THE LARVAL DEVELOPMENT, THE COCOON AND SILK PRODUCTION OF BOMBYX MORI (LEPIDOPTERA: BOMBYCIDAE)	II	888	24/08/00	16:30	CC		19	PS	19
Takahashi, R.	3521	EFFECTS OF TOPICAL APPLICATION OF FENOXYCARB AT DIFFERENT DOSES ON SILKWORM, BOMBYX MORI (LEPIDOPTERA: BOMBYCIDAE)	II	888	23/08/00	16:30	CC		19	PS	19
Takahashi, R.	3522	MORPHOLOGICAL DESCRIPTION OF THE CATERPILLAR OF BOMBYX MORI (LEPIDOPTERA: BOMBYCIDAE) WITH THE USE OF SCANNING ELECTRONIC MICROSCOPY	II	889	23/08/00	16:30	CC		19	PS	19
Takahashi, T.	3818	INTRASPECIFIC VARIATION IN GREEN LACEWING, CHRYSOPERLA NIPPONENSIS OF JAPAN USING COURTSHIP SONG AND MOLECULAR PHYLOGENETIC ANALYSES	II	964	24/08/00	16:30	CC		21	PS	21
Takahata, Y.	564	RELATION BETWEEN THE DIVERSITY OF CARABID BEETLES AND DEER, MICE, AND DWARF BAMBOO IN A DECLINING ALPINE FOREST	I	143	25/08/00	16:30	CC		3	PS	3
Takaki, S. C.	1375	BASES FOR AN INSECTICIDE RESISTANCE MANAGEMENT OF SPODOPTERA FRUGIPERDA IN CORN IN BRAZIL	I	347	24/08/00	16:30	CC		7	PS	7
Takashino, K.	2834	SEASONAL OCCURRENCE OF MAJOR INSECT PESTS AND ESTIMATION OF THE LEAF DAMAGES ON GLOSSY-LEAVED AND NORMAL VARIETIES OF BRASSICA NAPUS	II	715	25/08/00	16:30	CC		14	PS	14
Takasu, K.	1674	HOST DEFENSE BEHAVIOR OF THE EGG PARASITOID PARATELENOMUS SACCHARALIS (HYMENOPTERA:SCELIONIDAE) IN THE FIELD	I	422	25/08/00	16:30	CC		8	PS	8
Takeda, M.	3380	CLONING OF VITELLOGENIN cDNA OF PERILTANETA AMERICANA AND ITS STYRUCTURE AND EXPRESSION	II	853	25/08/00	16:30	CC		18	PS	18
Takeda, M.	3312	MOLECULAR BIOLOGY OF INSECT CLOCKS FOR PHOTOPERIODISM	II	836	25/08/00	14:00	HB	K	18	8	18
Takeda, M.	3418	CLOCK-ENDOCRINE AXIS REGULATING BOLTINISM IN ANTHERAEA PERNYI	II	863	22/08/00	14:30	HM	Q	19	3	19
Takeda, M.	3557	PHOTOPERIODIC CLOCK-ENDOCRINE SWITCH AXIS IN DIAPAUSE REGULATION IN SILKMOTH	II	897	24/08/00	16:30	CC		19	PS	19
Takeda, M.	3991	REPRODUCTION AND SURVIVAL RATE OF THE KANZAWA SPIDER MITE ON THE DIFFERENT VARIETIES OF TEA PLANTS	II	1007	23/08/00	16:30	CC		22	PS	22
Takeda, M.	3356	PHOTOPERIOD AND TEMPERATURE CONTROL ON MORPHOLOGY, PIGMENTATION AND REPRODUCTION IN HALYOMORPHA BREVIS	II	847	24/08/00	16:30	CC		18	PS	18
Takematsu, A. P.	2835	EVALUATION OF INSECTICIDES AGAINST THE THRIPS PALMI (THYSANOPTERA, THRIPIDAE) IN BEAN CROP (PHASEOLUS VULGARIS)	II	716	24/08/00	16:30	CC		14	PS	14
Takematsu, A. P.	2717	EVALUATION OF INSECTICIDES, IN LABORATORY, AGAINST THE VELVETBEAN CATERPILLAR ANTICARSIA GEMMATALIS (LEPIDOPTERA:NOCTUIDAE) IN SOY BEAN	II	686	24/08/00	16:30	CC		14	PS	14
Takematsu, A. P.	3022	EFFICACY OF DIFFERENT INSECTICIDES ON THE CONTROL OF THE ADULT MUSCA DOMESTICA IN LABORATORY CONDITIONS	II	762	25/08/00	16:30	CC		15	PS	15
Takematsu, Y.	559	SPECIES DIVERSITY AND FUNCTIONAL DIVERSITY OF TERMITES IN EASTERN ASIA	I	141	25/08/00	16:30	CC		3	PS	3
Takematsu, Y.	792	SPECIES INFORMATION DATABASE KONCHU ON JAPANESE, EAST ASIAN AND PACIFIC INSECTS, SPIDERS AND MITES ON INTERNET	I	200	23/08/00	16:30	CC		5	PS	5
Takenaka, O.	3499	SYMPATRIC AND INTRASPECIFIC QUEEN-SIZE DIMORPHISM ASSOCIATED WITH QUEEN DISPERSAL STRATEGY OF JAPANESE ANT, LEPTOTHORAX SPINOSIOR	II	883	23/08/00	16:30	CC		19	PS	19
Takeuchi, H.	3558	IDENTIFICATION AND CHARACTERIZATION OF A NOVEL GENE (KL-1), WHICH IS EXPRESSED PREFERENTIALLY IN LARGE TYPE KENYON CELLS OF THE HONEYBEE BRAIN	II	898	25/08/00	16:30	CC		19	PS	19
Takeuchi, H.	2263	CONCENTRATED EXPRESSION OF THE GENES FOR PROTEINS INVOLVED IN CALCIUM SIGNALING IN THE MUSHROOM BODIES OF THE BRAIN OF THE WORKER HONEYBEE APIS MELLIFERA	I	571	22/08/00	16:30	CC		12	PS	12
Takeuchi, H.	2448	CONCENTRATED EXPRESSION OF THE GENES FOR PROTEINS INVOLVED IN CALCIUM SIGNALING IN THE MUSHROOM BODIES OF THE BRAIN OF THE WORKER HONEYBEE APIS MELLIFERA	II	618	23/08/00	16:30	CC		13	PS	13
Takeuchi, H.	2336	IDENTIFICATION AND CHARACTERIZATION OF THE KS-1 GENE, WHICH IS EXPRESSED PREFERENTIALLY IN THE SMALL TYPE-KENYON CELLS OF THE HONEYBEE BRAIN	I	589	25/08/00	16:30	CC		12	PS	12
Takezaki, K.	1673	ATTEMPTS OF USING INDIGENOUS PARASITOIDS AS A CONTROL AGENT TO LIRIOMYZA TRIFOLII IN GREENHOUSES IN JAPAN	I	422	25/08/00	16:30	CC		8	PS	8

Sub-titles: (HB=Hotel Bourbon) - (HM=Hotel Mabu) - (CC=Convention Center) - (Bol=Foz Boulevard) - (PS=Poster Session) - (PL=Plenary Lecturer)

AUTHOR	Nº	TITLE	Book	Page	Date	Time	Local	Room	Session	Symp	New Session
Taki, H.	3818	INTRASPECIFIC VARIATION IN GREEN LACEWING, CHRYSOPERLA NIPPONENSIS OF JAPAN USING COURTSHIP SONG AND MOLECULAR PHYLOGENETIC ANALYSES	II	964	24/08/00	16:30	CC		21	PS	21
Takita, M. A.	3203	GENOME AND FUNCIONAL GENOMICS OF XYLELLA FASTIDIOSA	II	809	21/08/00	13:35	Bol	U	17	1	17
Takiya, D. M.	3848	A NEW GENUS OF CICADELLINI (HEMIPTERA: CICADELLIDAE) FROM SOUTHEASTERN BRAZIL.	II	971	25/08/00	16:30	CC		21	PS	21
Takken, W.	644	POSSIBLE ROLE OF AMMONIA IN HOST-SEEKING BEHAVIOR OF BLOOD-FEEDING INSECTS	I	163	25/08/00	11:35	Bol	R	4	9	15
Takken, W.	2871	UNDERSTANDING OF MOSQUITO ATTRACTION THROUGH IDENTIFICATION OF VOLATILE COMPOUNDS EMANATING FROM HUMANS	II	725	21/08/00	10:35	Bol	R	15	1	15
Takken, W.	2875	CLIMATE CHANGE, ECOLOGY AND HUMAN DISEASE	II	726	21/08/00	13:35	Bol	R	15	2	15
Takken, W.	2879	HIGHLAND FRINGE MALARIA IN AFRICA AND CLIMATE CHANGE	II	727	21/08/00	15:35	Bol	R	15	2	15
Takken, W.	3015	LOCAL POPULATION DYNAMICS OF ANOPHELES MOSQUITOES AND MALARIA TRANSMISSION IN WESTERN KENYA	II	761	24/08/00	16:30	CC		15	PS	15
Takken, W.	2877	CLIMATE CHANGE, ECOLOGY AND HUMAN DISEASE	II	726	21/08/00	16:30	CC		15	PS	12
Takken, Willem	2928	UNDERSTANDING OF MOSQUITO ATTRACTION THROUGH IDENTIFICATION OF VOLATILE COMPOUNDS EMANATING FROM HUMANS	II	739	21/08/00	16:30	CC		15	PS	15
Talbalaghi, A.	355	THE FIELD EXPERIENCES OF MOSQUITO'S (DIPTERA, CULICIDAE) CONTROL IN SOME AREA IN PIEDMONT (ITALY)	I	90	25/08/00	16:30	CC		2	PS	2
Talbalaghi, A.	4147	THE ITALIAN PEST CONTROL ASSOCIATION - CHALLENGES FOR THE NEW MILLENIUM	II	1047	21/08/00	16:30	CC		24	PS	24
Tamagawa, Y.	2726	MODE OF ACTION AND CHARACTARISTICS OF A NOVEL INSECT PEST CONTROL AGENT, CHROMAFENOZIDE	II	688	23/08/00	16:30	CC		14	PS	14
Tamaguti, C.	1122	SURVEYS ON BEMISIA ARGENTIFOLII WITH STICK TRAPS IN COTTON CULTIVATIONS IN MIGUELÓPOLIS - S.P - BRAZIL	I	283	24/08/00	16:30	CC		6	PS	6
Tamai, M. A.	270	OCCURENCE OF THRIPS ON NIAGARA TABLE GRAPE AND ITS CONTROL WITH THE INSECTICIDES THIACLOPRID AND METHIOCARB ASSOCIATED WITH METARHIZIUM ANISOPLIAE	I	69	23/08/00	16:30	CC		2	PS	2
Tambasco, F. J.	1207	COMPETITION BETWEEN TWO ARMORED SCALES FOR CITRUS LEAVES COLONIZATION	I	304	23/08/00	16:30	CC		6	PS	6
Tambasco, F. J.	2855	ARMORED SCALES POPULATION DYNAMICS IN SÃO PAULO STATE CITRUS REGION	II	721	21/08/00	16:30	CC		14	PS	14
Tambasco, F. J.	1641	POS-INTRODUCTION OF THE NATURAL ENEMY AGENIAPIS CITRICOLA IN CITRUS GROVES IN JAGUARIÚNA AND AGUAÍ REGIONS, SÃO PAULO STATE, BRAZIL: PRELIMINARY RESULTS	I	414	24/08/00	16:30	CC		8	PS	8
Tambasco, F. J.	1675	TEN YEARS OF INTERNATIONAL EXCHANGE AND QUARANTINE OF BENEFICIAL ORGANISMS BY THE BRAZILIAN QUARANTINE LABORATORY FOR BIOLOGICAL CONTROL	I	422	25/08/00	16:30	CC		8	PS	8
Tambasco, F. J.	1676	NON-SUITABILITY OF THE BRAZILIAN SUGARCANE BORER, DIATRAEA SACCHARALIS, (LEPIDOPTERA: PYRALIDAE) AS A HOST FOR PEDIOBIUS FURVUS (HYMENOPTERA: EULOPHIDAE)	I	422	25/08/00	16:30	CC		8	PS	8
Tanez-Guerra, R.	2077	A PAECILOMYCES FUMOSOROSEUS MUTANT OVERPRODUCING CHITINASE DISPLAYS HIGH VIRULENCE AGAINST BEMISIA TABACI	I	524	22/08/00	16:30	CC		11	PS	11
Tanez-Guerra, R.	2125	GENETIC VARIABILITY AMONG BEAUVERIA BASSIANA AND PAECILOMYCES FUMOSOROSEUS	I	536	24/08/00	16:30	CC		11	PS	11
Tanmariello, S. P.	3279	REGULATION OF CELL CYCLE ARREST IN DIAPAUSE	II	828	23/08/00	10:05	HB	K	18	4	18
Tanmariello, S. P.	3278	DIAPAUSE-SPECIFIC GENE EXPRESSION	II	828	23/08/00	9:50	HB	K	18	4	18
Tamó, C.	1422	IS IT FEASIBLE TO INCREASE THE ATTRACTIVENESS OF CROP PLANTS TO PARASITOIDS?	I	359	21/08/00	10:50	HM	O	8	1	8
Tamura, T.	3265	RECENT PROGRESS IN THE TRANSGENESIS OF SILKWORM, BOMBYX MORI AND APPLICATION TO THE GENOME PROJECT	II	825	22/08/00	10:35	HB	K	18	2	18
Tamura, T.	3417	BIOTECHNOLOGY OF SILK SPINING INSECTS: POSSIBILITY TO PRODUCE ANTHERAEA FIBROIN IN BOMBYX SILK GLAND	II	863	22/08/00	14:15	HM	Q	19	3	19
Tamura, T.	3530	CHANGE OF GENE EXPRESSION PATTERN CAUSEDBY COMPOUND EYE METAMORPHOSIS OF BOMBYX MORI	II	891	24/08/00	16:30	CC		19	PS	19
Tamura, T.	2305	CHARACTERIZATION OF GENOMIC GENE ENCODING KYNURENINE 3-MONOOXYGENASE IN THE SILKWORM BOMBYX MORI	I	582	24/08/00	16:30	CC		12	PS	12
Tan, J.	1229	SODIUM CHANNEL MUTATIONS AND PYRETHROID RESISTANCE	I	310	21/08/00	14:35	HM	N	7	2	7
Tan, K. H.	3354	UTILIZATION OF SPECIFIC PLANT VOLATILES IN MATING STRATEGIES IN THE ORIENTAL FRUIT FLY AND MEDFLY	II	847	23/08/00	16:30	CC		18	PS	18
Tan, S. J.	3559	KIN RECOGNITION ANALYSIS OF CAMPONOTUS JAPONICUS (HYMENOPTERA: FORMICIDAE) COMBINED WITH AGGRESSIVE BEHAVOUR TEST AND RAPD-PCR METHOD	II	898	25/08/00	16:30	CC		19	PS	19
Tan, S. J.	356	GENETIC VARIATION AND GENE FLOW AMONG POPULATIONS OF THE COTTON BOLLWORM HELICOVERPA ARMIGERA (LEPIDOPTERA: NOCTUIDAE) IN CHINA	I	90	24/08/00	16:30	CC		2	PS	2
Tanabe, R. D.	2798	PERFORMANCE OF GROWTH REGULATOR INSECTICIDES ON THE CONTROL OF ARMYWORM (PSEUDALETIA SEQUAX) IN CORN	II	706	25/08/00	16:30	CC		14	PS	14
Tanabe, R. D.	1389	EVALUATION OF GROWTH REGULATOR INSECTICIDES ON THE CONTROL OF RACHIPLUSIA NU (LEPIDOPTERA - NOCTUIDAE) ON SOYBEAN	I	350	24/08/00	16:30	CC		7	PS	7
Tanaka, C.	1677	HOST LOCATION BEHAVIOR OF THE PARASITOID FLY, EXORISTA JAPONICA (DIPTERA: TACHINIDAE)	I	423	25/08/00	16:30	CC		8	PS	8
Tanaka, H.	2356	REGULATION OF TISSUE-SPECIFIC AND LIPOPOLYSACCHARIDE-INDUCIBLE GENE EXPRESSION OF AN ANTIBACTERIAL PROTEIN FROM THE SILKWORM, BOMBYX MORI	II	595	23/08/00	11:45	HB	I	13	4	13
Tanaka, H.	2515	cDNA AND CHARACTERIZATION OF A SPECIFIC PEPTIDE PRODUCED THROUGHOUT ADULT DIAPAUSE IN THE LEAF BEETLE, GASTROPHYSA ATROCYANEA	II	635	25/08/00	16:30	CC		13	PS	13
Tanaka, H.	2516	CDNA CLONING AND EXPRESSION ANALYSIS OF REL PROTEINS FROM BOMBYX MORI	II	635	25/08/00	16:30	CC		13	PS	13
Tanaka, H.	2144	BACULOVIRUS-MEDIATED EXPRESSION AND ANTIFUNGAL ACTIVITY OF A DIAPAUSE-SPECIFIC PEPTIDE OF THE ADULT LEAF BEETLE	I	541	25/08/00	16:30	CC		11	PS	11
Tanaka, H.	2446	ISOLATION, cDNA CLONING AND MODIFICATION OF DEFENSIN FROM THE COCONUT RHINOCEROS BEETLE, ORYCTES RHINOCEROS	II	618	22/08/00	16:30	CC		13	PS	13
Tanaka, H.	2257	MORPHOLOGY AND GENETICS OF THE NEWLY DISCOVERED INTERSEX IN THE SILKWORM, BOMBYX MORI	I	570	22/08/00	16:30	CC		12	PS	12
Tanaka, K.	2836	ADAPTATION OF THE BROWN PLANTHOPPER TO RESISTANT RICE VARIETIES: ESTIMATION OF HERITABILITY AND EVOLUTIONARY RATE	II	716	25/08/00	16:30	CC		14	PS	14
Tanaka, K.	2532	HORMONAL CONTROL OF PHYSIOLOGICAL TRAITS ASSOCIATED WITH DIAPAUSE AND COLD HARDINESS IN A LEAF BEETLE, AULACOPHORA NIGRIPENNIS	II	640	25/08/00	16:30	CC		13	PS	13
Tanaka, K.	3961	INSECTICIDAL ACTIVITY OF A NOVEL INSECT PEST CONTROL AGENT, CHROMAFENOZIDE	II	1000	22/08/00	16:30	CC		22	PS	22
Tanaka, K.	2726	MODE OF ACTION AND CHARACTARISTICS OF A NOVEL INSECT PEST CONTROL AGENT, CHROMAFENOZIDE	II	688	23/08/00	16:30	CC		14	PS	14
Tanaka, K.	4183	HORMONAL CONTROL OF PHYSIOLOGICAL TRAITS ASSOCIATED WITH DIAPAUSE AND COLD HARDINESS IN A LEAF BEETLE, AULACOPHORA NIGRIPENNIS	II	1055	21/08/00	16:30	CC		13	PS	13

Sub-titles: (HB=Hotel Bourbon) - (HM=Hotel Mabu) - (CC=Convention Center) - (Bol=Foz Boulevard) - (PS=Poster Session) - (PL=Plenary Lecturer)

AUTHOR	Nº	TITLE	Book	Page	Date	Time	Local	Room	Session	Symp	New Session
Tanaka, S.	3254	HORMONAL CONTROL OF BODY-COLOR POLYMORPHISM IN LOCUSTS: [HIS7]-CORAZONIN AND JH	II	822	21/08/00	11:35	HB	K	18	I	18
Tanaka, S.	3258	NEUROPEPTIDES IN LOCUSTS: PROGRESS IN THE SEARCH FOR FUNCTIONS	II	823	21/08/00	15:00	HB	K	18	I	18
Tanaka, S. I.	3374	PHOTOPERIODIC CONTROL OF SEASONAL DEVELOPMENT IN THE SCUTELLERID BUG, POECILOCORIS LEWISI	II	852	25/08/00	16:30	CC		18	PS	18
Tanaka, Y.	3560	ECDYSONE BUT NOT 20-HYDROXYECDYSONE INDUCES THE REGENERATION OF MIDGUT EPITHELIAL CELLS IN THE SILKWORM, BOMBYX MORI	II	898	25/08/00	16:30	CC		19	PS	18
Tanaka, Y.	3501	MOLECULAR CLONING OF A PROTHORACICOSTATIC PEPTIDE (PTSP) IN THE LARVAL BRAIN OF THE SILKWORM, BOMBYX MORI	II	884	23/08/00	16:30	CC		19	PS	18
Tanhuanpää, M.	856	DO NATURAL ENEMIES PREVENT OUTBREAKS OF EPIRRITA AUTUMNATA IN SOUTHERN FENNOSCANDIA?	I	216	25/08/00	10:20	HB	D	6	7	6
Tanne, E.	3230	HYTOPLASMA-BEARING LEAFHOPPERS/PLANTHOPPERS, SUSPECTED TO BE VECTORS, IN VINEYARDS IN THE GOLAN HEIGHTS, ISRAEL	II	815	23/08/00	16:30	CC		17	PS	17
Tanne, E.	2582	EPIDEMEIOLOGY OF DISEASES CAUSED BY PHYTOPLASMA IN ISRAEL	II	652	24/08/00	11:05	HB	B	14	6	14
Tanzini, M. R.	2155	SELECTION OF ENTOMOPATOGENIC FUNGI IN THE CONTROL OF LEPTOPHARSA HEVEAE	I	543	25/08/00	16:30	CC		11	PS	11
Tapias, O.	1077	POPULATIONS OF NECROPHAGOUS COLEOPTERA AS BIOLOGICAL INDICATORS OF PHYSIOGRAPHIC SUB-REGIONS IN THE TACHIRA'S MOUNTAIN PASS	I	272	23/08/00	16:30	CC		6	PS	6
Tarasco, E.	1848	PRELIMINARY STUDIES ON THE APPLICATION OF STEINERNEMATID NEMATODES AGAINST OVERWINTERING LARVAE OF PINE PROCESSIONARY CATERPILLAR, THAUMETOPOEA PITYOCAMPA DEN. ET SCHIFF. (LEPIDOPTERA: THAUMETOPOEIDAE)	I	466	23/08/00	15:50	HB	M	10	4	10
Tarozzi, N.	2276	THE PRESENCE OF THE TRANSPOSABLE ELEMENTS R1 AND R2 IS ASSOCIATED TO MITOTIC CROSSING OVER IN SEVERAL APHID SPECIES	I	574	23/08/00	16:30	CC		12	PS	12
Tarshis, M.	2105	DESTRUCTION OF BACTERIA IN THE DIGESTIVE TRACT OF THE MAGGOT OF THE GREEN BOTTLE FLY, PHAENICIA SERICATA	I	531	23/08/00	16:30	CC		11	PS	11
Tastás-Duque, R.	3849	SYSTEMATICS AND PHYLOGENY OF CECIDOMYIIDAE (DIPTERA)	II	971	25/08/00	16:30	CC		21	PS	21
Tatchell, G. M.	2253	POSSIBILITIES OF HOST ADAPTATION IN THE CABBAGE APHID, BREVICORYNE BRASSICAE	I	569	22/08/00	16:30	CC		12	PS	12
Tate, B. A.	1461	AUGMENTATION OF PARASITOIDS FOR CONTROL OF CITRUS PESTS IN SOUTHERN AFRICA	I	369	22/08/00	10:35	HM	O	8	3	8
Tati Subahar, S. S.	3992	DAILY ACTIVITY OF THE FRUIT FLIES (BACTROCERA DORSALIS COMPLEX) AND ITS PARASITOID (BIOSTERES VANDENBOSCHI) IN CARAMBOLA TREE, WEST JAVA INDONESIA	II	1007	25/08/00	16:30	CC		22	PS	22
Tati-Subahar, S. S.	3993	CORRELATION OF TERMINALIA LENGTH BETWEEN MALES AND FEMALES OF BACTROCERA CARAMBOLAE (DIPTERA: TEPHRITIDAE) FROM WESTJAVA, INDONESIA	II	1008	25/08/00	16:30	CC		22	PS	22
Tauber, C. A.	1110	DRY-SEASON EMBRIONIC DORMANCY IN DEOIS FLAVOPICTA (HOMOPTERA: CERCOPIDAE): ROLES OF TEMPERATURE AND MOISTURE IN NATURE	I	280	24/08/00	16:30	CC		6	PS	6
Tauber, M. J.	1110	DRY-SEASON EMBRIONIC DORMANCY IN DEOIS FLAVOPICTA (HOMOPTERA: CERCOPIDAE): ROLES OF TEMPERATURE AND MOISTURE IN NATURE	I	280	24/08/00	16:30	CC		6	PS	6
Tavares, A. M.	956	BIOLOGICAL ASPECTS, POPULATION DENSITY, DAMAGE RATE AND BEHAVIOR OF THE FRUIT-BORER, CONOTRACHELUS SP. (COLEOPTERA: CURCULIONIDAE) ON CUPUAÇU TREE (THEOBROMA GRANDIFLORUM SCHUM.) IN AMAZONIAN REGION, BRAZIL	I	241	22/08/00	16:30	CC		6	PS	6
Tavares, A. R. R.	636	INTENSITY OF LOSSES IN MAIZE CULTIVATED UNDER MINERAL AND ORGANIC FERTILIZATION SYSTEMS.	I	161	21/08/00	16:30	CC		4	PS	4
Tavares, J.	3328	FECUNDITY OF TRICHOGRAMMA CORDUBENSIS FEMALES FROM SEXUAL AND ASEXUAL LINES	II	840	22/08/00	16:30	CC		18	PS	18
Tavares, J. C.	1532	EFFECTS OF WASP DENSITY ON THE BIOLOGY OF TRICHOGRAMMA CORDUBENSIS	I	386	22/08/00	16:30	CC		8	PS	8
Tavares, M. A. G. C.	2837	INFLUENCE OF PHOSPHORUS GRADES IN DIFFERENT VARIETIES OF CORN (ZEA MAYS) ON THE FALL ARMYWORM (SPODOPTERA FRUGIPERDA) GROWTH	II	716	25/08/00	16:30	CC		14	PS	14
Tavares, M. C. H.	3020	SARCOSAPROPHAGOUS INSECTS ASSOCIATED WITH DECOMPOSITION OF PIG CARCASSES EXPOSED TO DIFFERENT ALTITUDES AND PLUVIOMETRIC REGIONS IN THE SERRA DO JAPI RESERVATION-SP, BRAZIL	II	762	25/08/00	16:30	CC		15	PS	15
Tavela, V.	2642	EFFECT OF THE CONTROL OF ARMY WORMS SPODOPTERA FRUGIPERDA IN CORN BY RIMON 10 EC (NOVALURON) 1999	II	667	21/08/00	16:30	CC		14	PS	14
Tavela, V.	2643	EFFICACY OF CONTROL OF ANTICARSIA GEMMATALIS IN SOYBEAN BY RIMON 10 EC (NOVALURON) AND OTHER INSECTICIDES, 1999	II	668	22/08/00	16:30	CC		14	PS	14
Tavela, V.	2641	CONTROL OF ANTICARSIA GEMMATALIS IN SOYBEAN BY RIMON 10 EC (NOVALURON) IN PARANÁ, BRAZIL 1999	II	667	22/08/00	16:30	CC		14	PS	14
Taylor, A.	1228	MOLECULAR STUDIES OF INSECT ACETYLCHOLINESTERASE: IS THERE NEW LIFE IN AN OLD TARGET?	I	310	21/08/00	14:05	HM	N	7	2	7
Taylor, B. J.	89	QUALITY ASSURANCE IN LARGE-SCALE DETECTION TRAPPING PROGRAMS	I	23	21/08/00	15:05	HB	A	2	2	2
Taylor, C. E.	2215	CHROMOSOMAL POLYMORPHISM AND SPECIATION IN ANOPHELES GAMBIAE	I	559	24/08/00	10:05	HB	L	12	9	12
Taylor, G.	3839	MOLECULAR SYSTEMATICS OF FERGUSONINA SPP. (DIPTERA: FERGUSONINIDAE): HOST SPECIFICITY, HOST-USE EVOLUTION, AND IMPLICATIONS FOR BIOCONTROL OF MELALEUCA QUINQUENERVA IN THE FLORIDA EVERGLADES	II	969	25/08/00	16:30	CC		21	PS	21
Taylor, T. J. B.	2325	COSTS AND BENEFITS OF MULTIPLE MATING IN A BEETLE	I	587	25/08/00	16:30	CC		12	PS	12
Tchujo, P. T.	2112	COMPATIBILITY OF ENTOMOPATOGENIC FUNGI WITH NEONICOTINOIDS INSECTICIDES	I	533	23/08/00	16:30	CC		11	PS	11
Te Brugge, V. A.	2349	THE INTEGRATIVE ACTIONS OF PEPTIDES AND AMINES ON IDENTIFIED TARGET TISSUES OF RHODNIUS PROLIXUS.	II	593	22/08/00	11:05	HB	I	13	3	13
Teal, P. E. A.	3251	MIMETIC ANALOGS OF REPRODUCTIVE/DEVELOPMENTAL INSECT NEUROPEPTIDES WITH ENHANCED CUTICLE PENETRABILITY AND/OR PEPTIDASE-RESISTANCE	II	821	21/08/00	10:05	HB	K	18	I	18
Tegelenbosch, R. A. J.	746	COMPUTERIZED VIDEO TRACKING, MOVEMENT ANALYSIS AND BEHAVIOR RECOGNITION IN INSECTS	I	188	21/08/00	10:55	Bol	T	5	I	5
Teixeira, E. C.	284	CHEMICAL CONTROL OF THIPS TABACI (THYSANOPTERA: THRIPIDAE) WITH INSECTICIDE CONFIDOR (IMIDACLOPRID), IN POTATO CROP, SOLANUM TUBEROSUM	I	72	23/08/00	16:30	CC		2	PS	2
Teixeira, E. C.	283	A DOSE RECOMENDATION AND AN EVALUATION OF THE EFFICIENCY OF THE FARM CHEMICAL CONFIDOR (IMIDACLOPRID) TO CONTROL MYZUS PERSICAE (HOMOPTERA: APHIDIDAE) IN THE POTATO CROP SOLANUM TUBEROSUM	I	72	23/08/00	16:30	CC		2	PS	2
Teixeira, E. P.	1177	BIOLOGICAL ASPECTS OF ZAPRIONUS INDIANUS, A NEW PEST OF FICUS CARICA IN VALINHOS, SÃO PAULO, BRAZIL	I	297	25/08/00	16:30	CC		6	PS	6
Teixeira, I.	2632	IMIDACLOPRID AND THIAMETHOXAM AS NEW TOOLS FOR GRAPE PEST MANAGEMENT	II	665	21/08/00	16:30	CC		14	PS	14
Teixeira, I. R. V.	1185	ECOLOGICAL AND EVOLUTINARY CORRELATIONS AMONG ACCEPTABILITY, OVIPOSITION PREFERENCE AND PERFORMANCE IN ZABROTES SUBFASCIATUS (COLEOPTERA, BRUCHIDAE)	I	299	25/08/00	16:30	CC		6	PS	6
Teixeira, M. M.	278	EVALUATION OF TWO COFFEE SPECIES AS HOST OF FRUIT FLIES (DIPTERA: TEPHRITIDAE) IN THE ESPÍRITO SANTO STATE, BRAZIL	I	71	23/08/00	16:30	CC		2	PS	2
Teixeira, V. A.	1625	OCCURRENCE OF SCALES, WHITEFLIES AND NATURAL ENEMIES IN CITRIC PLANTS IN THE MUNICIPAL DISTRICT OF CÁCERES, MT, BRASIL	I	410	25/08/00	16:30	CC		8	PS	8
Teodoro, A.V.	1633	EFFECT OF THE PREY DENSITY ON THE FUNCTIONAL AND NUMERICAL RESPONSE OF TWO SPECIES OF PREDACEOUS MITES	I	412	24/08/00	16:30	CC		8	PS	8

Sub-titles: (HB=Hotel Bourbon) - (HM=Hotel Mabu) - (CC=Convention Center) - (Bol=Foz Boulevard) - (PS=Poster Session) - (PL=Plenary Lecturer)

AUTHOR	N°	TITLE	Book	Page	Date	Time	Local	Room	Session	Symp	New Session
Tepass, U.	3039	REGULATION OF OVARIAN MORPHOGENESIS IN DROSOPHILA	II	767	21/08/00	14:00	HB	G	16	1	16
Teppner, I.	1733	PREDATION BY GLEANING AND AERIAL HAWKING BATS: ITS EFFECT ON THE EVOLUTION OF HEARING AND SOUND COMMUNICATION IN TWO GROUPS OF KATYDIDS IN PANAMA	I	437	22/08/00	16:00	HB	F	9	3	9
Terashima, J.	3287	ENDOCRINE CONTROL OF PROGRAMMED CELL DEATH OF ANTERIOR SILK GLAND IN BOMBYX MORI	II	830	23/08/00	14:35	HB	K	18	5	18
Ter-Hovhanessyan, A. R.	2228	ABOUT GENETICAL VARIABILITY OF CODLING MOTH POPULATIONS INHABITING IN DIFFERENT CONDITION	I	562	21/08/00	16:30	CC		12	PS	12
Ter-Hovhanessyan, A. R.	2228	ABOUT GENETICAL VARIABILITY OF CODLING MOTH POPULATIONS INHABITING IN DIFFERENT CONDITION	I	562	21/08/00	16:30	CC		12	PS	12
Ternes, S.	1678	SPATIO-TEMPORAL DISTRIBUTION OF CITRUS LEAFMINER AND ITS NATURAL ENEMIES IN SÃO PAULO STATE, BRAZIL	I	423	25/08/00	16:30	CC		8	PS	8
Terra, W. R.	2387	ORIGIN AND FUNCTION OF INSECT PERITROPHIC MEMBRANE	II	603	26/08/00	9:35	HB	I	13	10	13
Terra, W. R.	2418	SURVEY OF MIDGUT ENZYMES AND MIDGUT PH IN INSECTS OF DIFFERENT ORDERS	II	611	21/08/00	16:30	CC		13	PS	13
Terra, W. R.	2424	PURIFICATION AND CHARACTERIZATION OF TENEBRIO MOLITOR MIDGUT •-GLYCOSIDASES	II	612	22/08/00	16:30	CC		13	PS	13
Terra, W. R.	1754	APOCRINE SECRETION OF AMYLASE AND EXOCYTOSIS OF TRYPSIN ALONG THE MIDGUT OF TENEBRIO MOLITOR LARVAE	I	442	21/08/00	16:30	CC		9	PS	13
Terra, W. R.	2399	ISOLATION OF PERITROPHIC MEMBRANE PROTEINS AND THEIR SECRETION BY SPODOPTERA FRUGIPERDA (LEPIDOPTERA) LARVAE	II	606	21/08/00	16:30	CC		13	PS	13
Terra, W. R.	2506	OCCURRENCE OF ALPHA-GLUCOSIDASE AS A BIOCHEMICAL MARKER FOR PERIMICROVILLAR MEMBRANES IN HEMIPTERA AND THYSANOPTERA	II	633	24/08/00	16:30	CC		13	PS	13
Terra, W. R.	2490	APHIDS AND APHID PROTEASES AS NON-CONVENTIONAL TARGETS FOR PROTEASE INHIBITOR TRANSGENES USED FOR CONTROLLING PHLOEM-FDEEDING INSECTS	II	629	24/08/00	16:30	CC		13	PS	13
Terra, W.R.	2459	EVOLUTION OF TRYPSIN SPECIFICITY IN INSECTS	II	621	23/08/00	16:30	CC		13	PS	13
Terry, M. D.	3850	DRUMMING, SKIMMING, AND EVOLUTION OF FLIGHT: A NEW PHYLOGENY OF PLECOPTERA	II	972	25/08/00	16:30	CC		21	PS	21
Tesh, R. B.	3000	BITING PATTERNS AND DEVELOPMENTAL SUBSTRATES FOR CULICOIDES PARAENSIS (DIPTERA; CERATOPOGONIDAE), THE VECTOR OF OROPOUCHE VIRUS, IN IQUITOS, PERU	II	757	24/08/00	16:30	CC		15	PS	15
Tesoriero, L.	3223	INTERACTIONS BETWEEN INSECT VECTORS OF PLANT DISEASES IN AUSTRALIA	II	814	22/08/00	16:30	CC		17	PS	17
Teston, J. A.	1186	POPULATIONAL FLUCTUATION OF PANTHERODES PARDALARIA (LEPIDOPTERA: GEOMETRIDAE) IN RIO GRANDE DO SUL STATE, BRAZIL	I	299	25/08/00	16:30	CC		6	PS	6
Teston, J. A.	1187	POPULATIONAL FLUCTUATION OF PANTHERODES PARDALARIA (LEPIDOPTERA: GEOMETRIDAE) IN RIO GRANDE DO SUL STATE, BRAZIL	I	299	25/08/00	16:30	CC		6	PS	6
Teston, J. A.	522	DISTRIBUTION OF THE GENUS ADELPHA (LEPIDOPTERA: NYMPHALIDAE: LIMENITINAE) IN THE AMERICAN CONTINENT	I	132	23/08/00	16:30	CC		3	PS	3
Tewari, P. K.	4055	LABORATORY TRIALS ON THE USE OF THREE SPECIES OF USCANA FOR THE CONTROL OF STORE BRUCHIDS (BRUCHIDAE; COLEOPTERA)	II	1024	24/08/00	14:30	HB	J	23	9	23
Tezze, A. A.	1478	DIAPAUSE INDUCTION AND COLD STORAGE IN TRICHOGRAMMA NERUDAI	I	373	21/08/00	16:30	CC		8	PS	8
Thanaphum, S.	2216	MOLECULAR PHYLOGENY OF THE BACTROCERA TAU SPECIES COMPLEX	I	559	24/08/00	10:35	HB	L	12	9	12
Thayer, M. K.	3815	AN ILLUSTRATED GUIDE TO THE STAPHYLINIDAE (COLEOPTERA) OF MEXICO	II	963	24/08/00	16:30	CC		21	PS	21
Theiller, M.	71	REPELLENCY OF GREEN ONION TO THE TWO-SPOTTED SPIDER MITE	I	18	25/08/00	16:30	CC		1	PS	1
Theodoraki, M.	2262	HEAT SHOCK RESPONSE IN THE MEDITERRANEAN FRUIT FLY: GENES, PROMOTERS AND THERMOTOLERANCE	I	571	22/08/00	16:30	CC		12	PS	12
Theunis, L.	519	LEAF LITTER ANT AND TERMITE DIVERSITY IN IGUASSU AND RIO PILCOMAYO NATIONAL PARKS, ARGENTINA	I	131	23/08/00	16:30	CC		3	PS	3
Theunis, W.	2014	PATHOGENS OF TARO BEETLES AND THEIR POTENTIAL USE IN PEST MANAGEMENT IN THE SW PACIFIC	I	508	23/08/00	14:00	HM	P	11	5	11
Thibault, S.	1846	MODEL ORGANISM GENETICS AND GENOMICS: TOOLS FOR TARGET DEVELOPMENT IN PEST CONTROL	I	465	23/08/00	15:05	HB	M	10	4	10
Thibault, S.	3994	MODEL ORGANISM GENETICS AND GENOMICS: TOOLS FOR TARGET DEVELOPMENT IN PEST CONTROL	II	1008	25/08/00	16:30	CC		22	PS	22
Thiele, K.	766	HYBRID KEYS AND SYNTHETIC DATASETS: NEW DEVELOPMENTS IN INTERACTIVE KEYS WITH LUCID VERSION 2.0	I	193	23/08/00	14:00	Bol	T	5	4	5
Thiele, R.	398	HOW FAR NORTH AND SOUTH DOES THE APIFAUNA OF AMAZONIA REACH, ESPECIALLY THE BEE SPECIES VISITING MASS-FLOWERING TREES	I	101	22/08/00	15:05	HB	C	3	2	3
Thistlewood, H. M.	2553	STERILE INSECT RELEASE IN CANADA: FROM ERADICATION TO AREA-WIDE MANAGEMENT	II	645	21/08/00	16:05	HB	B	14	2	14
Thistlewood, H. M.	2838	STERILE INSECT RELEASE IN CANADA: FROM ERADICATION TO AREA-WIDE MANAGEMENT	II	716	25/08/00	16:30	CC		14	PS	14
Thomas, C. D.	817	RAPID EVOLUTION OF FLIGHT POTENTIAL IN LEPIDOPTERA	I	207	22/08/00	11:20	HB	D	6	3	6
Thomas, C. J.	2964	THE IMPORTANCE OF MOSQUITO LARVAL SURVEYS IN THE MAPPING OF MALARIA TRANSMISSION RISK	II	748	21/08/00	16:30	CC		15	PS	15
Thomas, C. J.	1396	POPULATION DYNAMICS OF ODONATES IN AGRICULTURAL LANDSCAPES:A LARGE-SCALE ECOTOXICOLOGICAL PERSPECTIVE	I	352	22/08/00	9:35	HM	N	7	3	7
Thomas, D. D.	3995	INSECT POPULATION CONTROL USING A DOMINANT, REPRESSIBLE, LETHAL GENETIC SYSTEM	II	1008	25/08/00	16:30	CC		22	PS	22
Thomas, J. A.	1009	DISPERSAL OF AN ERIOPHYID MITE, THE WHEAT CURL MITE, AND ITS IMORTANCE IN DISEASE EPIDEMIOLOGY.	I	255	22/08/00	16:30	CC		6	PS	6
Thomas, M. B.	3915	ECOLOGICAL APPROACHES TO DETERMINING THE RISK OF MICROBIAL CONTROL AGENTS	II	988	25/08/00	13:30	HB	H	22	7	22
Thomas, M. B.	1638	ANALYSIS OF THE BIOLOGICAL CONTROL OF THE DIATRAEA SACCHARALIS AT DIFFERENT SPATIAL SCALES: LACK OF CONTROL OR POOR DATA SET?	I	413	24/08/00	16:30	CC		8	PS	8
Thomas, S. R.	357	SPATIAL AND TEMPORAL DISTRIBUTIONS OF PREDATORY INVERTEBRATES WITHIN, AND DISPERSING FROM, OVERWINTERING REFUGES IN UK CEREAL FIELDS	I	90	25/08/00	16:30	CC		2	PS	2
Thomas, W. K.	3839	MOLECULAR SYSTEMATICS OF FERGUSONINA SPP. (DIPTERA: FERGUSONINIDAE): HOST SPECIFICITY, HOST-USE EVOLUTION, AND IMPLICATIONS FOR BIOCONTROL OF MELALEUCA QUINQUENERVA IN THE FLORIDA EVERGLADES	II	969	25/08/00	16:30	CC		21	PS	21
Thomazini, A. P. B. W.	554	DIVERSITY OF HYMENOPTERA IN AREAS OF PRIMARY FOREST FRAGMENT, REGENERATION FOREST AND PASTURE AT THE SOUTHEAST OF ACRE, BRAZIL	I	140	25/08/00	16:30	CC		3	PS	3
Thomazini, A. P. B. W.	560	DIVERSITY OF COLEOPTERA IN A FOREST FRAGMENT, SECONDARY FOREST AND PASTURE IN THE SOUTHEAST OF ACRE , BRAZIL	I	142	25/08/00	16:30	CC		3	PS	3
Thomazini, M. J.	560	DIVERSITY OF COLEOPTERA IN A FOREST FRAGMENT, SECONDARY FOREST AND PASTURE IN THE SOUTHEAST OF ACRE , BRAZIL	I	142	25/08/00	16:30	CC		3	PS	3
Thomazini, M. J.	554	DIVERSITY OF HYMENOPTERA IN AREAS OF PRIMARY FOREST FRAGMENT, REGENERATION FOREST AND PASTURE AT THE SOUTHEAST OF ACRE, BRAZIL	I	140	25/08/00	16:30	CC		3	PS	3
Thomazini, M. J.	1188	INSECTS ASSOCIATED TO THE LONG PEPPER IN THE STATE OF ACRE, BRAZIL	I	299	25/08/00	16:30	CC		6	PS	6
Thomazini, M. J.	1189	POPULATION FLUCTUATION AND INFESTATION LEVELS OF THE CUPUAÇU FRUIT BORER, CONOTRACHELUS HUMEROPICTUS, IN AGROFORESTRY SYSTEMS IN STATE OF RONDONIA, BRAZIL	I	300	25/08/00	16:30	CC		6	PS	6
Thomazini, T.	1375	BASES FOR AN INSECTICIDE RESISTANCE MANAGEMENT OF SPODOPTERA FRUGIPERDA IN CORN IN BRAZIL	I	347	24/08/00	16:30	CC		7	PS	7
Thompson, D.	1929	AZADIRACHTIN FROM THE NEEM TREE: AN EFFECTIVE NATURAL PRODUCT FOR FOREST INSECT PEST MANAGEMENT	I	486	22/08/00	16:30	CC		10	PS	10

Sub-titles: (HB=Hotel Bourbon) - (HM=Hotel Mabu) - (CC=Convention Center) - (Bol=Foz Boulevard) - (PS=Poster Session) - (PL=Plenary Lecturer)

AUTHOR	N°	TITLE	Book	Page	Date	Time	Local	Room	Session	Symp	New Session
Thompson, D. J.	1141	INVASION SEQUENCE DETERMINES PREDATOR-PREY DYNAMICS IN A MULTISPECIES ASSEMBLAGE	I	288	24/08/00	16:30	CC		6	PS	6
Thompson, F. C.	435	DIPTERA	I	110	25/08/00	10:35	HB	C	3	7	3
Thompson, F. C.	777	BIOSYSTEMATIC DATABASE OF WORLD DIPTERA: THE FIRST GLOBAL MASTER SPECIES DATABASE IN ENTOMOLOGY	I	196	24/08/00	14:15	Bol	T	5	5	5
Thompson, F. C.	793	BIOSYSTEMATIC DATABASE OF WORLD DIPTERA. NAMES: KEYS TO INFORMATION	I	200	24/08/00	16:30	CC		5	PS	5
Thompson, G.	1272	A GLOBAL PERSPECTIVE ON THE BIOLOGY AND FIELD PERFORMANCE OF SPINOSAD	I	321	25/08/00	11:05	HM	N	7	9	7
Thompson, G. D.	1225	SPINOSAD: PROPERTIES OF A SUCCESSFUL REDUCED RISK INSECT CONTROL PRODUCT	I	309	21/08/00	11:05	HM	N	7	1	7
Thompson, G. J.	2326	MOLECULAR PHYLOGENETIC INSIGHTS INTO THE ORIGIN OF TERMITE WORKERS	I	587	25/08/00	16:30	CC		12	PS	12
Thompson, S. N.	1692	PRELIMINARY OBSERVATIONS ON DIETARY SELF-SELECTION BY MANDUCA SEXTA: DO PARASITIZED LARVAE CHOOSE NOT TO CHOOSE?	I	426	25/08/00	16:30	CC		8	PS	8
Thompson, S. N.	2366	INTERACTIONS OF DIETARY PROTEIN AND BLOOD SUGAR LEVEL: EFFECTS ON LARVAL FEEDING BEHAVIOUR IN MANDUCA SEXTA	II	598	24/08/00	10:20	HB	I	13	6	13
Thomson, D. R.	616	MATING DISRUPTION TO MANAGE ORCHARD PESTS IN THE PACIFIC NORTHWEST OF NORTH AMERICA: PAST, PRESENT AND FUTURE	I	156	24/08/00	15:00	Bol	S	4	6	4
Thongtab, T.	1190	BIONOMICS OF THE CITRUS YELLOW MITE, EOTETRANYCHUS CENDANAI (TETRANYCHIDAE)	I	300	25/08/00	16:30	CC		6	PS	6
Thongtab, T.	1679	BIONOMICS OF AMBLYSEIUS LONGISPINOSUS (PHYTOSEIDAE) AND ITS EFFICACY AS A BIOLOGICAL CONTROL AGENT OF EOTETRANYCHUS CENDANAI (TETRANYCHIDAE)	I	423	24/08/00	16:30	CC		8	PS	8
Throne, J. E.	760	DESIGN AND ANALYSIS OF TIME-MORTALITY BIOASSAYS AND WEB-BASED PROGRAM DISTRIBUTION	I	192	23/08/00	9:35	Bol	T	5	4	5
Throne, J. E.	4015	A SIMULATION MODEL FOR LYCTOCORIS CAMPESTRIS, A PREDATOR OF STORED-PRODUCT INSECT PESTS	II	1014	22/08/00	9:45	HB	J	23	3	23
Throne, J. E.	4020	NEAR-INFRARED SPECTROSCOPY APPLIED TO DETECTING PARASITOIDS AND HIDDEN INSECT LARVAE, IDENTIFYING COLEOPTERA, AND CHRONOLOGICAL AGE-GRADING	II	1015	22/08/00	11:00	HB	J	23	3	23
Thuler, R. T.	1627	COLLECTS AND IDENTIFICATION OF RACES OF TRICHOGRAMMA IN COMMERCIAL FIELDS OF TOMATO, IN DIFFERENT ALTITUDE	I	410	24/08/00	16:30	CC		8	PS	8
Thullner, R.	1348	TICK CONTROL: EVIDENCE TO SUPPORT RESISTANCE MANAGEMENT RECOMMENDTIONS	I	340	23/08/00	16:30	CC		7	PS	7
Thwaite, W. G.	2545	STATUS OF CODLING MOTH MANAGEMENT AND CURRENT CONTROL PROGRAMS: SOUTHERN HEMISPHERE	II	643	21/08/00	13:50	HB	B	14	2	14
Thwaite, W. G.	2549	INSECTICIDE RESISTANCE IN CODLING MOTH WORLDWIDE: MONITORING, MECHANISMS AND CROSS-RESISTANCES.	II	644	21/08/00	14:50	HB	B	14	2	14
Thwaite, W. G.	2812	INSECTICIDE RESISTANCE IN CODLING MOTH WORLDWIDE: MONITORING, MECHANISMS AND CROSS-RESISTANCES.	II	710	24/08/00	16:30	CC		14	PS	14
Thys, S.	1903	FOREST SOIL CLASSIFICATION BASED ON COLLEMBOLA FAUNA	I	480	22/08/00	16:30	CC		10	PS	10
Tian, M. Y.	3996	INTEGRATED MEASURES FOR CONTROLLING THE DIAMONDBACK MOTH (DBM) IN SOUTHERN CHINA	II	1008	25/08/00	16:30	CC		22	PS	22
Tian, M. Y.	4001	EFFECTS OF INTEGRATED MEASURES FOR CONTROLLING THE DIAMONBACK MOTH (DBM) ON ARTHROPOD DIVERSITIES IN VEGETABLE PLANTATIONS	II	1010	25/08/00	16:30	CC		22	PS	22
Tian, T.	3213	BIOLOGY OF CRINIVIRUSES AND WHITEFLY-TRANSMISSION	II	811	22/08/00	14:30	Bol	U	17	2	17
Tielsch, J.	2878	THE IMPACT OF DEFORESTATION ON MALARIA: A CASE STUDY FROM THE PERUVIAN AMAZON	II	726	21/08/00	15:05	Bol	R	15	2	15
Tierney, S. M.	3561	RIGHT-WING BEES? PHYLOGENETIC CONSERVATISM IN AUSTRALIAN ALLODAPINES AND IMPLICATIONS FOR SOCIAL EVOLUTION	II	898	25/08/00	16:30	CC		19	PS	19
Tierney, S. M.	3446	ALLODAPINE BEES GAIN NESTING OPPORTUNITIES FROM AN ANT-ACACIA MUTUALISM	II	870	21/08/00	16:30	CC		19	PS	19
Tierno de Figueroa, J.M.	3102	COMPARATIVE SPERMATOLOGY IN PLECOPTERA	II	783	26/08/00	15:45	HB	G	16	9	16
Tigano, M. S.	2156	PHYLOGENY OF PAECILOMYCES SPECIES REVEALED BY ANALYSIS OF RIBOSOMAL RNA ITS SEQUENCES	I	544	25/08/00	16:30	CC		11	PS	11
Tigano, M. S.	2157	PHYLOGENY OF PAECILOMYCES SPECIES REVEALED BY ANALYSIS OF RIBOSOMAL RNA ITS SEQUENCES	I	544	25/08/00	16:30	CC		11	PS	11
Tigano, M. S.	2154	INTEGRATED SYSTEM TO SIMULATE THE IMPACT OF THE FUNGUS NOMURAEA RILEYI ON BRAZILIAN ANTICARSIA GEMMATALIS POPULATIONS	I	543	25/08/00	16:30	CC		11	PS	11
Tignor, K. R.	3350	STRUCTURAL BASIS FOR WATER EXCHANGE BETWEEN THE FEMALE COCKROACH (BLATTELLA GERMANICA L.) AND HER OOTHECAE	II	846	23/08/00	16:30	CC		18	PS	18
Tillman, J. A.	602	MOLECULAR STUDIES ON THE ENDOCRINE REGULATION AND TISSUE LOCALIZATION OF DE NOVO MONOTERPENOID PHEROMONE COMPONENT BIOSYNTHESIS IN PINE BARK BEETLES	I	152	23/08/00	11:25	Bol	S	4	4	4
Tilmon, K. J.	1680	PERISTENUS PARASITISM OF LYGUS LINEOLARIS IN MULTIPLE PLANT HABITATS	I	423	25/08/00	16:30	CC		8	PS	8
Timokhov, A.V.	362	ALLOCATION OF ARTHROPODS IN WINTER WHEAT CROP AND AROUND IT	I	92	25/08/00	16:30	CC		2	PS	2
Timokhova, O.V.	362	ALLOCATION OF ARTHROPODS IN WINTER WHEAT CROP AND AROUND IT	I	92	25/08/00	16:30	CC		2	PS	2
Ting, C. T.	2524	EXTREME HIGH-LEVEL OF AMINO ACID POLYMORPHISM IN A MALE REPRODUCTIVE PROTEIN GENE, ACP26AA, IN DROSOPHILA MAURITIANA	II	637	25/08/00	16:30	CC		13	PS	13
Tirone, G.	2300	SEX CHROMOSOME VARIATION AMONG MUSCOIDEA FLIES	I	580	24/08/00	16:30	CC		12	PS	12
Tirone, G.	3375	SECRETION OF SEXUAL ACCESSORY GLANDS OF FEMALE FLIES: SOME BIOCHEMICAL CHARACTERISTICS AND ANTIBACTERIAL ACTIVITY (DIPTERA, CALLIPHORIDAE, MUSCIDAE)	II	852	25/08/00	16:30	CC		18	PS	18
Tirry, L.	1403	SIGNIFICANCE OF UPTAKE AND BINDING IN LEPIDOPTERA AND COLEOPTERA ON TOXICITY OF DIBENZOYLHYDRAZINE ECDYSONE AGONISTS	I	354	25/08/00	16:30	CC		7	PS	7
Tishechkin, A. K.	472	DIVERSITY OF TWO LOWLAND RAINFOREST BEETLE TAXA (HISTERIDAE AND STAPHYLINIDAE: PSELAPHINAE) AT A WESTERN AMAZONIAN LOCALITY	I	120	21/08/00	16:30	CC		3	PS	3
Tissot, A. C.	3010	PRODUCTIVITY OF BREEDING ARTIFICIAL OF CULICIDAE, CAMPUS FEDERAL UNIVERSITY OF PARANA, PARANA STATE, BRAZIL	II	759	25/08/00	16:30	CC		15	PS	15
Tito, G.	71	REPELLENCY OF GREEN ONION TO THE TWO-SPOTTED SPIDER MITE	I	18	25/08/00	16:30	CC		1	PS	1
Tittiger, C.	602	MOLECULAR STUDIES ON THE ENDOCRINE REGULATION AND TISSUE LOCALIZATION OF DE NOVO MONOTERPENOID PHEROMONE COMPONENT BIOSYNTHESIS IN PINE BARK BEETLES	I	152	23/08/00	11:25	Bol	S	4	4	4
Tittiger, C.	599	ENDOCRINE REGULATION AND MECHANISM OF HYDROCARBON PHEROMONE PRODUCTION IN THE HOUSEFLY, MUSCA DOMESTICA	I	152	23/08/00	10:35	Bol	S	4	4	4
Tjallingii, W. F.	3241	APHID PROBING EVENTS IN AN ANOMALOUS VIRUS TRANSMISSION	II	818	24/08/00	16:30	CC		17	PS	17
Tobe, S. S.	2395	MOLECULAR CHARACTERIZATION OF THE ALLATOSTATIN PEPTIDE FAMILY	II	605	21/08/00	16:30	CC		13	PS	13
Tobe, S. S.	3047	ALLATOSTATINS AND THE REGULATION OF THE CORPORA ALLATA IN A COCKROACH	II	769	22/08/00	11:05	HB	G	16	2	16
Toda, S.	3851	DISCRIMINATION OF NINE THRIPS SPECIES (THYSANOPTERA: THRIPIDAE) BY PCR-RFLP ANALYSIS	II	972	25/08/00	16:30	CC		21	PS	21
Toda, S.	2720	INTEGRATED PEST MANAGEMENT OF MAJOR INSECT PESTS UTILIZING APHID RESISTANT VARIETY AND NATURAL ENEMIES ON GREENHOUSE MELON	II	687	23/08/00	16:30	CC		14	PS	14
Todd, J. W.	2566	SUCCESSES WITH PEANUT IPM IN THE SOUTHEASTERN UNITED STATES THROUGH INTERDISCIPLINARY APPROACHES	II	648	22/08/00	14:50	HB	B	14	4	14

Sub-titles: (HB=Hotel Bourbon) - (HM=Hotel Mabu) - (CC=Convention Center) - (Bol=Foz Boulevard) - (PS=Poster Session) - (PL=Plenary Lecturer)

AUTHOR	N°	TITLE	Book	Page	Date	Time	Local	Room	Session	Symp	New Session
Todd, J. W.	2635	DEVELOPMENT OF A METHOD OF RISK ASSESSMENT TO FACILITATE INTEGRATED MANAGEMENT OF SPOTTED WILT DISEASE OF PEANUT IN GEORGIA	II	666	22/08/00	16:30	CC		14	PS	14
Toft, S.	1656	CONTROL OF PLANTHOPPERS AND LEAFHOPPERS IN RICE BY THE SPIDER ATYPENA FORMOSANA	I	417	24/08/00	16:30	CC		8	PS	8
Tohno, Y.	3557	PHOTOPERIODIC CLOCK-ENDOCRINE SWITCH AXIS IN DIAPAUSE REGULATION IN SILKMOTH	II	897	24/08/00	16:30	CC		19	PS	19
Tohsaka, Y.	837	TIMING OF GALL-FORMATION CAUSING DIFFERENTIAL PERFORMANCE OF A STEM MOTHER IN NEOTHORACAPHIS YANONIS (APHIDIDAE)	I	212	23/08/00	14:00	HB	D	6	5	6
Tojo, S.	2517	INVOLVEMENT OF BOTH GRANULAR CELLS AND PLASMATOCYTES IN PHAGOCYTIC REACTION IN THE GREATER WAX MOTH, GALLERIA MELLONELLA	II	636	25/08/00	16:30	CC		13	PS	13
Tojo, S.	1083	OCCURRENCE PATTERNS OF SPODOPTERA LITURA (LEPIDOPTERA: NOCTUIDAE) IN SOUTHERN JAPAN AND SOUTH-EASTERN ASIA	I	273	23/08/00	16:30	CC		6	PS	6
Toko, M.	38	EFFECTS OF CASSAVA CULTIVAR ON ABUNDANCE OF EXOTIC PHYTOSEIID MITES IN AFRICA	I	10	22/08/00	16:30	CC		1	PS	1
Tokoro, M.	705	INCREASE OF TRAP CATCHES BY A COMBINATION OF MALE SEX PHEROMONES AND FLORAL ATTRACTANT IN LONGHORN BEETLE, ANAGLYPTUS SUBFASCIATUS (COLEOPTERA: CERAMBYCIDAE)	I	178	24/08/00	16:30	CC		4	PS	4
Tokoro, M.	704	INFLUENCE OF EXPERIENCE ON THE OLFACTORY RESPONSES OF A PREDATORY BEETLE, TROGOSSITA JAPONICA (COLEPTERA: TROGOSSITIDAE) TO VOLATILES OF ITS PREY-HOST TREE COMPLEX	I	178	24/08/00	16:30	CC		4	PS	4
Tokuda, G.	2161	PROTOZOAN AND ENDOGENOUS CELLULASES FROM TERMITES OF THE GENUS COPTOTERMES	I	545	25/08/00	16:30	CC		11	PS	11
Tokuda, M.	835	SYNCHRONIZATION OF GALLER'S APPEARANCE WITH HOST PLANT PHENOLOGY	I	211	23/08/00	13:30	HB	D	6	5	6
Tolbert, L. P.	2518	NEURAL DEVELOPMENT DURING EMBRYONIC AND METAMORPHIC DEVELOPMENT IN INSECTS	II	636	25/08/00	16:30	CC		13	PS	13
Toledo, A.	305	CICADELLIDAE (INSECTA-HOMOPTERA) SPECIES RICHNESS AND ABUNDANCE ON MAIZE IN ARGENTINA	I	77	24/08/00	16:30	CC		2	PS	2
Toledo, S.	1700	BIOLOGICAL CONTROL OF THE CITRUS LEAFMINER (LEPIDOPTERA: GRACILLARIIDAE) IN NORTHWEST ARGENTINA	I	428	21/08/00	16:30	CC		8	PS	8
Toll, S.	1717	MEIOTIC DRIVE, SPERM COMPETITION AND THE EVOLUTION OF MULTIPLE MATING BY FEMALE STALK-EYED FLIES (DIOPSIDAE)	I	433	21/08/00	15:10	HB	F	9	1	9
Tollefson, J. J.	158	INTRODUCTION TO DIABROTICINE PESTS IN THE UNITED STATES	I	41	26/08/00	13:35	HB	A	2	11	2
Tolmasky, D. S.	2519	METABOLISM OF GLYCOGEN DURING THE METAMORPHOSIS OF THE MEDFLY, CERATITIS CAPITATA	II	636	25/08/00	16:30	CC		13	PS	13
Tolmay, V.	3883	MOLECULAR MARKERS IN WHEAT LINKED TO GENES EXPRESSING RESISTANCE TO THE GREENBUG AND THE RUSSIAN WHEAT APHID	II	980	22/08/00	13:35	HB	H	22	3	22
Tomara, N.	3242	APHID POPULATION FLUCTUATION AND SPREAD OF APHID-BORNE VIRUSES IN TOBACCO CROPS IN GREECE	II	818	23/08/00	16:30	CC		17	PS	17
Tomioka, K.	3272	PROTEIN SYNTHESIS IS A REQUIRED PROCESS FOR THE CIRCADIAN CLOCK IN THE OPTIC LOBE OF THE CRICKET GRYLLUS BIMACULATUS	II	826	23/08/00	14:35	HB	K	18	3	18
Tomkins, B. L.	3325	GLUTATHIONE S-TRANSFERASE FROM THE SPRUCE BUDWORM, CHORISTONEURA FUMIFERANA: IDENTIFICATION, CHARACTER-IZATION, LOCALIZATION, CDNA CLONING, DEVELOPMENTAL EXPRESSION AND INDUCTION BY VARIOUS FACTORS	II	840	21/08/00	16:30	CC		18	PS	18
Tomkins, J. L.	1713	LEK PARADOX RESOLVED: EMPIRICAL EVIDENCE FOR GENETIC VARIANCE IN CONDITION AND IN CONDITION DEPENDENCE	I	432	21/08/00	13:50	HB	F	9	1	9
Tomkins, W.	2382	HORMONAL REGULATION OF CUTICLE FORMATION AND CHITIN SYNTHESIS	II	602	25/08/00	13:35	HB	I	13	9	13
Tomkins, W.	1845	BIOLOGICAL CONTROL OF FOREST PESTS USING INSECT SPECIFIC VIRUSES	I	465	23/08/00	14:35	HB	M	10	4	10
Tomkins, W.	3280	MOLECULAR ANALYSIS OF THE OVERWINTERING DIAPAUSE IN THE SPRUCE BUDWORM, CHORISTONEURA FUMIFERANA	II	828	23/08/00	10:20	HB	K	18	4	18
Tomlin, E. S.	1853	MECHANISMS OF RESISTANCE IN TREES TO SHOOT INSECTS	I	467	24/08/00	10:20	HB	M	10	5	10
Tomppo, E.	1872	GROWTH LOSSES AND ECONOMIC CONSEQUENCES OF PINE SAWFLY DEFOLIATION	I	472	25/08/00	11:35	HB	M	10	7	10
Tomquelski, G. V.	1407	PERFORMANCE OF THE MICROENCAPSULATED FORMULATION OF LAMBDA-CYHALOTHRIN FOR THE CONTROL OF THE WHITEFLY, BEMISIA TABACI (BIOTYPE B) (HEMIPTERA: ALEYRODIDAE), IN BEANS	I	355	25/08/00	16:30	CC		7	PS	7
Tomquelski, G. V.	1379	STRATEGIES FOR THE USE OF THIAMETHOXAM ON THE MANAGEMENT OF THE APHID Aphis gossypii IN COTTON	I	348	24/08/00	16:30	CC		7	PS	7
Tomquelski, G. V.	1378	EFFECT OF CHEMIGATION THROUGH CENTRAL PIVOT, FOR THE CONTROL OF THE FALL ARMYWORM, SPODOPTERA FRUGIPERDA, (LEPIDOPTERA: NOCTUIDAE), IN CORN	I	348	24/08/00	16:30	CC		7	PS	7
Ton, L. Q.	2915	MALARIA PARASITE ENCAPSULATION GENES IN ANOPHELES GAMBIAE	II	736	24/08/00	14:05	Bol	R	15	8	15
Tonet, G. L.	1408	EFFICIENCY OF INSECTICIDES TO STERNECHUS SUBSIGNATUS ON SOYBEAN	I	355	25/08/00	16:30	CC		7	PS	7
Tonet, G. L.	358	EFFICIENCY OF INSECTICIDES TO CONTROL ADULTS OF STERNECHUS SUBSIGNATUS IN SOYBEAN	I	91	25/08/00	16:30	CC		2	PS	2
Tonet, G. L.	359	INSECTICIDE EFFICACY TO CONTROL STERNECHUS SUBSIGNATUS ON SOYBEAN SEED TREATMENT	I	91	25/08/00	16:30	CC		2	PS	2
Tong, L. X.	76	CAUSES OF MITE PEST OUTBREAKS IN BAMBOO FORESTS IN FUJIAN, CHINA: ANALYSES OF MITE DAMAGE IN MONOCULTURE VERSUS POLYCULTURE STANDS	I	19	25/08/00	16:30	CC		1	PS	1
Tonhasca Jr, A.	1751	OVIPOSITION BEHAVIOR AND BIOLOGICAL CHARACTERISTICS OF TWO PHORID FLY PARASITOIDS OF THE LEAF-CUTTING ANT ATTA LAEVIGATA	I	441	21/08/00	16:30	CC		9	PS	9
Tonhasca Jr., A.	1035	THE ROLE OF LEARNING AND MEMORY IN LEAF-CUTTING ANT FORAGING ECOLOGY	I	261	23/08/00	16:30	CC		6	PS	6
Tonn, C. E.	729	BIOLOGICAL ACTIVITIES OF PLANT SECONDARY METABOLITES TOWARD INSECTS	I	184	25/08/00	16:30	CC		4	PS	4
Topp, W.	1976	DEADWOOD IN COMMERCIAL FORESTS: A SOURCE OF INCREASED BIODIVERSITY AND OF OUTBREAKS OF PEST SPECIES?	I	498	25/08/00	16:30	CC		10	PS	10
Topp, W.	3706	CIRCANNUAL LIFE-CYCLE PATTERNS IN MICROCAVE-DWELLING CHOLEVIDAE	II	936	26/08/00	16:05	HB	E	21	10	21
Topp, W.	4078	HUMIDITY PREFERENCE AND WATER LOSS IN LARVAE OF THE BROWN HOUSE MOTH (HOFMANNOPHILA PSEUDOSPRETELLA)	II	1030	22/08/00	16:30	CC		23	PS	23
Torales, G. J.	3562	TERMITES AS STRUCTURAL PESTS IN ARGENTINA	II	899	25/08/00	16:30	CC		19	PS	19
Torales, G. J.	3511	NEW FINDINGS OF NYMPH- SOLDIER INTERCASTES OF NASUTITERMES AQUILINUS (ISOPTERA, TERMITIDAE, NASUTITERMITINAE)	II	886	23/08/00	16:30	CC		19	PS	19
Torales, G. J.	3512	PRELIMINARY INVENTORY OF ISOPTERA FROM NATURAL PROTECTED AREAS OF NORTHEAST ARGENTINA	II	886	23/08/00	16:30	CC		19	PS	19
Torfs, H.	2344	DIFFERENTIAL ACTIVATION OF AN INSECT G PROTEIN-COUPLED PEPTIDE RECEPTOR BY INSECTATACHYKININ-LIKE AGONISTS	II	592	21/08/00	14:35	HB	I	13	2	13
Torfs, H.	2528	INSECT G PROTEIN-COUPLED RECEPTORS AND SIGNAL TRANSDUCTION	II	638	25/08/00	16:30	CC		13	PS	13
Torfs, H.	2529	INSECT G PROTEIN-COUPLED RECEPTORS AND SIGNAL TRANSDUCTION	II	639	25/08/00	16:30	CC		13	PS	13
Torii, T.	3852	CLADISTIC ANALYSES OF THE JAPANESE TIPULIDAE (DIPTERA). PART I: PHYLOGENY OF THE TRIBE PEDICIINI (LIMONIINAE)	II	972	25/08/00	16:30	CC		21	PS	21
Torii, T.	3853	CLADISTIC ANALYSES OF THE JAPANESE TIPULIDAE (DIPTERA). PART II: PHYLOGENY OF THE GENUS ANTOCHA RECORDED FROM JAPAN AND ITS ADJACENT AREA (LIMONIINAE: LIMONIINI)	II	972	25/08/00	16:30	CC		21	PS	21

Sub-titles: (HB=Hotel Bourbon) - (HM=Hotel Mabu) - (CC=Convention Center) - (Bol=Foz Boulevard) - (PS=Poster Session) - (PL=Plenary Lecturer)

AUTHOR	Nº	TITLE	Book	Page	Date	Time	Local	Room	Session	Symp	New Session
Toros, S.	45	LIFE TABLES OF ACARUS SIRO (ACARI, ACARIDAE) ON SEVEN DIFFERENT DIETS	I	12	23/08/00	16:30	CC		1	PS	1
Toros, S.	46	A FAUNISTIC INVESTIGATION ON THE MITE SPECIES OF STORED PRODUCTS IN TEKIRDAG PROVINCE	I	12	23/08/00	16:30	CC		1	PS	1
Torre, A della	2279	ODYSSEUS, A NOVEL TRANSPOSON INVOLVED IN THE GENERATION OF CHROMOSOMAL INVERSIONS IN THE MALARIA MOSQUITO ANOPHELES ARABIENSIS	I	575	23/08/00	16:30	CC		12	PS	12
Torre, M. C. de la	2460	ANTIFEEDANT ACTIVITY AND POST-INGESTIVE EFFECT OF TERPENOIDS ISOLATED FROM TRICHILIA HAVANENSIS AND SCUTELLARIA ALPINA ON COLORADO POTATO BEETLE LARVAE	II	621	25/08/00	16:30	CC		13	PS	13
Torres, J. B.	1681	QUANTITATIVE MASS PRODUCTION OF THE STINKBUG PREDATOR PODISUS NIGRISPINUS (HETEROPTERA: PENTATOMIDAE)	I	424	25/08/00	16:30	CC		8	PS	8
Torres, J. B.	587	EFFECTS OF PHEROMONES IN ARTIFICIAL DIETS FOR PREDATORY BUGS	I	149	22/08/00	9:50	Bol	S	4	2	4
Torres, J. B.	1522	TUTA ABSOLUTA PARASITISM BY TRICHOGRAMMA PRETIOSUM WITH NOTES ON HOST SITE	I	384	21/08/00	16:30	CC		8	PS	8
Torres, J. B.	1690	ENVIRONMENTAL AND PREY INTERACTION ON THE DEVELOPMENT AND REPRODUCTION OF THE STINKBUG PREDATOR PODISUS NIGRISPINUS	I	426	25/08/00	16:30	CC		8	PS	8
Torres, J. B.	1330	EFFECT OF VEGETAL AQUEOUS EXTRACTS ON IMMATURE STAGES AND FEMALES OF THE CASSAVA GREEN MITE MONONYCHELUS TANAJOA	I	336	22/08/00	16:30	CC		7	PS	7
Torres, J. B.	4085	IDENTIFICATION OF COWPEA VIGNA UNGUICULATA GENOTYPES RESISTANT TO CALLOSOBRUCHUS MACULATUS	II	1031	23/08/00	16:30	CC		23	PS	23
Torres, J. E. B.	1829	POTENTIAL USE OF ASOPINAE STINKBUG BUG PREDATORS IN BRAZIL	I	461	22/08/00	11:20	HB	M	10	2	10
Torres, L. M.	2839	EVALUATION OF TRAPS FOR MONITORING BACTROCERA OLEAE ADULTS, IN INTEGRATED PEST MANAGEMENT	II	717	25/08/00	16:30	CC		14	PS	14
Torres, L. M.	1488	DATA ON THE NATURAL CONTROL OF THE OLIVE MOTH, PRAYS OLEAE , BY PARASITOIDS IN TRÁS-OS-MONTES REGION (NORTHEASTERN PORTUGAL)	I	375	21/08/00	16:30	CC		8	PS	8
Torres, R. F.	1191	MIMETIC ASSEMBLAGES OF LYCID BEETLES IN SOUTHERN BRAZIL	I	300	25/08/00	16:30	CC		6	PS	6
Torres, R. F.	1192	MIMICRY DYNAMICS OF WASPS AND OTHER INSECTS IN SOUTHERN BRAZIL	I	300	25/08/00	16:30	CC		6	PS	6
Torres, R. M. S.	1648	FUNCTIONAL RESPONSE OF CYCLONEDA SANGUINEA (COLEOPTERA : COCCINELLIDAE) AT DIFFERENT DENSITIES OF THE APHID MYZUS PERSICAE (HOMOPTERA: APHIDIDAE)	I	415	22/08/00	16:30	CC		8	PS	8
Torti, C.	2209	TRANSPOSABLE ELEMENT ABUNDANCE, DISTRIBUTION AND EVOLUTION IN TEPHRITID FLIES	I	558	24/08/00	14:35	HB	L	12	8	12
Tosaka, Y.	1801	RANDOM MATING SECONDARILY DERIVED FROM LMC (LOCAL MATE COMPETITION) IN A GALL APHID, NEOTHORACAPHIS YANONIS	I	454	25/08/00	16:30	CC		9	PS	9
Toscano, L. C.	1484	BIOLOGICAL ASPECTS OF CHRYSOPERLA EXTERNA AND CERAEOCHRYSA CINCTA IMMATURE STAGES FED EGGS AND NYMPHS OF BIOTYPE "B" BEMISIA TABACI	I	374	22/08/00	16:30	CC		8	PS	8
Toscano, L. C.	1802	AGING AND TOMATO LEAFLET POSITIONS INFLUENCE ON OVIPOSITION OF BEMISIA TABACI BIOTYPE "B" (HEMIPTERA: ALEYRODIDAE)	I	454	25/08/00	16:30	CC		9	PS	9
Toscano, L. C.	2840	OVIPOSITION PREFERENCE OF SILVERLEAF WHITEFLY (HEMIPTERA: ALEYRODIDAE) FOR SQUASH GENOTYPES	II	717	22/08/00	16:30	CC		14	PS	14
Tosh, C. R.	902	IMPACT OF THE GENOTYPE OF A SYMBIOTIC BACTERIA ON THE FITNESS OF A PHYTOPHAGOUS INSECT	I	228	21/08/00	16:30	CC		6	PS	6
Tóthmérész, B.	1779	EDGE EFFECT ON GROUND BEETLES	I	448	23/08/00	16:30	CC		9	PS	9
Tóthmérész, B.	1915	EFFECTS OF NON-NATIVE SPRUCE PLANTATION ON CARABID BEETLES	I	483	21/08/00	16:30	CC		10	PS	10
Touré, Y. T.	2215	CHROMOSOMAL POLYMORPHISM AND SPECIATION IN ANOPHELES GAMBIAE	I	559	24/08/00	10:05	HB	L	12	9	12
Toumel, G.	2401	MORPHINE EXTRACTION IN NECROPHAGOUS INSECTS REMAINS FOR DETERMINING ANTE-MORTEM OPIATE INTOXICATION	II	607	21/08/00	16:30	CC		13	PS	13
Townsend Jr, V. R.	2441	MEMBRANE DYNAMICS OF RAPID FLUID TRANSPORT IN THE MALPIGHIAN TUBULES OF THE HOUSE CRICKET, ACHETA DOMESTICUS	II	617	22/08/00	16:30	CC		13	PS	13
Toya, T.	2726	MODE OF ACTION AND CHARACTARISTICS OF A NOVEL INSECT PEST CONTROL AGENT, CHROMAFENOZIDE	II	688	23/08/00	16:30	CC		14	PS	14
Toya, T.	3961	INSECTICIDAL ACTIVITY OF A NOVEL INSECT PEST CONTROL AGENT, CHROMAFENOZIDE	II	1000	22/08/00	16:30	CC		22	PS	22
Toyama, T.	1803	INTRASEXUAL COMPETITION FOR VIRGIN FEMALES, AND MATURATION STRATEGY IN A FOLIAGE SPIDER CHIRACANTHIUM JAPONICUM (ARANEAE: CLUBIONIDAE)	I	454	25/08/00	16:30	CC		9	PS	9
Toyoshima, S.	3376	AN EVIDENCE OF MATERNALLY CONTROLLED SEX DETERMINATION IN PHYTOSEIULUS PERSIMILIS	II	852	25/08/00	16:30	CC		18	PS	18
Tozetto, S. de O.	3377	HEXOKINASE ISOENZYME PATTERN IN THE DEVELOPMENT OF APIS MELLIFERA DRONES	II	853	25/08/00	16:30	CC		18	PS	18
Tozetto, S. de O.	3378	CYTOSKELETON DYNAMICS DURING SPERMATOGENESIS IN APIS MELLIFERA DRONES	II	853	25/08/00	16:30	CC		18	PS	18
Tozetto, S. O.	3379	EFFECT OF MORPHOGENETIC HORMONES ON THE PROTEIN PROFILE OF TESTES, MUCUS GLANDS AND SEMINAL VESICLES OF APIS MELLIFERA DRONES	II	853	25/08/00	16:30	CC		18	PS	18
Tram, U.	3300	CONTROL OF DROSOPHILA REPRODUCTION BY MALE-DERIVED PROTEINS IN THE SEMINAL FLUID	II	833	25/08/00	13:35	HB	K	18	7	18
Tranfaglia, A.	1451	HOST SELECTION STRATEGIES BY THE APHID PARASITOID APHIDIUS ERVI	I	366	23/08/00	13:35	HM	O	8	6	8
Travalini, C.	1375	BASES FOR AN INSECTICIDE RESISTANCE MANAGEMENT OF SPODOPTERA FRUGIPERDA IN CORN IN BRAZIL	I	347	24/08/00	16:30	CC		7	PS	7
Travis, J. M. J.	1193	MIGRATION, METAPOPULATIONS, AND LANDSCAPES: RECENT DEVELOPMENTS	I	301	25/08/00	16:30	CC		6	PS	6
Travis, J. M. J.	1194	CLIMATE CHANGE, DISPERSAL AND INSECT BIODIVERSITY	I	301	25/08/00	16:30	CC		6	PS	6
Treacy, M.	2565	SELECTIVE CHEMISTRY AND GENETICALLY MODIFIED MICROORGANISMS AS TOOLS FOR IPM IN CONVENTIONAL AND TRANSGENIC CROPPING SYSTEMS	II	648	22/08/00	14:35	HB	B	14	4	14
Tregenza, T.	1719	POLYANDRY, MULTIPLE MATING AND OFFSPRING ENVIRONMENT – WHY DO FEMALE DUNGFLIES RE-MATE?	I	433	21/08/00	15:50	HB	F	9	1	9
Trejo, A.	3012	A THREE-YEAR FIELD EVALUATION OF THE IMPACT OF ROTATIONS AND MOSAIC AS RESISTANCE MANAGEMENT STRATEGIES IN ANOPHELES ALBIMANUS IN SOUTHERN MEXICO	II	760	24/08/00	16:30	CC		15	PS	15
Trematerra, P.	4002	THE ROLE OF INSECT PHEROMONES IN STORED PRODUCT PROTECTION	II	1011	21/08/00	9:35	HB	J	23	1	23
Trematerra, P.	4003	WHEAT KERNELS STATUS AND HOST SELECTION IN SOME STORED PRODUCT INSECTS	II	1011	21/08/00	10:00	HB	J	23	1	23
Trematerra, P.	4024	PROBLEMS ASSOCIATED WITH USE OF INSECT PHEROMONES IN INTEGRATED PEST MANAGEMENT OF STORED PRODUCTS	II	1016	22/08/00	14:45	HB	J	23	5	23
Trematerra, P.	4112	MONITORING OF ARTHROPODS IN A CENTRAL ITALY FEED-MILL	II	1038	25/08/00	16:30	CC		23	PS	23
Tremblay, E.	2364	PHYSIOLOGICAL AND NUTRITIONAL INTERACTIONS BETWEEN THE PEA APHID AND THE ENDOPHAGOUS BRACONID APHIDIUS ERVI	II	597	24/08/00	9:50	HB	I	13	6	13
Trenner, S.	736	A NEW AUTOMATIC BIOASSAY TO TEST THE ATTRACTION OF HOST STIMULI IN CRAWLING INSECTS	I	186	25/08/00	16:30	CC		4	PS	4
Trevizan, L. R. P.	2841	DELTAMETHRIN RESIDUES ON/IN WHEAT GRAIN AND IN SOME OF THEIR PROCESSED PRODUCTS DETERMINED BY GAS CHROMATOGRAPHY	II	717	25/08/00	16:30	CC		14	PS	14
Trevizan, L. R. P.	1409	DELTAMETHRIN RESIDUES ON/IN CORN AND POPCORN GRAINS AND IN SOME OF THEIR PROCESSED PRODUCTS DETERMINED BY GAS CHROMATOGRAPHY	I	355	25/08/00	16:30	CC		7	PS	7
Tricio, A.E.	561	RHOPALOCEROS FROM IGUAZU NATIONAL PARK (MISIONES, ARGENTINA)	I	142	25/08/00	16:30	CC		3	PS	3
Tricio, A.E.	562	DISTRIBUTION OF SOME SWALLOWTAIL BUTTERFLIES OF POSADAS, MISIONES, ARGENTINA	I	142	25/08/00	16:30	CC		3	PS	3
Tricio, A.E.	3021	MONITORING OF HEMATOPHAGOUS VECTORS IN THE AREA OF INFLUENCE OF THE YACYRETA DAM	II	762	22/08/00	16:30	CC		15	PS	15

Sub-titles: (HB=Hotel Bourbon) - (HM=Hotel Mabu) - (CC=Convention Center) - (Bol=Foz Boulevard) - (PS=Poster Session) - (PL=Plenary Lecturer)

AUTHOR	Nº	TITLE	Book	Page	Date	Time	Local	Room	Session	Symp	New Session
Triggiani, O.	1848	PRELIMINARY STUDIES ON THE APPLICATION OF STEINERNEMATID NEMATODES AGAINST OVERWINTERING LARVAE OF PINE PROCESSIONARY CATERPILLAR, THAUMETOPOEA PITYOCAMPA DEN. ET SCHIFF. (LEPIDOPTERA: THAUMETOPOEIDAE)	I	466	23/08/00	15:50	HB	M	10	4	10
Trigo, J. R.	1658	PYRROLIZIDINE ALKALOIDS (PAS) ANTI-PREDATOR ACTIVITY AGAISNT INVERTEBRATE AND VERTEBRATE PREDATORS	I	418	24/08/00	16:30	CC		8	PS	8
Trigo, J. R.	970	PERFORMANCE OF UTETHEISA ORNATRIX (LEP.: ARCTIIDAE) IN TWO SPECIES OF CROTALARIA SP. (FABACEAE) HOST PLANTS	I	245	22/08/00	16:30	CC		6	PS	6
Trindade, A. A.	4113	CONTROL OF NASUTITERMES SP. IN A HISTORICAL PATRIMONY IN THE CONTRYSIDE OF RIO DE JANEIRO	II	1038	24/08/00	16:30	CC		23	PS	23
Trindade, A. A.	4114	CONTROL OF NASUTITERMES SP. ATTACKING A STORE OF FABRICS IN THE COUNTRYSIDE OF RIO DE JANEIRO STATE	II	1039	25/08/00	16:30	CC		23	PS	23
Trindade, A. A.	360	FIRST EVIDENCE OF COPTOTERMES HAVILANDI IN CAMPOS DOS GOYTACAZES (RJ), BRAZIL	I	91	25/08/00	16:30	CC		2	PS	2
Tripet, F.	2215	CHROMOSOMAL POLYMORPHISM AND SPECIATION IN ANOPHELES GAMBIAE	I	559	24/08/00	10:05	HB	L	12	9	12
Tripole, E. S.	477	AQUATIC INSECT BIODIVERSITY IN STREAMS OF DIFFERENT BASINS AT A REGIONAL SCALE	I	121	21/08/00	16:30	CC		3	PS	3
Trjapitzin, V. A.	2520	ECESIS OF ENCYRTIDAE (HYMENOPTERA: CHALCIDOIDEA) INTO MÉXICO	II	636	25/08/00	16:30	CC		13	PS	13
Trouche, G.	2662	DEVELOPPING IPM COMPONENTS FOR THE CONTROL OF SORGHUM MAIN PESTS IN BURKINA FASO	II	672	21/08/00	16:30	CC		14	PS	14
Trougakos, I. P.	3168	THE EGGSHELL OF LEPTINOTARSA DECEMLINEATA: STRUCTURAL AND BIOCHEMICAL ANALYSIS OF THE CRYSTALLINE CHORION LAYER	II	799	24/08/00	16:30	CC		16	PS	16
Trougakos, I. P.	3190	DIFFERENTIAL SORTING OF THE CONSTITUTIVELY CO-SECRETED VITELLINE MEMBRANE AND YOLK PROTEINS OF DROSOPHILA IN THE VITELLOGENIC OVARIAN FOLLICLE CELLS; A HIGH RESOLUTION IMMUNO-ELECTRON MICROSCOPY STUDY OF THE FOLLICLE CELLS SECRETORY AND OOCYTE ACCUMULATIVE PATHWAYS	II	805	25/08/00	16:30	CC		16	PS	16
Troxell, T. C.	112	OVERVIEW OF FDA'S PESTICIDE RESIDUE MONITORING PROGRAM	I	29	23/08/00	11:35	HB	A	2	5	2
Trudeau, D.	2521	MELANIZATION AND ENCAPSULATION IN HELICOVERPA ZEA LARVAE INFECTED WITH AUTOGRAPHA CALIFORNICA M NUCLEOPOLYHEDROVIRUS	II	637	25/08/00	16:30	CC		13	PS	13
Trudeau, D.	2371	THE ROLE OF POLYDNAVIRUSES IN DEFINING PARASITOID HOST RANGES	II	599	24/08/00	13:35	HB	I	13	7	13
Trueba, G.	3006	THE IMPORTANCE OF DEVELOPING NOVEL STRATEGIES FOR PESTICIDE USE IN CONTROLLING VECTOR-BORNE DISEASES	II	758	24/08/00	16:30	CC		15	PS	15
Trueman, J.	104	IPM OF BEMISIA TABACI IN AUSTRALASIA	I	27	22/08/00	15:30	HB	A	2	4	2
Trueman, J. W. H.	2157	PHYLOGENY OF PAECILOMYCES SPECIES REVEALED BY ANALYSIS OF RIBOSOMAL RNA ITS SEQUENCES	I	544	25/08/00	16:30	CC		11	PS	11
Trueman, J. W. H.	2156	PHYLOGENY OF PAECILOMYCES SPECIES REVEALED BY ANALYSIS OF RIBOSOMAL RNA ITS SEQUENCES	I	544	25/08/00	16:30	CC		11	PS	11
Truman, J. W.	2338	CHECK-POINTS AND TRIGGERS IN THE PEPTIDE CASCADE THAT ORCHESTRATES ECDYSIS BEHAVIOR IN INSECTS	II	591	21/08/00	9:35	HB	I	13	1	13
Truman, J. W.	2522	POSSIBLE MOLECULAR STRATEGIES THAT UNDERLIE THE EVOLUTION OF METAMORPHIC DEVELOPMENT	II	637	25/08/00	16:30	CC		13	PS	13
Truman, J. W.	2523	THE USE OF DROSOPHILA TO STUDY THE CONTROL PATHWAYS FOR EXOGENOUS AND ENDOGENOUS COMPONENTS OF THE ECDYSIS RHYTHM	II	637	25/08/00	16:30	CC		13	PS	13
Truman, J. W.	3273	THE USE OF DROSOPHILA TO STUDY THE CONTROL PATHWAYS FOR EXOGENOUS AND ENDOGENOUS COMPONENTS OF THE ECDYSIS RHYTHM	II	827	23/08/00	14:50	HB	K	18	3	18
Truman, J. W.	3296	POSSIBLE MOLECULAR STRATEGIES THAT UNDERLIE THE EVOLUTION OF METAMORPHIC DEVELOPMENT	II	832	25/08/00	14:35	HB	K	18	6	18
Truman, J. W.	3288	CROSS TALK BETWEEN ECDYSTEROIDS AND JUVENILE HORMONE AT THE CELLULAR LEVEL	II	830	23/08/00	15:05	HB	K	18	5	18
Trumble, J. T.	1413	RECLAMATION OF SELENIUM-CONTAMINATED SITES: RESPONSE OF SPODOPTERA EXIGUA (LEPIDOPTERA: NOCTUIDAE) TO CONTAMINATED ALFALFA AND ATRIPLEX PLANTS	I	356	25/08/00	16:30	CC		7	PS	7
Trumble, J. T.	942	EFFECT OF ELEVATED CARBON DIOXIDE ON PLANT ALLOCATION TO ANTIHERBIVORY COMPOUNDS	I	238	21/08/00	16:30	CC		6	PS	6
Trumper, E. V.	316	SAMPLING DISTRIBUTION PATTERNS OF RACHIPLUSIA NU (LEPIDOPTERA: NOCTUIDAE) AND DESIGN OF SAMPLE PLANS	I	80	24/08/00	16:30	CC		2	PS	2
Trumper, E. V.	321	EGG DEVELOPMENT IN DIATRAEA SACCHARALIS (LEPIDOPTERA: PYRALIDAE) UNDER DIFFERENT TEMPERATURE REGIMES	I	81	24/08/00	16:30	CC		2	PS	2
Trumper, E. V.	361	ARMADILLIDIUM VULGARE (CRUSTACEA: ISOPODA). NEW PEST TO SOYBEANS IN ARGENTINA?	I	91	25/08/00	16:30	CC		2	PS	2
Trumper, E. V.	1329	EXPLORING THE INFLUENCE OF INSECTICIDE ON INSECT PEST-PREDATOR INTERACTIONS USING A THEORETICAL TWO-FIELD MODEL	I	335	22/08/00	16:30	CC		7	PS	7
Trunzer, B.	1768	COOPERATION AND DIVISION OF LABOR BETWEEN UNRELATED INDIVIDUALS IN THE ANT PACHYCONDYLA 'INVERSA'	I	445	22/08/00	16:30	CC		9	PS	9
Truol, G. A.	563	PRESENCE OF DIURAPHIS NOXIA (HOMOPTERA: APHIDIDAE) COLONIZING BARLEY CROPS IN THE CENTRAL AREA OF THE PROVINCE OF CÓRDOBA (ARGENTINA)	I	142	25/08/00	16:30	CC		3	PS	3
Tsai, C. W.	1195	ANALYSIS OF SPECIFIC ADAPTATION TO A DOMICILE HABITAT: A COMPARATIVE STUDY OF TWO CLOSELY RELATED COCKROACH SPECIES	I	301	25/08/00	16:30	CC		6	PS	6
Tsai, H.-J.	1018	PRELIMINARY STUDY OF LIFE HISTORY OF TORTOISE BEETLE, ASPIDOMORPH MILIARIS (COLEOPTERA: HRYSOMELIDAE)	I	257	23/08/00	16:30	CC		6	PS	6
Tsai, R. S.	3198	ANTENNATION AND SEXUALLY DIMORPHIC ANTENNAE OF THE BLISTER BEETLE, EPICAUTA HIRTICONIS	II	807	25/08/00	16:30	CC		16	PS	16
Tsang, W.	1682	PRACTICES OF IPM ON VEGETABLES IN HONG KONG	I	424	25/08/00	16:30	CC		8	PS	8
Tsaur, S. C.	2524	EXTREME HIGH-LEVEL OF AMINO ACID POLYMORPHISM IN A MALE REPRODUCTIVE PROTEIN GENE, ACP26AA, IN DROSOPHILA MAURITIANA	II	637	25/08/00	16:30	CC		13	PS	13
Tscharntke, T.	989	TRAP-NESTING BEES AND WASPS AND THEIR NATURAL ENEMIES AS BIOINDICATORS	I	250	22/08/00	16:30	CC		6	PS	6
Tscharntke, T.	3596	COMMUNITIES OF POD-INHABITING INSECTS IN MADAGASCAR: PATTERNS OF SPECIES RICHNESS, SPATIAL RESOURCE FRAGMENTATION, AND TROPICAL-TEMPERATE COMPARISONS.	II	907	22/08/00	16:30	CC		20	PS	20
Tschuch, G.	1744	EVOLUTION OF APOSEMATIC SIGNALS IN MUTILLID WASPS (HYMENOPTERA)	I	439	23/08/00	11:45	HB	F	9	3	9
Tshernyshev, W. B.	362	ALLOCATION OF ARTHROPODS IN WINTER WHEAT CROP AND AROUND IT	I	92	25/08/00	16:30	CC		2	PS	2
Tshernyshev, W. B.	2842	INTEGRATED PEST MANAGEMENT (IPM) AND ECOLOGICAL PEST MANAGEMENT (EPM)	II	717	25/08/00	16:30	CC		14	PS	14
Tsiropoulos, G. J.	3200	MORPHOLOGICAL CHARACTERISTICS OF COMMUNICATION ORGANS OF ADULT BACTROCERA (DACUS) OLEAE (DIPTERA: TEPHRITIDAE)	II	807	25/08/00	16:30	CC		16	PS	16
Tsitsipis, J. A.	2327	LIFE CYCLE, MORPHOLOGICAL AND GENETIC VARIATION IN CLONES OF MYZUS PERSICAE (HOMOPTERA: APHIDIDAE)	I	587	25/08/00	16:30	CC		12	PS	12
Tsitsipis, J. A.	3242	APHID POPULATION FLUCTUATION AND SPREAD OF APHID-BORNE VIRUSES IN TOBACCO CROPS IN GREECE	II	818	23/08/00	16:30	CC		17	PS	17
Tsitsipis, J. A.	3227	NEW APHID VECTORS OF ZUCCHINI YELLOW MOSAIC VIRUS AND THEIR ROLE IN THE EPIDEMIOLOGY OF THE VIRUS IN GREECE	II	815	22/08/00	16:30	CC		17	PS	17
Tsitsipis, J. A.	2139	OBSERVATIONS ON THE VICE-LIKE STRUCTURES IN PUPAE OF PLUSIINAE (LEPIDOPTERA, NOCTUIDAE)	I	539	24/08/00	16:30	CC		11	PS	11
Tsitsipis, J. A.	4152	DIFFERENTIAL DISPLAY PCR WITH NON-RADIOACTIVE DETECTION OF DIFFERENTIALLY EXPRESSED mRNAs IN APHIDS.	II	1049	21/08/00	16:30	CC		Erratum	PS	21

Sub-titles: (HB=Hotel Bourbon) - (HM=Hotel Mabu) - (CC=Convention Center) - (Bol=Foz Boulevard) - (PS=Poster Session) - (PL=Plenary Lecturer)

AUTHOR	Nº	TITLE	Book	Page	Date	Time	Local	Room	Session	Symp	New Session
Tsuchida, K.	2525	PURIFICATION AND PROPERTIES OF TWO CAROTENOIDS BINDING PROTEINS FROM SILK GLAND OF BOMBYX MORI	II	638	25/08/00	16:30	CC		13	PS	13
Tsuchida, K.	3264	RELATIONSHIPS BETWEEN THE LOCATION AND THE RADIATION SENSITIVITY OF RETROTRANSPOSONS IN THE GENOME AND THE INSERTION MECHANISM	II	824	22/08/00	10:20	HB	K	18	2	18
Tsuchida, K.	3167	ISOLATION AND COMPARISON OF MARINER-LIKE SEQUENCES (MLSS) AMONG SOME LEPIDOPTERAN INSECTS AND INVERTEBRATES	II	799	24/08/00	16:30	CC		16	PS	16
Tsuda, K.	1150	BIODIVERSITY OF FAGUS GALL MIDGES: COEXITENCE AND LIFE HISTORY STRATEGY	I	290	24/08/00	16:30	CC		6	PS	6
Tsukada, M.	1196	THE ROLE OF FRASS-COVER ON INSECT EGGS: FROM THE VIEWPOINT OF PARASITIZATION REDUCTION	I	301	25/08/00	16:30	CC		6	PS	6
Tsukamoto, Y.	3961	INSECTICIDAL ACTIVITY OF A NOVEL INSECT PEST CONTROL AGENT, CHROMAFENOZIDE	II	1000	22/08/00	16:30	CC		22	PS	22
Tsumuki, H.	2526	EFFECTS OF PHOTOPERIOD, TEMPERATURE AND HORMONES ON GLYCEROL CONTENT AND ENDOGENOUS ICE NUCLEUS PRODUCTION IN LARVAE OF THE RICE STEM BORER, CHILO SUPPRESSALIS (LEPIDOPTERA: PYRALIDAE)	II	638	25/08/00	16:30	CC		13	PS	13
Tsurumaki, J.	3566	PHOTOPERIODIC AND NEUROENDOCRINE REGULATION OF THE SEASONAL MORPH DEVELOPMENT IN A BIVOLTINE RACE (DAIZO) OF THE SILKMOTH, BOMBYX MORI	II	900	25/08/00	16:30	CC		19	PS	19
Tsuzuki, S.	3287	ENDOCRINE CONTROL OF PROGRAMMED CELL DEATH OF ANTERIOR SILK GLAND IN BOMBYX MORI	II	830	23/08/00	14:35	HB	K	18	5	18
Tu, Z.	2208	MOLECULAR AND EVOLUTIONARY ANALYSIS OF DIVERSE FAMILIES OF MOSQUITO TRANSPOSABLE ELEMENTS AND POTENTIAL APPLICATIONS	I	557	24/08/00	14:15	HB	L	12	8	12
Tucci, E. C.	3022	EFFICACY OF DIFFERENT INSECTICIDES ON THE CONTROL OF THE ADULT MUSCA DOMESTICA IN LABORATORY CONDITIONS	II	762	25/08/00	16:30	CC		15	PS	15
Tucker , J. S.	5	A NOVEL ANTI-INFLAMMATORY FACTOR IN THE SALIVA OF THE LONE STAR TICK AMBLYOMMA AMERICANUM	I	2	24/08/00	15:35	HB	F	1	1	1
Tufail, M.	3380	CLONING OF VITELLOGENIN cDNA OF PERILTANETA AMERICANA AND ITS STYRUCTURE AND EXPRESSION	II	853	25/08/00	16:30	CC		18	PS	18
Tulke, H. H.	983	SOURCE-SINK RE-COLONISATION: A POSSIBLE STRATEGY OF INSECTS LIVING IN TEMPORARILY SUITABLE HABITATS	I	248	22/08/00	16:30	CC		6	PS	6
Tumlinson, J. H.	1454	FINDING HOSTS IN A COMPLEX ENVIRONMENT: THE ROLE OF PLANT COMMUNICATION	I	367	23/08/00	14:35	HM	O	8	6	8
Turchetto, M.	3023	DIAGNOSTIC MORPHOLOGICAL CHARACTERS IN DIFFERENT LIFE STAGES OF HERMETIA ILLUCENS STUDIED BY VP SCAN MICROSCOPE: A NEW NOT DAMAGING METHOD FOR UNTREATED ORGANISMS	II	763	25/08/00	16:30	CC		15	PS	15
Turillazzi, S.	1555	A DISCUSSION ON THE PRELIMINARY OBSERVATIONS OF THE RELATIONSHIP BETWEEN XENOS VESPARUM ROSSI AND IT'S HOST POLISTES DOMINULUS CHRIST (HYMENOPTERA)	I	392	22/08/00	16:30	CC		8	PS	8
Turillazzi, S.	3652	INITIAL OBSERVATIONS OF THE STREPSIPTERAN XENOS VESPARUM IN THE PAPER WASP POLISTES DOMINULUS	II	922	23/08/00	15:20	HB	E	21	5	21
Turin, H.	1037	ABUNDANCE-REGIONAL DISTRIBUTION RELATIONSHIPS IN NORTHERN EUROPEAN CARABIDS (COLEOPTERA: CARABIDAE)	I	262	23/08/00	16:30	CC		6	PS	6
Turini, T.	2765	COTTON HOST PLANT RESISTANCE TO THE SILVERLEAF WHITEFLY TRANSMITTED COTTON LEAF CRUMPLE DISEASE	II	698	24/08/00	16:30	CC		14	PS	14
Turlings, T.	861	THE ACTIVE ROLE OF PLANTS IN ATTRACTING PARASITOIDS: DOES IT BENEFIT THE PLANTS?	I	218	25/08/00	13:35	HB	D	6	8	6
Turlings, T.	1422	IS IT FEASIBLE TO INCREASE THE ATTRACTIVENESS OF CROP PLANTS TO PARASITOIDS?	I	359	21/08/00	10:50	HM	O	8	1	8
Turlings, T.	671	VARIATION AND SPECIFICITY OF HERBIVORE-INDUCED PLANT ODORS AS FORAGING CUES FOR PARASITOIDS	I	170	23/08/00	16:30	CC		4	PS	4
Turlings, T. C. J.	1452	POST-EMERGENCE HOST MANIPULATION BEHAVIOR BY LARVAE OF THE SOLITARY ENDOPARASITOID COTESIA MARGINIVENTRIS (HYMENOPTERA: BRACONIDAE)	I	366	23/08/00	13:55	HM	O	8	6	8
Turner, M.	3141	THE FUNCTIONAL MICROMORPHOLOGY OF THE WARTHOG LOUSE (HAEMATOPINUS PHACOCHOERI) AS REVEALED BY SCANNING ELECTRON MICROSCOPY	II	792	22/08/00	16:30	CC		16	PS	16
Turner, N. C.	3989	RESPONSE OF TRANSGENIC PEAS CONTAINING A SEED SPECIFIC ALPHA-AMYLASE INHIBITOR GENE TO HEAT AND WATER STRESSES	II	1007	24/08/00	16:30	CC		22	PS	22
Turner, P. C.	4	ECDYSTEROID SYNTHESIS AND ACTION IN THE IXODID TICKS	I	1	24/08/00	15:05	HB	F	1	1	1
Turner, R. F.	3134	FINE STRUCTURE OF THE REPRODUCTIVE SYSTEM OF THE CARIBBEAN FRUITFLY	II	791	22/08/00	16:30	CC		16	PS	16
Turner, T.	3073	BICOID AS A PHYLOGENETIC ADDITION TO THE INSECT BODY PLAN	II	775	24/08/00	14:00	HB	G	16	6	16
Turnipseed, S. G.	2570	COTTON IN THE SOUTHERN USA AS A MODEL IPM SYSTEMS	II	649	22/08/00	15:50	HB	B	14	4	14
Tushemereirwe, W. K.	2697	MANAGEMENT OF THE BANANA WEEVIL COSMOPOLITES SORDIDUS (COLEOPTERA:CURCULIONIDAE) IN BANANA-BASED CROPPING SYSTEMS IN NTUNGAMO, UGANDA	II	681	22/08/00	16:30	CC		14	PS	14
Twardus, D. B.	1943	USDA FOREST SERVICE FOREST HEALTH PROTECTION INTERNATIONAL PARTNERSHIPS AND ACTIVITIES	I	490	23/08/00	16:30	CC		10	PS	10
Tyshenko, M. G.	3283	WHEN YOU CANT FLY TO BRAZIL: SURVIVING WINTER WITH ANTIFREEZE PROTEIN GENES	II	829	23/08/00	11:05	HB	K	18	4	18
Tzolovsky, G.	3319	OOGENESIS IN DROSOPHILA	II	838	22/08/00	16:30	CC		18	PS	18
Uchida, S.	3313	ECDYSTEROID CONTROL OF WING MORPHOGENESIS DURING METAMORPHOSIS AND PUPAL DEVELOPMENT	II	837	23/08/00	16:30	CC		18	PS	18
Uchôa, M. A. F.	1683	CANDIDATE INSECTS FOR THE BIOCONTROL OF THE PLANT PHYTOPARASITE PSITTACANTHUS SP. (LORANTHACEAE) IN THE REGION OF THE PANTANAL, MATO GROSSO DO SUL STATE, BRAZIL	I	424	25/08/00	16:30	CC		8	PS	8
Uchôa, M. A. F.	2843	FIRST SURVEY ON FRUIT FLIES, FRUGIVOROUS LONCHAEIDAE (DIPTERA: TEPHRITOIDEA) AND THEIR HOST FRUITS IN THE SOUTH PANTANAL, MATO GROSSO DO SUL STATE, BRAZIL	II	718	25/08/00	16:30	CC		14	PS	14
Uchôa, M. A. F.	2844	FRUIT FLIES AND FRUGIVOROUS LONCHAEIDAE (DIPTERA: TEPHRITOIDEA) ON URBAN HOSTS IN TWO CITIES OF THE STATE OF MATO GROSSO DO SUL, BRAZIL	II	718	25/08/00	16:30	CC		14	PS	14
Udayagiri, S.	1476	HOST ACCESSIBILITY IMPACTS ON BIOLOGICAL CONTROL OF LYGUS HESPERUS WITH ANAPHES IOLE: THE STRAWBERRY EXPERIENCE	I	372	26/08/00	11:35	HM	O	8	8	8
Uechi, N.	839	HOST ALTERNATION BY MULTIVOLTINE GALL MIDGES OF THE GENUS ASPHONDYLIA	I	212	23/08/00	14:30	HB	D	6	5	6
Ueckermann, P.	3563	THE DISTRIBUTION AND CONTROL OF ANTS (HYMENOPTERA: FORMICIDAE) IN VINEYARDS IN THE MAJOR GRAPE-GROWING REGIONS OF SOUTH AFRICA	II	899	25/08/00	16:30	CC		19	PS	19
Ueda, A.	564	RELATION BETWEEN THE DIVERSITY OF CARABID BEETLES AND DEER, MICE, AND DWARF BAMBOO IN A DECLINING ALPINE FOREST	I	143	25/08/00	16:30	CC		3	PS	3
Ueda, H.	3312	MOLECULAR BIOLOGY OF INSECT CLOCKS FOR PHOTOPERIODISM	II	836	25/08/00	14:00	HB	K	18	8	18
Ueda, K.	293	YIELD LOSS ASSESSMENT OF UPLAND RICE DUE TO INSECT PESTS IN CENTRAL KALIMANTAN, BORNEO, INDONESIA IN WET SEASON 1997/98	I	74	24/08/00	16:30	CC		2	PS	2
Uematsu, H.	1804	DAILY PERIODICITY OF MATING- AND OVIPOSITING- BEHAVIOR IN DIAMONDBACK MOTH	I	454	25/08/00	16:30	CC		9	PS	9
Ugalde-Gómez, J. A.	404	INSTITUTO NACIONAL DE BIODIVERSIDAD (INBIO) HELPING TO CONSERVE COSTA RICAN BIODIVERSITY	I	103	23/08/00	9:50	HB	C	3	3	3
Uhm, K.-B.	2863	ARTHROPOD COMMUNITY STRUCTURE AND ITS CHANGING PATTERNS IN RICE ECOSYSTEMS IN KOREA	II	723	25/08/00	16:30	CC		14	PS	14

Sub-titles: (HB=Hotel Bourbon) - (HM=Hotel Mabu) - (CC=Convention Center) - (Bol=Foz Boulevard) - (PS=Poster Session) - (PL=Plenary Lecturer)

AUTHOR	Nº	TITLE	Book	Page	Date	Time	Local	Room	Session	Symp	New Session
Ulenberg, S. A.	788	COMPUTER-ASSISTED TOOLS FOR THE SPECIES RECOGNITION OF ECONOMICALLY IMPORTANT INSECTS AND MITES	I	199	22/08/00	16:30	CC		5	PS	5
Ulhôa, J. L. R.	2640	SELECTIVITY OF INSECTICIDES USED IN CHRYSANTEMUS PEST CONTROL TO ORIUS INSIDIOSUS	II	667	21/08/00	16:30	CC		14	PS	14
Ullman, D. E.	3243	HOW AND WHY DO THRIPS TRANSMIT TOSPOVIRUSES, A CELLULAR APPROACH TO UNDERSTANDING	II	819	25/08/00	16:30	CC		17	PS	17
Unnithan, G. C.	2477	REGULATION OF JH LEVELS IN MOSQUITOES	II	626	23/08/00	16:30	CC		13	PS	13
Unruh, T.	2551	THE ROLE OF NATURAL ENEMIES AND HABITAT MODIFICATION IN CODLING MOTH MANAGEMENT PROGRAMS	II	645	21/08/00	15:35	HB	B	14	2	14
Unruh, T.	2758	THE ROLE OF NATURAL ENEMIES AND HABITAT MODIFICATION IN CODLING MOTH MANAGEMENT PROGRAMS	II	696	23/08/00	16:30	CC		14	PS	14
Unruh, T. R.	2086	DEVELOPMENT OF ENTOMOPATHOGENIC NEMATODES FOR CONTROL OF OVERWINTERING CODLING MOTH LARVAE	I	526	23/08/00	16:30	CC		11	PS	11
Upton, J.	2086	DEVELOPMENT OF ENTOMOPATHOGENIC NEMATODES FOR CONTROL OF OVERWINTERING CODLING MOTH LARVAE	I	526	23/08/00	16:30	CC		11	PS	11
Uramoto, K.	279	HOST PLANTS OF FRUIT FLIES (DIPTERA: TEPHRITIDAE) IN THE STATE OF ESPÍRITO SANTO, BRAZIL	I	71	23/08/00	16:30	CC		2	PS	2
Urbanska, A.	690	BIOCHEMICAL ADAPTATION OF BIRD CHERRY-OAT APHID TO PLANT PHENOLICS	I	174	23/08/00	16:30	CC		4	PS	4
Urbanska, A.	737	APHID ENZYMES INVOLVED IN DETOXICATION OF CEREAL ALLELOCHEMICALS	I	186	25/08/00	16:30	CC		4	PS	4
Urias-Lopez, M.	4170	DIABROTICINE IN MEXICAN AGROECOSYSTEMS	II	1053	26/08/00	15:50	HB	A	Erratum	11	2
Uribe, A.	1214	PRELIMINARY STUDIES ON FORENSIC ENTOMOLOGY IN MEDELLIN-COLOMBIA	I	306	25/08/00	16:30	CC		6	PS	6
Uris, S. R.	3420	USE OF WILD SILKMOTHS AS A POOL FOR RURAL DEVELOPMENT	II	863	22/08/00	15:00	HM	Q	19	3	19
Urso-Guimarães, M. V.	3854	PHYLOGENETIC ANALYSIS FROM SUPERTRIBE LASIOPTERIDI (DIPTERA: CECIDOMYIIDAE), WITH FOCUS IN THE POSITION OF TROTTERIA	II	973	25/08/00	16:30	CC		21	PS	21
Usha Rani, P.	704	INFLUENCE OF EXPERIENCE ON THE OLFACTORY RESPONSES OF A PREDATORY BEETLE, TROGOSSITA JAPONICA (COLEPTERA: TROGOSSITIDAE) TO VOLATILES OF ITS PREY-HOST TREE COMPLEX	I	178	24/08/00	16:30	CC		4	PS	4
Uthamasamy, S.	363	SPINOSAD - A NEW BIOMOLECULE FOR MANAGEMENT OF BOLL WORM IN COTTON ECOSYSTEM	I	92	25/08/00	16:30	CC		2	PS	2
Uthamasamy, S.	2793	MANAGEMENT OF SUCKING INSECT PESTS IN COTTON ECOSYSTEM WITH A NEW SYSTEMIC MOLECULE, ACETAMIPRID	II	705	24/08/00	16:30	CC		14	PS	14
Uygun, N.	3228	OVERWINTERING BIOLOGY OF CIRCULIFER HAEMATOCEPS (HOMOPTERA, CICADELLIDAE), A VECTOR OF PROCARYONTS IN CITRUS AND SESAME	II	815	23/08/00	16:30	CC		17	PS	17
Uys, T. J. E.	3944	TRANSGENIC COTTON COTTON, AN ALTERNATIVE TO CONVENTIONAL (NON-TRANSGENIC) COTTON FOR SOUTH AFRICA	II	995	21/08/00	16:30	CC		22	PS	22
Vaccaro, N.	368	FRUIT FLY (DIPTERA:TEPHRITIDAE) QUARANTINE PROCEDURES FOR EXPORT OF AVOCADOS FROM ARGENTINA TO CHILE	I	93	25/08/00	16:30	CC		2	PS	2
Vafopoulou, X.	3250	TESTIS ECDYSIOTROPIN, AN INSECT GONADOTROPIN THAT INDUCES SYNTHESIS OF ECDYSTEROID	II	821	21/08/00	9:50	HB	K	18	1	18
Vahed, K.	1731	THE FUNCTION OF NUPTIAL FEEDING IN THE TETTIGONIID STEROPLEURUS STALI: FIELD EVIDENCE REFUTES THE PATERNAL INVESTMENT HYPOTHESIS	I	436	22/08/00	15:30	HB	F	9	3	9
Vala, J. C.	3855	NOT ALL SCIOMYZIDAE KILL MOLLUSKS : SEPEDONELLA NANA EATS WORMS	II	973	25/08/00	16:30	CC		21	PS	21
Valdecasas, A. G.	3122	HIGH RESOLUTION EXTENDED DEPTH OF FOCUS IMAGES FOR ENTOMOLOGY	II	788	21/08/00	16:30	CC		16	PS	16
Valdéz, J.	3118	ANTENNAL SENSILLA OF COPITARSIA CONSUETA (LEPIDOPTERA: NOCTUIDAE)	II	787	21/08/00	16:30	CC		16	PS	16
Valdiviezo J., L.	409	BIODIVERSITY AND THE SOCIEDAD ENTOMOLOGICA DEL PERU	I	104	23/08/00	11:20	HB	C	3	3	3
Valencia, A. J.	2487	PARTIAL CHARACTERIZATION OF DIGESTIVE PROTEINASES FROM COFFEE BERRY BORER ADULTS (HYPOTHENEMUS HAMPEI)	II	628	24/08/00	16:30	CC		13	PS	13
Valencia, A. J.	2527	DIGESTIVE ALPHA-AMYLASES FROM COFFEE BERRY BORER (HYPOTHENEMUS HAMPEI) AND THEIR INHIBITION BY AMYLASE INHIBITORS FROM PLANTS.	II	638	25/08/00	16:30	CC		13	PS	13
Valencia, A. J.	3329	IN VITRO DEVELOPMENT OF COFFEE BERRY BORER (HYPOTHENEMUS HAMPEI) IN AN FREEZE DRY DIET	II	841	22/08/00	16:30	CC		18	PS	18
Valente, C.	1685	BIOLOGICAL CONTROL OF GONIPTERUS SCUTELLATUS (COLEOPTERA: CURCULIONIDAE) IN PORTUGAL	I	425	25/08/00	16:30	CC		8	PS	8
Valente, V. L. S.	2196	NEW APPROACHES TO LONG STANDING PROBLEMS IN THE CHROMOSOME INVERSION POLYMORPHISM OF DROSOPHILA WILLISTONI	I	554	23/08/00	13:35	HB	L	12	6	12
Valentín, N.	4091	DATA ON INSECTS IMPLICATED IN THE DESTRUCTION OF WORKS OF ART IN SPAIN	II	1033	23/08/00	16:30	CC		23	PS	23
Valério, J. R.	2845	SCREENING FORAGE GRASSES OF THE GENUS BRACHIARIA FOR RESISTANCE TO THE SPITTLEBUGS (HOMOPTERA: CERCOPIDAE)	II	718	25/08/00	16:30	CC		14	PS	14
Valério, M. A.	1410	PULVERIZATIONS WITH THIAMETHOXAM TO CONTROL ADULTS OF DIABROTICA SPECIOSA ON SMALL POTATO CROP	I	356	25/08/00	16:30	CC		7	PS	7
Valério, M. A.	1411	INSECTICIDE THIAMETHOXAM USED ON DIFFERENT FORMULATIONS TO CONTROL MYZUS PERSICAE ON SMALL POTATO CROP	I	356	25/08/00	16:30	CC		7	PS	7
Valério, M. A.	2644	EVALUATION OF AGRONOMIC EFFICIENCY AND PRACTIBILITY OF INSECTICIDES ON COTTON WORM (ALABAMA ARGILLACEA) CONTROL ON COTTON CROP. 1999	II	668	21/08/00	16:30	CC		14	PS	14
Valeur, P.	741	ANTENNAL AND BEHAVIORAL RESPONSES TO NONHOST ANGIOSPERM LEAF AND BARK VOLATILES BY CONIFER INSECT	I	187	25/08/00	16:30	CC		4	PS	4
Valicente, F. H.	2308	MOLECULAR GENETIC MAPPING IN THE HESSIAN FLY	I	582	24/08/00	16:30	CC		12	PS	12
Valicente, F. H.	3941	EFFECTS OF TROPICAL BACULOVIRUS ISOLATES AGAINST SPODOPTERA FRUGIPERDA (LEPIDOPTERA: NOCTUIDAE) LARVAE	II	995	21/08/00	16:30	CC		22	PS	22
Valicente, F. H.	3967	ANALYSIS OF SUPERNATANTS FROM CULTURES OF 'B.t.' STRAINS CONTAINING VIP3A-LIKE GENES AND THEIR RELATIVE EFICIENCY IN THE CONTROL OF TROPICAL FALL ARMYWORM LARVAE	II	1001	23/08/00	16:30	CC		22	PS	22
Valicente, F. H.	3968	TEMPORAL PATTERN OF PROTEIN SECRETION AND INSECTICIDAL ACTIVITY AGAINST TROPICAL FALL ARMYWORM IN THE SUPERNATANT OF THE 'B.t.' STRAIN 'HD125'	II	1001	23/08/00	16:30	CC		22	PS	22
Valicente, F. H.	2158	EFFECT OF TREATMENT TIMING OF BACULOVIRUS SPODOPTERA AND BACILLUS THURINGIENSIS ON SPODOPTERA FRUGIPERDA	I	544	25/08/00	16:30	CC		11	PS	11
Valladares, G.	565	ESTIMATING INSECT DIVERSITY IN CENTRAL ARGENTINA: A COMPARISON AMONG TAXA AND HABITATS	I	143	25/08/00	16:30	CC		3	PS	3
Valladares, G.	657	ANTIFEEDANT EFFECTS OF ARGENTINE MELIA AZEDARACH FRUIT EXTRACT AND ITS ACTIVE COMPOUND MELIARTENIN	I	166	22/08/00	16:30	CC		4	PS	4
Valladares, G.	1071	DIVERSITY AND FUNCTIONAL STRUCTURE OF INSECT COMMUNITIES UNDER GRAZING AND EXCLUSION REGIMES IN A MONTANE ARGENTINE GRASSLAND	I	270	23/08/00	16:30	CC		6	PS	6
Valladares, G.	1197	A TRITROPHIC ANALYSIS OF HOST PREFERENCE AND PERFORMANCE IN THE POLYPHAGOUS LEAFMINER LIRIOMYZA HUIDOBRENSIS	I	302	23/08/00	16:30	CC		6	PS	6
Valladares, G.	1328	INSECTICIDE AND REPELLENT EFFECTS OF MELIA AZEDARACH EXTRACTS AGAINST AEDES AEGYPTI (DIPTERA: CULICIDAE)	I	335	22/08/00	16:30	CC		7	PS	7
Valladares, L. F.	566	AQUATIC COLEOPTERA ASSEMBLAGES FROM SHALLOW LAKES ASSOCIATED TO THE CANAL DE CASTILLA (CENTRAL SPAIN)	I	143	22/08/00	16:30	CC		3	PS	3
Vallania, E. A.	477	AQUATIC INSECT BIODIVERSITY IN STREAMS OF DIFFERENT BASINS AT A REGIONAL SCALE	I	121	21/08/00	16:30	CC		3	PS	3
Valle, D	2406	CHARACTERIZATION OF THE DIGESTIVE PROCESS IN NEOTROPICAL ANOPHELINES	II	608	21/08/00	16:30	CC		13	PS	13
Valle, G. E.	4095	EVALUATION OF INSECTICIDES IN THE CONTROL OF RICE WEEVIL AND LESSER GRAIN BORER ON STORED BARLEY	II	1034	25/08/00	16:30	CC		23	PS	23

Sub-titles: (HB=Hotel Bourbon) - (HM=Hotel Mabu) - (CC=Convention Center) - (Bol=Foz Boulevard) - (PS=Poster Session) - (PL=Plenary Lecturer)

AUTHOR	N°	TITLE	Book	Page	Date	Time	Local	Room	Session	Symp	New Session
Valle, G. E.	2846	EFFECT OF INSECTICIDES ON NYMPHS OF BEMISIA TABACI B BIOTYPE	II	718	25/08/00	16:30	CC		14	PS	14
Valle, G. E.	2769	DEVELOPMENT AND DAMAGE OF THE RICE WEEVIL ON TRITICALE AND WHEAT CULTIVARS	II	699	21/08/00	16:30	CC		14	PS	23
Vallejos, R. A.	302	INSECTS ASSOCIATED WITH TOBACCO CULTURE WITHOUT CHEMICAL MANAGEMENT IN MISIONES ARGENTINA	I	77	25/08/00	16:30	CC		2	PS	2
Valles, S. M.	1229	SODIUM CHANNEL MUTATIONS AND PYRETHROID RESISTANCE	I	310	21/08/00	14:35	HM	N	7	2	7
Valverde, A. C.	3838	DESCRIPTION OF THE FIVE INSTARS OF DYSDERCUS RUFICOLLIS (HETEROPTERA: PYRRHOCORIDAE)	II	969	25/08/00	16:30	CC		21	PS	21
Valverde, A. del C.	3191	LARVAL AND PUPAL MORPHOLOGY OF THE GENUS MAGELLOMYIA (TRICHOPTERA: LIMNEPHILIDAE): COMPARATIVE CHARACTERIZATION OF THE SPECIES CITED FOR SOUTH AMERICA	II	805	24/08/00	16:30	CC		16	PS	16
Valverde, M. T.	37	LIFE TABLES OF THE RED MITE, EOTETRANYCHUS LEWISI (ACARI: TETRANYCHIDAE)	I	10	22/08/00	16:30	CC		1	PS	1
Van den berg, M.A.	1684	CLASSICAL BIOLOGICAL CONTROL OF THE SPINY BLACKFLY, ALEUROCANTHUS SPINIFERUS (HEM.: ALEYRODIDAE), AN ECONOMIC STUDY	I	424	25/08/00	16:30	CC		8	PS	8
Van Den Meersschaut, D.	1813	GROUND BEETLE DIVERSITY AND ASSEMBLAGES FROM FORESTS IN FLANDERS: A BASELINE STUDY	I	457	22/08/00	16:30	CC		10	PS	3
Van Den Meersschaut, D.	1813	GROUND BEETLE DIVERSITY AND ASSEMBLAGES FROM FORESTS IN FLANDERS: A BASELINE STUDY	I	457	22/08/00	16:30	CC		10	PS	3
van Doesburg, P. H.	3755	DESCRIPTION OF THE CERVUS-GROUP OF EDESSA (HETEROPTERA, PENTATOMIDAE, EDESSINAE)	II	948	22/08/00	16:30	CC		21	PS	21
van Doesburg, P. H.	3756	DESCRIPTION OF THE DOLICHOCERA-GROUP OF EDESSA (HETEROPTERA, PENTATOMIDAE, EDESSINAE)	II	948	22/08/00	16:30	CC		21	PS	21
van Doesburg, P. H.	3757	DESCRIPTION OF THE BECKERI-GROUP OF EDESSA (HETEROPTERA, PENTATOMIDAE, EDESSINAE)	II	948	22/08/00	16:30	CC		21	PS	21
van Doesburg, P. H.	3758	NOMENCLATURAL CHANGES IN EDESSINAE (HETEROPTERA, PENTATOMIDAE)	II	949	22/08/00	16:30	CC		21	PS	21
van Eeden, C. F.	2634	CRUISER® 70 WS: A NEW-LOOK NEONICOTINOID SEED TREATMENT FOR CEREAL CROPS.	II	665	22/08/00	16:30	CC		14	PS	14
van Eeden, C.F.	645	SIRENE® 6.0 GS: ATTRACT AND KILL, A NOVEL WAY TO CONTROL CODLING MOTH WITH AN AGE OLD VICE	I	163	21/08/00	16:30	CC		4	PS	4
van Emden, H. F.	1417	TRITROPHIC IMPACT OF HOST PLANT RESISTANCE – SOME POTENTIAL PITFALLS FOR GENETICALLY MODIFIED CROPS	I	358	21/08/00	9:35	HM	O	8	1	8
van Frankenhuyzen, K.	1871	DEVELOPMENT OF INTEGRATED MANAGEMENT OF DEFOLIATING INSECTS IN CANADA	I	472	25/08/00	11:20	HB	M	10	7	10
van Houten, Y. M.	3936	DO PLANTS BENEFIT FROM PROVIDING FOOD TO PREDATORS IF IT IS ALSO EDIBLE TO HERBIVORES? MODELS AND EXPERIMENTS	II	993	24/08/00	16:05	HM	Q	22	9	22
van Lenteren, J. C.	1646	HOST PREFERENCE OF APHIDIUS COLEMANI (HYMENOPTERA:APHIDIIDAE) FOR MYZUS PERSICAE AND APHIS GOSSYPII (HEMIPTERA:APHIDIDAE)	I	415	24/08/00	16:30	CC		8	PS	8
van Loon, J. J.	2870	OLFACTORY RECEPTORS OF THE MALARIA MOSQUITO ARE SENSITIVE TO HUMAN SWEAT COMPONENTS	II	724	21/08/00	10:20	Bol	R	15	1	15
Van Poyer, W.	2528	INSECT G PROTEIN-COUPLED RECEPTORS AND SIGNAL TRANSDUCTION	II	638	25/08/00	16:30	CC		13	PS	13
Van Poyer, W.	2529	INSECT G PROTEIN-COUPLED RECEPTORS AND SIGNAL TRANSDUCTION	II	639	25/08/00	16:30	CC		13	PS	13
Van Poyer, W.	2344	DIFFERENTIAL ACTIVATION OF AN INSECT G PROTEIN-COUPLED PEPTIDE RECEPTOR BY INSECTATACHYKININ-LIKE AGONISTS	II	592	21/08/00	14:35	HB	I	13	2	13
van Rijn, P. C. J.	3936	DO PLANTS BENEFIT FROM PROVIDING FOOD TO PREDATORS IF IT IS ALSO EDIBLE TO HERBIVORES? MODELS AND EXPERIMENTS	II	993	24/08/00	16:05	HM	Q	22	9	22
van Schelt, J.	1465	DO ECONOMICS AND BIOLOGY POSSESS SIMILAR GOALS?	I	370	24/08/00	14:05	HM	O	8	7	8
Vancassel, M.	3777	DERMAPTERAN LIFE HISTORY EVOLUTION AND PHYLOGENY WITH SPECIAL REFERENCE TO THE FORFICULIDAE FAMILY	II	953	23/08/00	16:30	CC		21	PS	21
Vancassel, M.	3331	MULTIPLE PATERNITY, DISPERSAL MODES AND GENETIC STRUCTURE ASSOCIATED WITH DIFFERENT REPRODUCTIVE STRATEGIES IN FORFICULA AURICULARIA (DERMAPTERA)	II	841	22/08/00	16:30	CC		18	PS	18
Vandame, R.	3435	TOLERANCE TO THE MITE VARROA JACOBSONI IN AFRICANIZED AND EUROPEAN BEES IN MEXICO	II	867	24/08/00	9:35	HM	Q	19	5	19
Vandame, R.	4173	HYGIENIC BEHAVIOR AND TOLERANCE TO VARROA JACOBSONI	II	1054	24/08/00	11:35	HM	Q	Erratum	5	19
Vandame, R.	1384	RELATION DOSE-LETHALITY OF THREE PESTICIDES ON VARROA JACOBSONI (GAMASIDA: VARROIDAE) AND APIS MELLIFERA (HYMENOPTERA: APIDAE): COMPARISON OF TWO ADMINISTRATION METHODS	I	349	24/08/00	16:30	CC		7	PS	7
Vandame, R.	3412	TOLERANCE TO THE MITE VARROA JACOBSONI IN AFRICANIZED AND EUROPEAN BEES IN MEXICO	II	861	21/08/00	16:30	CC		19	PS	19
Vandekerkhove, K.	1813	GROUND BEETLE DIVERSITY AND ASSEMBLAGES FROM FORESTS IN FLANDERS: A BASELINE STUDY	I	457	22/08/00	16:30	CC		10	PS	3
Vandekerkhove, K.	1813	GROUND BEETLE DIVERSITY AND ASSEMBLAGES FROM FORESTS IN FLANDERS: A BASELINE STUDY	I	457	22/08/00	16:30	CC		10	PS	3
Vandekerkhove, K.	567	BEETLE DIVERSITY AND FOREST CHARACTERISTICS IN FLANDERS (BELGIUM)	I	143	25/08/00	16:30	CC		3	PS	3
Vanden Broeck, J.	3249	MALE-FEMALE DIFFERENCES IN NEUROPEPTIDE PROFILES IN LOCUSTS	II	821	21/08/00	9:35	HB	K	18	1	18
Vanden Broeck, J.	2259	MOLECULAR CLONING OF NEUROPARSIN PRECURSOR cDNAs IN THE DESERT LOCUST SCHISTOCERCA GREGARIA	I	570	22/08/00	16:30	CC		12	PS	12
Vanden Broeck, J.	2528	INSECT G PROTEIN-COUPLED RECEPTORS AND SIGNAL TRANSDUCTION	II	638	25/08/00	16:30	CC		13	PS	13
Vanden Broeck, J.	2529	INSECT G PROTEIN-COUPLED RECEPTORS AND SIGNAL TRANSDUCTION	II	639	25/08/00	16:30	CC		13	PS	13
Vanden Broeck, J.	2344	DIFFERENTIAL ACTIVATION OF AN INSECT G PROTEIN-COUPLED PEPTIDE RECEPTOR BY INSECTATACHYKININ-LIKE AGONISTS	II	592	21/08/00	14:35	HB	I	13	2	13
Vanden Broeck, J.	2321	THE 4-kDa PROTEASE INHIBITOR FAMILY IN THE DESERT LOCUST SCHISTOCERCA GREGARIA: MOLECULAR CLONING AND ANALYSIS OF TISSUE- AND STAGE-DEPENDENT EXPRESSION	I	586	23/08/00	16:30	CC		12	PS	12
Vanden Broeck, J.	2447	MOLECULAR CLONING OF NEUROPARSIN PRECURSOR CDNAS IN THE DESERT LOCUST SCHISTOCERCA GREGARIA	II	618	25/08/00	16:30	CC		13	PS	13
Vanden Broeck, J.	2509	THE 4-KDA PROTEASE INHIBITOR FAMILY IN THE DESERT LOCUST SCHISTOCERCA GREGARIA: MOLECULAR CLONING AND ANALYSIS OF TISSUE- AND STAGE-DEPENDENT EXPRESSION	II	634	24/08/00	16:30	CC		13	PS	13
Vandingenen, A.	3261	ANGIOTENSIN CONVERTING ENZYME-LIKE ACTIVITY IN THE FLESHFLY NEOBELLIERIA BULLATA	II	824	21/08/00	16:15	HB	K	18	1	18
VanDyk, J.	759	PHOTOGRAPHIC VIRTUAL REALITY TECHNIQUES FOR ENTOMOLOGICAL DISTANCE EDUCATION	I	192	22/08/00	15:35	Bol	T	5	3	5
VanDyk, J. K.	752	USING THE INTERNET TO SERVE ENTOMOLOGY TEACHING, RESEARCH AND EXTENSION AT IOWA STATE UNIVERSITY	I	190	22/08/00	9:35	Bol	T	5	2	5
VanDyk, J. K.	765	COLLABORATIVE SEARCH TOOLS FOR INTEGRATED PEST MANAGEMENT	I	193	23/08/00	13:30	Bol	T	5	4	5
Vane-Wright, R. I.	381	MODELLING DISTRIBUTIONS AND MAKING COMPARISONS: CAN WE PREDICT RELATIVE GAPS IN OUR KNOWLEDGE OF INSECT BIODIVERSITY MORE ACCURATELY?	I	97	21/08/00	11:50	HB	C	3	1	3
Vaňhara, J.	1134	DIPTERA OF THE PALAVA BIOSPHERE RESERVE OF UNESCO (CZECH REPUBLIC)	I	286	24/08/00	16:30	CC		6	PS	6
Vanin, S.	3023	DIAGNOSTIC MORPHOLOGICAL CHARACTERS IN DIFFERENT LIFE STAGES OF HERMETIA ILLUCENS STUDIED BY VP SCAN MICROSCOPE: A NEW NOT DAMAGING METHOD FOR UNTREATED ORGANISMS	II	763	25/08/00	16:30	CC		15	PS	15

Sub-titles: (HB=Hotel Bourbon) - (HM=Hotel Mabu) - (CC=Convention Center) - (Bol=Foz Boulevard) - (PS=Poster Session) - (PL=Plenary Lecturer)

AUTHOR	Nº	TITLE	Book	Page	Date	Time	Local	Room	Session	Symp	New Session
Vanin, S. A.	3163	MORPHOLOGICAL COMPARATIVE STUDY OF THE PTYCHODERES ELONGATUS AND TRIBOTROPIS PRASINATUS (COLEOPTERA, ANTHRIBIDAE)	II	798	24/08/00	16:30	CC		16	PS	21
Vannier, G.	2430	PRELIMINARY RESULTS ON THERBIOLOGICAL STUDIES ON NEOTROPICAL STINK BUGS OEBALUS POECILUS (HEMIPTERA, PENTATOMIDAE)	II	614	23/08/00	16:30	CC		13	PS	13
Vänninen, I.	1556	THE EFFECT OF ALTERNATIVE FOOD ON ORIUS LAEVIGATUS, ITS PREY FRANKLINIELLA OCCIDENTALIS AND THEIR INTERACTION	I	392	22/08/00	16:30	CC		8	PS	8
Varanda, E. M.	726	SAPONINS IN THREE ALFALFA (MEDICAGO SATIVA) VARIETIES AND THEIR RELATION TO APHID RESISTANCE	I	183	25/08/00	16:30	CC		4	PS	4
Varanda, E. M.	1886	ARTHROPODS AS BIOINDICATORS IN AN AREA UNDER REFORESTATION IN SÃO PAULO STATE, BRAZIL	I	475	26/08/00	11:50	HB	M	10	9	10
Varanda, E. M.	2480	LEPIDOPTERA ROLLERS AND BYRSONIMA INTERMEDIA RELATIONSHIP: THE ROLE OF SECONDARY METABOLITES AND NUTRICIONAL STATUS	II	626	23/08/00	16:30	CC		13	PS	4
Varela, G.	3235	RESOURCE AVAILABILITY AND SPATIAL DISTRIBUTION OF DELPHACODES KUSCHELI (FULGOROMORPHA: DELPHACIDAE)	II	817	23/08/00	16:30	CC		17	PS	17
Vargas, R.	62	LABORATORY STUDIES ON THE LIFE HISTORY, POST-EMBRYONIC SURVIVAL AND OVIPOSITION OF THE PREDACEOUS MITE CYDNODROMUS SP. [ACARINA: PHYTOSEIIDAE] ON DIFFERENT KINDS OF FOOD SUBSTANCES	I	16	24/08/00	16:30	CC		1	PS	1
Vargas, R.	1661	FRUIT FLY BIOLOGICAL CONTROL IN LATIN AMERICA: MINIMIZING THE RISKS POSED BY TEPHRITIDAE IN MEXICO AND CENTRAL AMERICA	I	419	25/08/00	16:30	CC		8	PS	8
Vargas-Fernandez, I.	456	BIODIVERSITY OF PAPILIONOIDEA FROM MEXICO	I	116	26/08/00	14:35	HB	C	3	10	3
Varricchio, P.	2372	EXPRESSION OF CARDIOCHILES NIGRICEPS POLYDNAVIRUS IN PARASITIZED HELIOTHIS VIRESCENS LARVAE AND INDUCED HOST FUNCTIONAL ALTERATIONS	II	599	24/08/00	14:05	HB	I	13	7	13
Varshney, A. K.	1160	BIOLOGICAL ATTRIBUTES OF SPOTTED STEM BORER, CHILO PARTELLUS FED ON MAIZE CULTIVARS	I	292	25/08/00	16:30	CC		6	PS	6
Vasconcellos, A.	3477	DAMAGES CAUSED BY THE NASUTITERMES SPP. (ISOPTERA : TERMITIDAE) IN ERIOTHECA CRENULATICALYX (BOMBACACEAE) AT THE UNIVERSIDADE FEDERAL DA PARAÍBA, JOÃO PESSOA (PB), BRAZIL	II	878	22/08/00	16:30	CC		19	PS	19
Vasconcellos-Neto, J.	4132	POLYMORPHISM IN A CASSIDINAE SPECIES	II	1044	25/08/00	15:40	HM	P	24	2	24
Vasconcellos-Neto, J.	4127	SYSTEMATIC POSITION OF TWO POLYMORPHIC SPECIES OF CHELYMORPHA BOH. (COLEOPTERA: CHRYSOMELIDAE: CASSIDINAE)	II	1042	25/08/00	13:40	HM	P	24	2	24
Vasconcellos-Neto, J.	4140	BIOLOGICAL AND ECOLOGICAL STUDIES ON OMASPIDES TRICOLORATA (COLEOPTERA: CHRYSOMELIDAE: CASSIDINAE)	II	1046	26/08/00	10:00	HM	P	24	0	24
Vasconcellos-Neto, J.	1850	INFLUENCE OF NATURAL ENEMIES ON THE POPULATIONS OF TWO STOLAINI SPECIES (COLEOPTERA: CHRYSOMELIDAE: CASSIDINAE) IN A BRAZILIAN TROPICAL FOREST	I	466	23/08/00	16:20	HB	M	10	4	10
Vasconcellos-Neto, J.	1958	BIOLOGICAL DATA AND POPULATION ABUNDANCE OF THREE SPECIES OF CASSIDINAE (COLEOPTERA: CHRYSOMELIDAE) IN A TROPICAL FOREST AREA IN BRAZIL	I	493	24/08/00	16:30	CC		10	PS	10
Vasconcellos-Neto, J.	4145	BIOLOGICAL DATA AND POPULATION ABUNDANCE OF THREE SPECIES OF CASSIDINAE (COLEOPTERA: CHRYSOMELIDAE) IN A TROPICAL FOREST AREA IN BRAZIL	II	1047	26/08/00	10:00	HM	P	24	0	24
Vasconcellos-Neto, J.	4146	INFLUENCE OF NATURAL ENEMIES ON THE POPULATIONS OF TWO STOLAINI SPECIES (COLEOPTERA: CHRYSOMELIDAE: CASSIDINAE) IN A BRAZILIAN TROPICAL FOREST	II	1047	26/08/00	10:00	HM	P	24	0	24
Vasconcellos-Neto, J.	2742	ECOLOGICAL AND BIOLOGICAL STUDIES ON THE POLYMORPHIC SPECIES CHELYMORPHA CRIBRARIA (COL.: CHRYSOMELIDAE) IN RIO DE JANEIRO, BRAZIL	II	692	23/08/00	16:30	CC		14	PS	14
Vasconcellos-Neto, J.	980	BIOLOGICAL AND ECOLOGICAL STUDIES ON OMASPIDES TRICOLORATA (COLEOPTERA: CHRYSOMELIDAE: CASSIDINAE)	I	247					6		6
Vasconcellos-Neto, J.	3856	SYSTEMATIC POSITION OF TWO POLYMORPHIC SPECIES OF CHELYMORPHA BOH. (COLEOPTERA: CHRYSOMELIDAE: CASSIDINAE)	II	973					21		21
Vasconcelos, H. L.	3431	INTERACTIONS BETWEEN LEAF-CUTTING ANTS AND FOREST REGENERATION IN CENTRAL AMAZONIA	II	866	23/08/00	11:05	HM	Q	19	4	19
Vasconcelos, S. D.	364	WHITEFLY IMPACT ON IRRIGATED AGRICULTURE IN SEMI-ARID REGION OF BRAZIL: THE FARMER'S PERSPECTIVE	I	92	25/08/00	16:30	CC		2	PS	2
Vasconcelos, S. D.	1969	A POPULATION SURVEY OF PHLEBOTOMINAE IN REMAINDERS OF RAINFOREST IN NORTHEASTERN BRAZIL	I	496	24/08/00	16:30	CC		10	PS	10
Vasconcelos, S. D.	1970	USE OF ATTRACTANTS FOR SURVEYING DIPTERAN POPULATIONS IN A RAINFOREST AREA IN NORTHEASTERN BRAZIL	I	496	24/08/00	16:30	CC		10	PS	10
Vasconcelos, S. D.	2847	WEEDS AS HOSTS FOR BEMISIA TABACI STRAIN B (= B. ARGENTIFOLII) (HEMIPTERA: ALEYRODIDAE) IN THE SEMI-ARID REGION OF BRAZIL	II	719	22/08/00	16:30	CC		14	PS	14
Vassart, G.	2344	DIFFERENTIAL ACTIVATION OF AN INSECT G PROTEIN-COUPLED PEPTIDE RECEPTOR BY INSECTATACHYKININ-LIKE AGONISTS	II	592	21/08/00	14:35	HB	I	13	2	13
Vassena, C.	4099	SYNERGIZED PYRETHROIDS FOR THE CONTROL OF PERMETHRIN RESISTANT HEAD LICE PEDICULUS CAPITIS (PHTHIRAPETRA, PEDICULIDAE)	II	1035	21/08/00	16:30	CC		23	PS	23
Vassena, C.	4100	REVERSION OF PERMETHRIN RESISTANCE BY INSECTICIDE SYNERGISTS IN THE HEADLICE PEDICULUS CAPITIS (PHTHIRAPTERA, PEDICULIDAE).	II	1035	21/08/00	16:30	CC		23	PS	23
Vassena, C.	1385	DETECTION AND MONITORING OF INSECTICIDE RESISTANCE IN TRIATOMA INFESTANS AND RHODNIUS PROLIXUS	I	349	24/08/00	16:30	CC		7	PS	7
Vaughan, L. J.	2159	BIOPESTICIDE PRODUCTS FOR MIGRATORY PESTS IN AFRICA: REGIONAL EFFORTS TO HARMONIZE REGISTRATION PROCEDURES	I	544	25/08/00	16:30	CC		11	PS	11
Vaury, C.	2211	ZAM, A RETROVIRUS FROM DROSOPHILA MELANOGASTER	I	558	24/08/00	15:35	HB	L	12	8	12
Vaz, A.	1685	BIOLOGICAL CONTROL OF GONIPTERUS SCUTELLATUS (COLEOPTERA: CURCULIONIDAE) IN PORTUGAL	I	425	25/08/00	16:30	CC		8	PS	8
Vaz-de-Mello, F. Z.	365	SCARABAEIDAE S. STR. (COLEOPTERA: SCARABAEOIDEA) FROM VIÇOSA, MINAS GERAIS STATE, BRAZIL	I	92	25/08/00	16:30	CC		2	PS	2
Vazquez Prokopec, G. M.	2925	A LONGITUDINAL PAIRED TRIAL OF TWO SENSING DEVICES FOR DETECTING PERIDOMESTIC POPULATIONS OF TRIATOMA INFESTANS (HEMIPTERA: REDUVIIDAE) IN RURAL NORTHWESTERN ARGENTINA	II	738	25/08/00	10:50	Bol	R	15	9	15
Veal, D. A.	3470	ANTIMICROBIAL COMPOUNDS FROM ANTS AND OTHER INSECTS AND THEIR ROLE IN THE EVOLUTION OF SOCIALITY	II	876	23/08/00	16:30	CC		19	PS	19
Vecín, P.	996	INSECTS AS BATS' PREY: A CASE STUDY ON KUHL'S PIPISTRELLE (PIPISTRELLUS KUHLII)	I	251	22/08/00	16:30	CC		6	PS	6
Vedenina, V. Yu.	1727	THE FUNCTION OF COURTSHIP IN GRASSHOPPERS RELATED TO CHORTHIPPUS ALBOMARGINATUS (ORTHOPTERA: GOMPHOCERINAE)	I	435	22/08/00	14:30	HB	F	9	3	9
Veenstra, J. A.	2477	REGULATION OF JH LEVELS IN MOSQUITOES	II	626	23/08/00	16:30	CC		13	PS	13
Vega, C.	2987	TRIATOMINES AND OTHER ARTHROPODS IN BIRD NESTS IN NATIVE AND MENNONITE COMMUNITIES OF THE PARAGUAYAN CHACO	II	754	22/08/00	16:30	CC		15	PS	15
Veiga, F. S. L.	1690	ENVIRONMENTAL AND PREY INTERACTION ON THE DEVELOPMENT AND REPRODUCTION OF THE STINKBUG PREDATOR PODISUS NIGRISPINUS	I	426	25/08/00	16:30	CC		8	PS	8
Veja, F. E.	2160	SCREENING FUNGAL PATHOGENS OF INSECTS FOR AMENABILITY TO LIQUID CULTURE SPORE PRODUCTION	I	545	25/08/00	16:30	CC		11	PS	11
Velasquez, S. M.	1198	EFFECT OF HABITAT TYPE ON AQUATIC INSECTS IN FOUR STREAMS OF PATAGONIA (ARGENTINA)	I	302	25/08/00	16:30	CC		6	PS	6
Velázquez de Castro, A. J.	3997	AN EXPERIMENTAL COURSE ON INSECTS IN A MEDITERRANEAN SECONDARY SCHOOL	II	1009	25/08/00	16:30	CC		22	PS	22
Vélez, P. E.	26	STUDIES ON INFECTION MECHANISMS OF THE FUNGI BEAUVERIA BASSIANA AND METARHIZIUM ANISOPLIAE ON HYPOTHENEMUS HAMPEI USING FLUORESCENCE MICROSCOPY AND SCANNING ELECTRON MICROSCOPY	I	7	23/08/00	16:30	CC		1	PS	1

Sub-titles: (HB=Hotel Bourbon) - (HM=Hotel Mabu) - (CC=Convention Center) - (Bol=Foz Boulevard) - (PS=Poster Session) - (PL=Plenary Lecturer)

AUTHOR	Nº	TITLE	Book	Page	Date	Time	Local	Room	Session	Symp	New Session
Vélez, P. E.	246	LIPOLYTIC AND PROTEOLYTIC ACTIVITY OF BEAUVERIA BASSIANA AND METARHIZIUM ANISOPLIAE AND THEIR RELATIONSHIP WITH PATHOGENICITY TO HYPOTHENEMUS HAMPEI	I	63	22/08/00	16:30	CC		2	PS	2
Veloso, V. R. S	3483	MONITORING TERMITES IN SUGAR CANE FIELDS IN GOIAS, BRAZIL: A PROFITABLE INVESTIMENT.	II	879	23/08/00	16:30	CC		19	PS	19
Veloso, V. R. S.	3998	INSECT DIVERSITY OCCURRING ON CAGAITA IN SAVANNAS OF GOIÁS, BRAZIL	II	1009	25/08/00	16:30	CC		22	PS	22
Veloso, V. R. S.	225	EFFECT OF THE INSECT GROWTH REGULATOR DIFLUBENZURON ON REPRODUCTION OF EUSCHISTUS HEROS (FABR.) (HETEROPTERA: PENTATOMIDAE)	I	57	22/08/00	16:30	CC		2	PS	2
Veloso, V.R.S.	1523	ECOLOGICAL ASPECTS AND DAMAGE EVALUATION OF FUIT FLIES IN CAGAITA IN THE SAVANNAS OF GOIAS STATE, BRAZIL.	I	384	21/08/00	16:30	CC		8	PS	8
Venables, A.	3865	PHYLOGENY AND EVOLUTION OF THE SUBFAMILY COLIADINAE (LEPIDOPTERA: PIERIDAE)	II	975	25/08/00	16:30	CC		21	PS	21
Vencl, F.	1597	HOST SELECTION CUES OF A POTENTIAL BIOLOGICAL CONTROL AGENT FOR THE LILY LEAF BEETLE, LILIOCERIS LILII	I	403	23/08/00	16:30	CC		8	PS	8
Vendramim, J. D.	2829	ANTIBIOSIS OF POTATO CLONES TO POTATO TUBER MOTH	II	714	24/08/00	16:30	CC		14	PS	14
Vendramim, J. D.	2739	ENVIRONMENT PROTECTION THROUGH RESISTANT POTATO: RESEARCH, EDUCATION AND DELIVERING INFORMATION IN BRAZIL	II	692	23/08/00	16:30	CC		14	PS	14
Vendramim, J. D.	2749	RESISTANCE OF BEAN GENOTYPES TO ZABROTES SUBFASCIATUS (COLEOPTERA: BRUCHIDAE)	II	694	23/08/00	16:30	CC		14	PS	14
Vendramim, J. D.	3472	ATTRACTION/REPELLENCE OF SUBTERRANEAN TERMITES WITH PLANT EXTRACTS	II	876	22/08/00	16:30	CC		19	PS	19
Vendramim, J. D.	3473	EFFECTS OF PLANT EXTRACTS AND ENTOMOPATHOGENIC FUNGI ON SUBTERRANEAN TERMITES	II	877	22/08/00	16:30	CC		19	PS	19
Vendramim, J. D.	4052	EFFECT OF POWDERS FROM VEGETAL SPECIES ON ZABROTES SUBFASCIATUS (COLEOPTERA: BRUCHIDAE) IN STORED BEAN	II	1023	22/08/00	16:30	CC		23	PS	23
Ventura, J. A.	482	COLLEMBOLA (ARTHROPODA: HEXAPODA) BIODIVERSITY IN TROPICAL AGRICULTURAL ENVIRONMENTS OF ESPIRITO SANTO, BRAZIL	I	122	21/08/00	16:30	CC		3	PS	3
Ventura, M. U.	306	CHEMICAL CONTROL OF THE BOLLWEEVIL, ANTHONOMUS GRANDIS, WITH PYRETHROIDS	I	78	24/08/00	16:30	CC		2	PS	2
Ventura, M. U.	307	CHEMICAL CONTROL OF THE VELVETBEAN CATERPILLAR, ANTICARSIA GEMMATALIS WITH PYRETHROIDS	I	78	24/08/00	16:30	CC		2	PS	2
Ventura, M. U.	2848	MANAGEMENT OF THE COTTON STEM BORER EUTINOBOTHRUS BRASILIENSIS	II	719	25/08/00	16:30	CC		14	PS	14
Ventura, M. U.	2849	CONTROL OF ASCIA MONUSTE ORSEIS BY PYRETHROID INSECTICIDES IN COLLARD	II	719	25/08/00	16:30	CC		14	PS	14
Ventura, M. U.	2850	CONTROL OF THRIPS TABACI BY PYRETHROID INSECTICIDES IN ONION	II	719	25/08/00	16:30	CC		14	PS	14
Ventura, M. U.	298	EFFECT OF DIFFERENT DOSAGES OF NOVALURON (RIMON 100 EC) FOR SPODOPTERA FRUGIPERDA CONTROL IN CORN AT LONDRINA - PR - BRAZIL	I	76	25/08/00	16:30	CC		2	PS	2
Ventura, M. U.	1369	INSECTICIDES FOR PSEUDALETIA SEQUAX CONTROL IN WHEAT TRITICUM AESTIVUM	I	345	24/08/00	16:30	CC		7	PS	7
Ventura, M. U.	1805	OVIPOSITION BEHAVIOR OF NEOMEGALOTOMUS PARVUS	I	455	22/08/00	16:30	CC		9	PS	9
Ventura, M. U.	1806	FEEDING BEHAVIOR OF NEOMEGALOTOMUS PARVUS	I	455	22/08/00	16:30	CC		9	PS	9
Ventura, S. R. S.	1050	BIOECOLOGY OF URBANUS ACAWOIOS (LEPIDOPTERA, HESPERIIDAE) IN CLITORIA FAIRCHILDIANA IN CONTROLLED TEMPERATURE	I	265	22/08/00	16:30	CC		6	PS	6
Ventura, S. R. S.	1625	OCCURRENCE OF SCALES, WHITEFLIES AND NATURAL ENEMIES IN CITRIC PLANTS IN THE MUNICIPAL DISTRICT OF CÁCERES, MT, BRASIL	I	410	25/08/00	16:30	CC		8	PS	8
Ventura, S. R. S.	1906	ANALYSIS OF THE DAMAGES CAUSED FOR ONCIDERES SAGA (COLEOPTERA: CERAMBYCIDAE) IN A FORESTRY REMNANT IN THE CAMPUS OF UFRRJ, BRASIL	I	480	21/08/00	16:30	CC		10	PS	10
Ventura, S. R. S.	1965	WOOD BORING BEETLES IN PLANTATION OF SAPUCAIA, LECYTHIS PISONIS (LECYTHIDACEAE), IN THE NATIONAL FOREST MÁRIO XAVIER, SEROPÉDICA, RJ, BRASIL	I	495	24/08/00	16:30	CC		10	PS	10
Ventura, S. R. S.	1907	OCCURRENCE AND DAMAGES CAUSED FOR ONCIDERES SAGA (COLEOPTERA: CERAMBYCIDAE) IN ARBORIZATION	I	481	21/08/00	16:30	CC		10	PS	10
Ventura, S. R. S.	1964	OCCURRENCE OF WOOD BORING BEETLES IN THE NATIONAL FOREST MÁRIO XAVIER, RJ, BRASIL	I	495	21/08/00	16:30	CC		10	PS	10
Venturini, R. V.	1313	A SUSTAINABLE AND ECONOMICAL INSECTICIDAL MANAGEMENT PROGRAM ON COTTON IN BRAZIL	I	331	21/08/00	16:30	CC		7	PS	7
Venugopal, M. S.	1366	RELATIVE TOXICITY OF INSECTICIDES TO COTTON LEAFHOPPER POPULATIONS FROM VARIED ENVIRONMENTS	I	345	25/08/00	16:30	CC		7	PS	7
Venugopal, M. S.	2760	INTEGRATION OF PLANT RESISTANCE WITH INSECTICIDES FOR THE MANAGEMENT OF COTTON LEAFHOPPER, AMRASCA DEVASTANS [DISTANT]	II	697	23/08/00	16:30	CC		14	PS	14
Venugopal, M. S.	2108	COMPARATIVE EFFICACY OF BACILLUS THURINGIENSIS FORMULATIONS FOR CONTROL OF RICE LEAF FOLDER AND THEIR EFFECTS ON BIODIVERSITY IN RICE ECOSYSTEM	I	532	25/08/00	16:30	CC		11	PS	11
Venugopal, M. S.	1598	DEVELOPING A COMMERCIALLY VIABLE SYSTEM USING TRICHOGRAMMA CHILONIS FOR CONTROL OF COTTON BOLLWORM HELIOTHIS ARMIGERA IN INDIA	I	403	23/08/00	16:30	CC		8	PS	8
Venugopal, M. S.	1599	DEVELOPING A COMMERCIALLY VIABLE SYSTEM USING CHRYSOPERLA CARNEA FOR CONTROL OF COTTON PESTS IN INDIA	I	403	23/08/00	16:30	CC		8	PS	8
Venzon, M.	1199	INTRAGUILD INTERACTIONS IN AN ARTHROPOD FOOD WEB ON PLANTS	I	302	25/08/00	16:30	CC		6	PS	6
Venzon, M.	862	BEHAVIOUR AND INDIRECT INTERACTIONS IN FOOD WEBS OF PLANT-INHABITING ARTHROPODS	I	218	25/08/00	14:05	HB	D	6	8	6
Vepsäläinen, K.	3574	MATING SUCCESS IN INTRA- AND INTERSPECIFIC MATINGS OF TWO WATERSTRIDER SPECIES (GERRIDAE)	II	902	23/08/00	14:00	Bol	U	20	1	20
Vera, I. A. F.	1590	BIOLOGICAL CONTROL OF THE NANTUCKET PINE TIP MOTH (RHYACIONIA FRUSTRANA), A PEST OF THE GENUS PINUS	I	401	23/08/00	16:30	CC		8	PS	8
Vera, M. T.	366	ASSESSING AREAS OF CLIMATIC STRESS FOR CERATITIS CAPITATA (DIPTERA: TEPHRITIDAE) IN ARGENTINA	I	93	25/08/00	16:30	CC		2	PS	2
Vera, M. T.	3024	POTENTIAL GEOGRAPHIC RANGE OF AEDES ALBOPICTUS (DIPTERA: CULICIDAE) IN ARGENTINA	II	763	23/08/00	16:30	CC		15	PS	15
Verbeek, M.	3212	CHAPERONIN CAMOUFLAGE: AN INTRIGUING PHENOMENON IN THE TRANSMISSION OF LUTEOVIRUSES BY APHIDS	II	811	22/08/00	14:00	Bol	U	17	2	17
Vercammen, T.	3258	NEUROPEPTIDES IN LOCUSTS: PROGRESS IN THE SEARCH FOR FUNCTIONS	II	823	21/08/00	15:00	HB	K	18	1	18
Verdyck, P.	2328	A POPULATION GENETIC COMPARISON OF ISOLATED POPULATIONS OF THE PHYTOPHAGOUS FOREST BEETLE PHYLLOTRETA TETRASTIGMA (COLEOPTERA: CHRYSOMELIDAE)	I	587	25/08/00	16:30	CC		12	PS	12
Verdyck, P.	4134	GENETIC PATTERNS IN PHYTOPHAGOUS BEETLES OF THE GALÁPAGOS ARCHIPELAGO	II	1044	25/08/00	16:20	HM	P	24	2	24
Verdyck, P.	1913	CARABID BEETLES AS MODEL ORGANISMS IN POPULATION GENETIC STUDIES ON HIGHLY FRAGMENTED TEMPERATE FORESTS (FLANDERS, BELGIUM)	I	482	21/08/00	16:30	CC		10	PS	10
Verdyck, P.	567	BEETLE DIVERSITY AND FOREST CHARACTERISTICS IN FLANDERS (BELGIUM)	I	143	25/08/00	16:30	CC		3	PS	3
Verdyck, P.	2329	GENETIC PATTERNS IN PHYTOPHAGOUS BEETLES OF THE GALÁPAGOS ARCHIPELAGO	I	588					12		12
Vergolas, P.	1272	A GLOBAL PERSPECTIVE ON THE BIOLOGY AND FIELD PERFORMANCE OF SPINOSAD	I	321	25/08/00	11:05	HM	N	7	9	7
Verhaagh, M.	1821	LITTER ANT COMMUNITY IN SUBTROPICAL ARAUCARIA AND COASTAL ESCARPMENT FORESTS IN SOUTHERN BRAZIL	I	459	21/08/00	16:05	HB	M	10	1	10
Verhaert, P. D.	2453	HORMONAL REGULATION OF FLIGHT METABOLISM IN A MIGRATORY BUTTERFLY, VANESSA CARDUI (LEPIDOPTERA: NYMPHALIDAE)	II	620	23/08/00	16:30	CC		13	PS	13

Sub-titles: (HB=Hotel Bourbon) - (HM=Hotel Mabu) - (CC=Convention Center) - (Bol=Foz Boulevard) - (PS=Poster Session) - (PL=Plenary Lecturer)

AUTHOR	Nº	TITLE	Book	Page	Date	Time	Local	Room	Session	Symp	New Session
Verissimo, C. J.	3317	ACARICIDE ACTION OF ROPE TOBACCO (NICOTINA TABACUM) OVER LARVAE OF BOOPHILUS MICROPLUS UNDER LABORATORY CONDITIONS	II	838	21/08/00	16:30	CC		18	PS	18
Verkerk, R. H. J.	1425	CASE STUDIES -TRITROPHIC ASPECTS OF INTEGRATED PEST MANAGEMENT FOR CRUCIFER PESTS IN THE FIELD	I	360	21/08/00	11:35	HM	O	8	I	8
Verkerk, R. H. J.	2079	DNA SEQUENCE DATA USED TO VALIDATE SPECIES TAXONOMY AND ORIGIN OF UK SUBTERRANEAN TERMITE (ISOPTERA: RHINOTERMITIDAE) INFESTATION	I	524	22/08/00	16:30	CC		11	PS	11
Verkerk, R.H.J.	3404	TERMITES IN EUROPE: PERSPECTIVES OF RESEARCH AND MANAGEMENT FROM THE LAST CENTURY	II	859	22/08/00	9:35	HM	Q	19	2	19
Vermuni, A. M. W.	3381	MOLECULAR CLONING OF JUVENILE HORMONE BINDING PROTEINS OF SILKWORM, BOMBYX MORI	II	854	25/08/00	16:30	CC		18	PS	18
Vernon, R. S.	3905	PHYSICAL BARRIERS FOR INSECT PESTS IN VEGETABLES AND SMALL FRUITS	II	986	24/08/00	11:05	HB	H	22	6	22
Vernon, R. S.	2719	MINING THE DATA OF A PEST MANAGEMENT COMPANY: IMPROVEMENTS TO TUBER FLEA BEETLE AND GREEN PEACH APHID IPM OF CANADIAN POTATOES	II	687	23/08/00	16:30	CC		14	PS	14
Verón, J.	302	INSECTS ASSOCIATED WITH TOBACCO CULTURE WITHOUT CHEMICAL MANAGEMENT IN MISIONES ARGENTINA	I	77	25/08/00	16:30	CC		2	PS	2
Versteirt, V.	1813	GROUND BEETLE DIVERSITY AND ASSEMBLAGES FROM FORESTS IN FLANDERS: A BASELINE STUDY	I	457	22/08/00	16:30	CC		10	PS	3
Versteirt, V.	1813	GROUND BEETLE DIVERSITY AND ASSEMBLAGES FROM FORESTS IN FLANDERS: A BASELINE STUDY	I	457	22/08/00	16:30	CC		10	PS	3
Versteirt, V.	1913	CARABID BEETLES AS MODEL ORGANISMS IN POPULATION GENETIC STUDIES ON HIGHLY FRAGMENTED TEMPERATE FORESTS (FLANDERS, BELGIUM)	I	482	21/08/00	16:30	CC		10	PS	10
Verveirt, V.	567	BEETLE DIVERSITY AND FOREST CHARACTERISTICS IN FLANDERS (BELGIUM)	I	143	25/08/00	16:30	CC		3	PS	3
Versteirt, V.	1977	DEAD WOOD AND BEETLES: A CASE STUDY IN FLANDERS (BELGIUM)	I	498	25/08/00	16:20	HB	M	10	8	10
Vescove, H. V.	715	AZADIRACTA INDICA AND BOUGAINVILLEA SPECTABILIS EXTRACTS TO CONTROL VELVETBEAN CATERPILLAR	I	181	24/08/00	16:30	CC		4	PS	4
Vescove, H. V.	1200	BIOLOGICAL AND NUTRITIONAL ASPECTS OF ANTICARSIA GEMMATALIS (LEPIDOPTERA: NOCTUIDAE), RAISED ON SOYBEAN, PEANUT AND ARTIFICIAL DIET.	I	302	25/08/00	16:30	CC		6	PS	6
Vet, L. E. M.	1118	LINKING MULTITROPHIC INTERACTIONS ABOVE-BELOWGROUND	I	282	24/08/00	16:30	CC		6	PS	6
Vet, L. E. M.	1535	EFFECTS OF MOLASSES GRASS (MELINIS MINUTIFLORA) VOLATILES ON THE FORAGING BEHAVIOUR OF THE STEMBORER PARASITOID COTESIA SESAMIAE	I	387	22/08/00	16:30	CC		8	PS	8
Vet, L. E. M.	1209	WHY DO DROSOPHILIDS PRODUCE AGGREGATION PHEROMONES WHEN IT GUIDES PARASITOIDS TO THEIR OFFSPRING?	I	305	25/08/00	16:30	CC		6	PS	6
Vezzani, D.	3024	POTENTIAL GEOGRAPHIC RANGE OF AEDES ALBOPICTUS (DIPTERA: CULICIDAE) IN ARGENTINA	II	763	23/08/00	16:30	CC		15	PS	15
Viana Bailez, A. M.	708	INFLUENCE OF PRE- AND POST- IMAGINAL EXPERIENCE ON HOST-FINDING BEHAVIOR OF HYPOTHENEMUS HAMPEI	I	179	24/08/00	16:30	CC		4	PS	4
Viana, B. F.	1201	COMMUNITY STRUCTURE OF BEES IN A COASTAL SAND DUNE IN BAHIA, NORTHEAST BRAZIL	I	303	25/08/00	16:30	CC		6	PS	6
Viana, B. F.	474	BEE FAUNA DIVERSITY OF BAHIA STATE, BRAZIL	I	120	21/08/00	16:30	CC		3	PS	3
Viana, P. A.	1412	THE EFFECT OF AQUEOUS EXTRACT OF AZADIRACHTA INDICA LEAVES ON THE CONTROL OF SPODOPTERA FRUGIPERDA FED WITH CORN LEAVES	I	356	25/08/00	16:30	CC		7	PS	7
Viana, P. A.	4101	INSECTICIDE ACTION OF ETHANOLIC EXTRACT FROM ANNONA CRASSIFLORA SEEDS AGAINST SPODOPTERA FRUGIPERDA	II	1035	24/08/00	16:30	CC		23	PS	23
Viana, P. A.	1513	EFFECT OF A NUCLEAR POLYHEDROSIS VIRUS ON SPODOPTERA FRUGIPERDA LARVAE, ITS DAMAGE AND YIELD OF MAIZE CROP AT DIFFERENT EGG MASS INFESTATION LEVELS	I	382	21/08/00	16:30	CC		8	PS	8
Viana, P. A.	1778	IS ELASMOPALPUS LIGNOSELLUS BEHAVIOR INFLUENCED BY SMOKE OF BURNED SUGAR CANE?	I	448	23/08/00	16:30	CC		9	PS	9
Viana, R. I.	1207	COMPETITION BETWEEN TWO ARMORED SCALES FOR CITRUS LEAVES COLONIZATION	I	304	23/08/00	16:30	CC		6	PS	6
Viana, T. M. B.	1978	LEPIDOPTEROUS ASSOCIATED TO TWO FOREST COMMUNITIES IN ITAARA, RS - BRAZIL	I	498	25/08/00	16:30	CC		10	PS	10
Viana, T. M. B.	1971	SCOLYTIDAE ASSOCIATED EUCALYPTUS SP. IN A FRAGMENT OF DECIDUAL SEASONAL FOREST	I	497	25/08/00	16:30	CC		10	PS	10
Viana-Bailez, A. M.	187	BIOLOGY OF THE GUAJAVA WEEVIL, CONOTRACHELUS PSIDII (COLEOPTERA: CURCULIONIDAE), REARED UNDER LABORATORY CONDITIONS	I	48	21/08/00	16:30	CC		2	PS	2
Viana-Bailez, A. M.	1169	CONTRIBUTIONS TO THE BIOLOGY AND ECOLOGY OF NEOLEUCINODES ELEGANTALIS (LEPIDOPTERA: CRAMBIDAE)	I	295	25/08/00	16:30	CC		6	PS	6
Viana-Bailez, A. M.	1170	OVIPOSITION PREFERENCE AND DEVELOPMENT OF NEOLEUCINODES ELEGANTALIS (LEPIDOPTEITRA: CRAMBIDAE) ON TOMATO GENOTYPES	I	295	25/08/00	16:30	CC		6	PS	6
Viana-Bailez, A. M.	1171	TOXICITY OF TOMATO ALLELOCHEMICALS TO EGGS AND NEONATE LARVAE OF NEOLEUCINODES ELEGANTALIS (LEPIDOPTERA: CRAMBIDAE)	I	295	25/08/00	16:30	CC		6	PS	6
Vianna, G. J. C.	568	AQUATIC HETEROPTERA (GERROMORPHA & NEPOMORPHA) FROM RETIRO DAS PEDRAS, A LOCALITY NEARBY BELO HORIZONTE, MINAS GERAIS, BRAZIL	I	144	25/08/00	16:30	CC		3	PS	3
Vicari, M.	850	INTERACTIONS BETWEEN ABOVE- AND BELOW-GROUND FUNGAL ENDOPHYTES: EFFECTS ON A LEPIDOPTERAN HERBIVORE	I	215	24/08/00	11:05	HB	D	6	6	6
Vick, K.	3920	LOSS OF METHYL BROMIDE AND ITS IMPACT ON INTERNACIONAL TRADE	II	989	25/08/00	15:50	HB	H	22	8	22
Vickerman, D. B.	1413	RECLAMATION OF SELENIUM-CONTAMINATED SITES: RESPONSE OF SPODOPTERA EXIGUA (LEPIDOPTERA: NOCTUIDAE) TO CONTAMINATED ALFALFA AND ATRIPLEX PLANTS	I	356	25/08/00	16:30	CC		7	PS	7
Vickery, R. A.	615	MATING DISRUPTION OF LEPIDOPTERA IN AUSTRALIA – TRIALS, TRIBULATIONS AND TOMORROW	I	156	24/08/00	14:30	Bol	S	4	6	4
Viçoso, E.	2500	NEW STRIDULATORY STRUCTURES IN A TIGER BEETLE (COLEOPTERA, CICINDELIDAE): MORPHOLOGY AND SOUND CHARACTERIZATION	II	631	24/08/00	16:30	CC		13	PS	13
Victor, S. R.	2122	PIPERONYL DERIVATES BASED ON SESAMIN AND THEIR INHIBITION OF THE SYMBIOTIC FUNGUS OF LEAF-CUTTING ANTS	I	535	24/08/00	16:30	CC		11	PS	11
Victor, S. R.	3433	GROWTH INHIBITION OF THE SYMBIOTIC FUNGUS OF ATTA SEXDENS, BY NATURAL PRODUCTS AND SYNTHETIC COMPOUNDS	II	867	23/08/00	11:35	HM	Q	19	4	19
Victoriano, E.	3192	ULTRASTRUCTURE OF THE LYONET'S GLAND IN DIATRAEA SACCHARALIS (LEPIDOPTERA: PYRALIDAE) LARVAE	II	805	25/08/00	16:30	CC		16	PS	16
Vidal, C. A.	3244	EXPERIMENTAL TRANSMISSION OF "STICKY DISEASE" OF PAPAYA BY BEMISIA ARGENTIFOLLI	II	819	25/08/00	16:30	CC		17	PS	17
Vidal, M.	968	A STUDY OF MACROINVERTEBRATES IN RIVES ECOSYSTEMS (NW IBERIAN PENINSULA), AFFECTED BY SMALL HYDROELECTRIC DAMS	I	244	22/08/00	16:30	CC		6	PS	6
Vidal, S.	4084	SIMULATION STUDIES ON THE EFFECTS OF SOLAR HEAT ON EGG-LAYING, DEVELOPMENT AND SURVIVAL OF CALLOSOBRUCHUS MACULATUS AND CALLOSOBRUCHUS SUBINNOTATUS IN STORED BAMBARA GROUNDNUT, VIGNA SUBTERRANEA	II	1031	23/08/00	16:30	CC		23	PS	23
Videla, G. W.	1248	INSECT RESISTANCE MANAGEMENT ON INSECT PROTECTED CROP IN LATIN AMERICA: PERSPECTIVES, CHALENGES AND EXPERIENCES	I	315	23/08/00	13:30	HM	N	7	6	7
Videla, M.	1197	A TRITROPHIC ANALYSIS OF HOST PREFERENCE AND PERFORMANCE IN THE POLYPHAGOUS LEAFMINER LIRIOMYZA HUIDOBRENSIS	I	302	23/08/00	16:30	CC		6	PS	6
Vieglais, D.	780	THE SPECIES ANALYST - STANDARDS FOR A GLOBAL BIODIVERSITY NETWORK	I	197	24/08/00	15:30	Bol	T	5	5	5
Vieira, L.	3111	EFFECT OF TWO PLANT EXTRACTS ON CERAEOCHRYSA CINCTA AND C. CUBANA (NEUROPTERA: CHRYSOPIDAE)	II	785	21/08/00	16:30	CC		16	PS	16
Vieira, M. H. P.	72	POPULATIONAL FLOTATION OF ACARI EDAPHICS ON TILLAGE AND NO TILLAGE SYSTEMS IN THE AREA OF DOURADOS - MS	I	18	25/08/00	16:30	CC		1	PS	1

Sub-titles: (HB=Hotel Bourbon) - (HM=Hotel Mabu) - (CC=Convention Center) - (Bol=Foz Boulevard) - (PS=Poster Session) - (PL=Plenary Lecturer)

AUTHOR	Nº	TITLE	Book	Page	Date	Time	Local	Room	Session	Symp	New Session
Vieira, A. V.	1686	EFFECTS OF CONVENTIONAL PESTICIDES ON THE PREIMAGINAL DEVELOPMENT OF TRICHOGRAMMA CORDUBENSIS (HYMENOPTERA: TRICHOGRAMMATIDAE)	I	425	25/08/00	16:30	CC		8	PS	8
Vieira, B. da S.	225	EFFECT OF THE INSECT GROWTH REGULATOR DIFLUBENZURON ON REPRODUCTION OF EUSCHISTUS HEROS (FABR.) (HETEROPTERA: PENTATOMIDAE)	I	57	22/08/00	16:30	CC		2	PS	2
Vieira, L.	1687	EFFECT OF DIATRAEA SACCHARALIS TREATED EGGS ON CRISOPIDS LARVAE	I	425	25/08/00	16:30	CC		8	PS	8
Vieira, L.	978	VELVETBEAN CATERPILLAR PREFERENCE TO SOYBEAN AND PENUTS VARIETIES	I	247	22/08/00	16:30	CC		6	PS	6
Vieira, L.	715	AZADIRACTA INDICA AND BOUGAINVILLEA SPECTABILIS EXTRACTS TO CONTROL VELVETBEAN CATERPILLAR	I	181	24/08/00	16:30	CC		4	PS	4
Vieira, L. G. E.	3117	COMPARISON OF PRESERVATION METHODS OF ATTA SPP. (HYMENOPTERA; FORMICIDAE) FOR DNA STUDIES	II	786	21/08/00	16:30	CC		16	PS	16
Vieira, M. H.	367	POPULATIONAL FLUCTUATION OF ARTROPODS EDAPHICS ON TILLAGE AND NO TILLAGE SYSTEMS IN THE AREA OF DOURADOS - MS	I	93	25/08/00	16:30	CC		2	PS	2
Vieira, M. R.	2851	WHITEFLY (HEMIPTERA: ALEYRODIDAE) OCCURRENCE ON PAPAYA TREE (CARICA PAPAYA) IN PROTECTED ENVIRONMENT	II	720	25/08/00	16:30	CC		14	PS	14
Vieira, M. R.	4153	SEASONAL FLUCTUATION OF SHEVTCHENKELLA PETIOLULA FERES AND PHYLLOCOPTRUTA SERINGUEIRAE FERES (ACARI: ERIOPHYIDAE) ON SEVEN CLONES OF RUBBER TREE (HEVEA BRASILIENSIS MUELL. ARG.)	II	1049	21/08/00	16:30	CC		Erratum	PS	6
Vieira, M. R.	22	BIOLOGY OF TETRANYCHUS DESERTORUM (ACARI: TETRANYCHIDAE) ON PAPAYA TREE AND ITS OCCURRENCE IN PROTECTED ENVIRONMENT	I	6	21/08/00	16:30	CC		1	PS	1
Vieira, P. C.	1309	METANOLIC EXTRACTS FROM DIMORPHANDRA MOLLIS (BARBATIMÃO) AND THEIR ACTIVITY IN WORKERS OF APIS MELLIFERA	I	330	21/08/00	16:30	CC		7	PS	7
Vieira, P. C.	3433	GROWTH INHIBITION OF THE SYMBIOTIC FUNGUS OF ATTA SEXDENS, BY NATURAL PRODUCTS AND SYNTHETIC COMPOUNDS	II	867	23/08/00	11:35	HM	Q	19	4	19
Vieira, P. R. G.	1612	BIOLOGICAL STUDIES OF NEPHASPIS GEMINII (COLEOPTERA: COCCINELIDAE) A PREDATOR OF BEMISIA TABACI BIOTYPE B (HEMIPTERA: ALEYRODIDADE), IN BRAZIL	I	406	23/08/00	16:30	CC		8	PS	8
Viejo, J. L.	3759	THE GENUS CRYPHIA (INSECTA, LEPIDOPTERA, NOCTUIDAE) IN CENTRAL SPAIN	II	949	22/08/00	16:30	CC		21	PS	21
Viejo, J. L.	3826	SOME WINTER GEOMETRIDS FROM CENTRAL SPAIN (INSECTA: LEPIDOPTERA, GEOMETRIDAE)	II	966	24/08/00	16:30	CC		21	PS	21
Viejo, J. L.	3857	CONTRIBUTION TO THE KNOWLEDGE OF BUTTERFLIES IN THE COIBA NATIONAL PARK, PANAMA. (LEPIDOPTERA: PAPILIONOIDEA)	II	973	24/08/00	16:30	CC		21	PS	21
Viejo, J. L.	4091	DATA ON INSECTS IMPLICATED IN THE DESTRUCTION OF WORKS OF ART IN SPAIN	II	1033	23/08/00	16:30	CC		23	PS	23
Vig, K.	4123	THE LEAF BEETLE FAUNA OF THE CARPATHIAN BASIN: WHAT DO WE REALLY KNOW? HISTORICAL BACKGROUND AND PERSPECTIVES	II	1041	25/08/00	10:40	HM	P	24	2	24
Viggiani, G.	1688	THE ITALIAN SPECIES OF ERETMOCERUS HALDEMAN (HYMENOPTERA: APHELINIDAE) AND THEIR ROLE AS BIOLOGICAL CONTROL AGENTS	I	425	25/08/00	16:30	CC		8	PS	8
Viggiani, G.	1475	BIOLOGICAL DATA ON MEGAPHRAGMA AMALPHITANUM AND MEGAPHRAGMA MYMARIPENNE (HYMENOPTERA: TRICHOGRAMMATIDAE), EGG-PARASITOIDS OF HELIOTHRIPS HAEMORRHOIDALIS (THYSANOPTERA: THRIPIDAE) IN SOUTHERN ITALY	I	372	26/08/00	11:20	HM	O	8	8	8
Vilardi, J. C.	2239	RIBOSOMAL DNA VARIATION IN NATURAL POPULATIONS OF DICHROPLUS ELONGATUS (ORTHOPTERA: ACRIDIDAE)	I	565	21/08/00	16:30	CC		12	PS	12
Vilardi, J. C.	2224	ANALYSIS OF GENETIC VARIABILITY AND MATING BEHAVIOUR OF ANASTREPHA FRATERCULUS (DIPTERA, TEPHRITIDAE) WITHIN THE FRAME OF CONTROL PROGRAMS	I	561	25/08/00	10:05	HB	L	12	11	12
Vilarinho, M. R.	103	INTERNATIONAL AND NATIONAL RESEARCH PROGRAMS FOR THE DEVELOPMENT OF BEMISIA IPM SYSTEMS	I	27	22/08/00	15:00	HB	A	2	4	2
Vilarinho, K. R.	2296	MORPHOLOGICAL AND MOLECULAR IDENTIFICATION OF WHITEFLIES SPECIES IN BRAZIL	I	579	24/08/00	16:30	CC		12	PS	12
Vilariño, M. P.	2804	HARMFUL AND BENEFICAL INSECT SPECIES IN TWO VARIETIES OF LUPINUS SPP. IN ARGENTINA	II	708	25/08/00	16:30	CC		14	PS	14
Vilcarromero, A. C. S.	73	STABILITY ANALYSIS IN A CLASSICAL PREDATOR-PREY MODEL: EXAMPLE OF CASSAVA MITES SYSTEM	I	19	25/08/00	16:30	CC		1	PS	1
Vilela, C. R.	2192	BREEDING SITES AND SPECIATION IN THE DROSOPHILA REPLETA SPECIES GROUP	I	553	23/08/00	10:05	HB	L	12	5	12
Vilela, E.	693	MANAGING TEMPERATE FRUIT PESTS IN BRAZIL USING SEMIOCHEMICALS	I	175	23/08/00	16:30	CC		4	PS	4
Vilela, E.	3970	A HIGHLY INTEGRATED MONITORING SYSTEM TO SUPPORT ON-TIME, ON-LINE DECISION-MAKING IN AGRICULTURE	II	1002	24/08/00	16:30	CC		22	PS	22
Vilela, E. F.	4160	SEXUAL BEHAVIOR AND DAILY ACTIVITY OF CITRUS BORER MOTH ECDYTOLOPHA AURANTIANA (LEPIDOPTERA: TORTRICIDAE)	II	1051	21/08/00	16:30	CC		Erratum	PS	4
Vilela, E. F.	610	MASS TRAPPING OF RHYNCHOPHORUS PALMARUM USING PHEROMONE IN COCONUT PLANTATION, IN BRAZIL	I	154	24/08/00	10:05	Bol	S	4	6	4
Vilela, E. F.	1723	FUNCTIONAL POLYGYNY IN ECTATOMMA TUBERCULATUM (HYMENOPTERA: FORMICIDAE).	I	434	22/08/00	10:20	HB	F	9	2	9
Vilela, E. F.	587	EFFECTS OF PHEROMONES IN ARTIFICIAL DIETS FOR PREDATORY BUGS	I	149	22/08/00	9:50	Bol	S	4	2	4
Vilela, E. F.	648	LOCAL DETERRENCE OF MULTIPLE ATTACKS BY THE COFFEE BERRY BORER	I	164	22/08/00	16:30	CC		4	PS	4
Vilela, E. F.	1632	PREDATORS IMPAIRING PARASITOIDS IN THE NATURAL BIOLOGICAL CONTROL	I	411	24/08/00	16:30	CC		8	PS	8
Vilela, E. F.	1720	SEXUAL BEHAVIOR OF LONGHORN BEETLE MIGDOLUS FRYANUS (COLEOPTERA: CERAMBYCIDAE)	I	433	22/08/00	9:35	HB	F	9	2	9
Vilela, E. F.	1778	IS ELASMOPALPUS LIGNOSELLUS BEHAVIOR INFLUENCED BY SMOKE OF BURNED SUGAR CANE?	I	448	23/08/00	16:30	CC		9	PS	9
Vilela, E. F.	654	SEX PHEROMONE OF THE BRAZILIAN APPLE LEAFROLLER, BONAGOTACRANAODES (LEPIDOPTERA: TORTRICIDAE): EFFECT OF GEOMETRICISOMERS ON MALE ATTRACTION TO (E,Z)-3,5-DODECADIENYL ACETATE	I	165	22/08/00	16:30	CC		4	PS	4
Vilela, N. J.	1581	CONTROL OF THE SOUTH AMERICAN TOMATO PINWORM IN GLASSHOUSE WITH T. PRETIOSUM: BIOLOGICAL AND ECONOMICAL EFFICIENCY	I	399	23/08/00	16:30	CC		8	PS	8
Vilella, F.	2622	INSECT DEVELOPMENT DELAY PRODUCED BY WITHANOLIDES FROM SOLANACEAE	II	662	22/08/00	16:30	CC		14	PS	14
Vilhelmsen, L.	1807	HOST LOCATION AND OVIPOSITION IN THE ORUSSIDAE (HYMENOPTERA), A BASAL PARASITIC WASP FAMILY	I	455	25/08/00	16:30	CC		9	PS	9
Vilhelmsen, L.	3193	MAJOR TRENDS IN THE EVOLUTION OF HYMENOPTERAN MORPHOLOGY	II	805	24/08/00	16:30	CC		16	PS	16
Vilimova, J.	3194	COMPARATIVE MORPHOLOGY OF THE PYGOPHORE IN PODOPINAE (PENTATOMIDAE: PENTATOMOIDEA)	II	806	25/08/00	16:30	CC		16	PS	16
Vilimova, J.	3635	HIGHER CLASSIFICATION AND PHYLOGENY OF PODOPINAE (PENTATOMIDAE: PENTATOMOIDEA)	II	918	22/08/00	11:35	HB	E	21	3	21
Villablanca, F.	2201	GENETIC DIVERSITY IN INVADING POPULATIONS	I	556	24/08/00	9:35	HB	L	12	7	12
Villablanca, F.	2203	POPULATION SPECIFIC MARKERS: THE POWER OF GENEALOGIES	I	556	24/08/00	10:35	HB	L	12	7	12
Villa-Castillo, J.	1202	GROUND BEETLE COMMUNITY STRUCTURE AS A BIOINDICATOR OF FOREST HEALTH IN TWO PINE-BUNCHGRASS ECOSYSTEMS SUBJECTED TO DIFFERENT DISTURBANCE EVENTS	I	303	25/08/00	16:30	CC		6	PS	6
Villacide, J. M.	1935	MAIN INSECT FOREST PESTS AFFECTING PINES IN THE PATAGONIA ARGENTINA	I	488	23/08/00	16:30	CC		10	PS	10
Villagrán, M. E.	368	FRUIT FLY (DIPTERA:TEPHRITIDAE) QUARANTINE PROCEDURES FOR EXPORT OF AVOCADOS FROM ARGENTINA TO CHILE	I	93	25/08/00	16:30	CC		2	PS	2

Sub-titles: (HB=Hotel Bourbon) - (HM=Hotel Mabu) - (CC=Convention Center) - (Bol=Foz Boulevard) - (PS=Poster Session) - (PL=Plenary Lecturer)

AUTHOR	Nº	TITLE	Book	Page	Date	Time	Local	Room	Session	Symp	New Session
Villalobos, L. C. de	2039	LARVAE OF DILOBODERUS ABDERUS (COLEPTERA, SCARABAEIDAE) PARASITED BY NEMATODES, IN ARGENTINA	I	514	21/08/00	16:30	CC		11	PS	11
Villani, M. G.	80	LARVAL BEHAVIOUR IN THE SCARABAEIDAE	I	21	21/08/00	10:05	HB	A	2	1	2
Villani, M. G.	2009	BEHAVIORAL RESPONSE OF SOIL ARTHROPODS TO FUNGAL PATHOGENS	I	507	23/08/00	10:05	HM	P	11	5	11
Villar, M. J.	2501	DISTRIBUTION OF FMRF-AMIDE LIKE IMMUNOREACTIVITY IN THE BRAIN OF TRIATOMA INFESTANS.	II	632	24/08/00	16:30	CC		13	PS	13
Villar, M. J.	2502	THE DISTRIBUTION OF NPY AND NPY-Y1 RECEPTOR LIKE IMMUNOREACTIVITIES IN THE BRAIN OF TRIATOMA INFESTANS.	II	632	24/08/00	16:30	CC		13	PS	13
Villaneal, S.	1656	CONTROL OF PLANTHOPPERS AND LEAFHOPPERS IN RICE BY THE SPIDER ATYPENA FORMOSANA	I	417	24/08/00	16:30	CC		8	PS	8
Villas Bôas, G. L.	1203	ADAPTIVE POTENTIAL OF THE SWEET-POTATO WHITEFLY BEMISIA ARGENTIFOLII TO SEVERAL HOST PLANTS	I	303	25/08/00	16:30	CC		6	PS	6
Villesen, P.	3430	MATING SYSTEM EVOLUTION IN ATTINE FUNGUS GROWING ANTS	II	866	23/08/00	10:50	HM	Q	19	4	19
Vincent, C	3901	OVERVIEW OF INSECT MANAGEMENT WITH PHYSICAL CONTROL METHODS: WHY, HOW AND WHERE	II	985	24/08/00	9:30	HB	H	22	6	22
Vincent, C.	1642	SURVIVAL AND FECUNDITY OF ANAGYRUS KAMALI (ENCYRTIDAE) UNDER DIFFERENT STORAGE CONDITIONS	I	414	24/08/00	16:30	CC		8	PS	8
Vincent, C.	3904	PNEUMATIC CONTROL OF INSECTS IN PLANT PROTECTION	II	985	24/08/00	10:35	HB	H	22	6	22
Vincent, C.	3963	INSECTICIDAL EFFECTS OF THUJA OCCIDENTALIS (CUPRESSACEAE) ESSENTIAL OIL ON CALLOSOBRUCHUS MACULATUS [COLEOPTERA: BRUCHIDAE]	II	1000	22/08/00	16:30	CC		22	PS	22
Vincent, C.	133	TOWARDS FEWER PESTICIDE APPLICATIONS IN QUEBEC VINEYARDS	I	34	24/08/00	14:45	HB	A	2	8	2
Vincent, C.	1302	INDOXACARB (DPX-MP062) A NEW OXIDIAZINE INSECTICIDE - ITS POTENTIAL IN QUEBEC APPLE ORCHARDS	I	329	22/08/00	16:30	CC		7	PS	7
Vinchi, R. R.	323	INFLUENCE OF DIFFERENT APPLICATION METHODS AND DOSAGES OF THIAMETHOXAM IN THRIPS CONTROL	I	82	24/08/00	16:30	CC		2	PS	2
Vinchi, R. R.	369	EFFICIENCY AND RESIDUAL OF DIFFERENT ACEPHATE FORMULATIONS IN CONTROL OF GREEN-PEACH APHIDS ON PEPPER'S CROP	I	93	25/08/00	16:30	CC		2	PS	2
Vinchi, R. R.	370	EFFICIENCY OF FENPROPATHRIN AND CHLORFLUAZURON IN CONTROL OF NEOLEUCINODES ELEGANTALIS (LEPIDOPTERA: PYRALIDAE) ON TOMATO'S CROP	I	94	25/08/00	16:30	CC		2	PS	2
Viner, R.	1228	MOLECULAR STUDIES OF INSECT ACETYLCHOLINESTERASE: IS THERE NEW LIFE IN AN OLD TARGET?	I	310	21/08/00	14:05	HM	N	7	2	7
Vinokurov, K. S.	2420	PROTEINASE INHIBITORS IN THE MIDGUT OF THE COCKROACH	II	611	21/08/00	16:30	CC		13	PS	13
Vinson, B.	2365	CONSTRASTING THE NUTRITIONAL CHALLENGES OF ECTO- AND ENDOPARASITOIDS	II	597	24/08/00	10:05	HB	I	13	6	13
Vinson, S. B.	1123	IMPACT OF AREA ON THE BEHAVIORAL INTERACTIONS OF SOLENOPSIS INVICTA AND MONOMORIUM MINIMUM COLONIES	I	283	24/08/00	16:30	CC		6	PS	6
Vinson, S. B.	94	ARE POLLINATOR NUMBERS DECLINING OR FLUCTUATING NORMALLY ?	I	25	22/08/00	10:15	HB	A	2	3	2
Vinson, S. B.	1458	DIFFERENTIAL HOST EXPLOITATION STRATEGIES BY MORPHOTYPES OF MELITTOBIA DIGITATA (HYMENOPTERA, EULOPHIDAE)	I	368	23/08/00	15:50	HM	O	8	6	8
Vinson, S. B.	2375	PHYSIOLOGY OF THE MORPHOTYPE DIFFERENTIATION IN THE PARASITIC WASP MELITTOBIA DIGITATA (HYMENOPTERA, EULOPHIDAE)	II	600	24/08/00	15:35	HB	I	13	7	13
Vinson, S. B.	1456	SPIRACULAR GLANDS OF DROSOPHILA MELANOGASTER PUPARIA ELICIT RECOGNITION REPONSE IN TRICHOPRIA DROSOPHILAE	I	367	23/08/00	15:15	HM	O	8	6	8
Vinson, S. B.	1457	EGG PARASITOIDS ATTACKING HOMOLOGOUS HOSTS: EQUIVALENCES AND DIFFERENCES BETWEEN TWO ALLOPATRIC CABBAGE BUGS	I	368	23/08/00	15:35	HM	O	8	6	8
Vinson, S. B.	3145	SPIRACULAR GLANDS OF DROSOPHILA MELANOGASTER PUPARIA ELICIT RECOGNITION RESPONSE IN TRICHOPRIA DROSOPHILAE	II	793	23/08/00	16:30	CC		16	PS	16
Virant-Doberlet, M.	1753	THE LANGUAGE AND DIALECTS OF THE SOUTHERN GREEN STINK BUG NEZARA VIRIDULA, AN INSECT WHICH COMMUNICATES THROUGH PLANTS	I	442	21/08/00	16:30	CC		9	PS	9
Virla, E.	3236	DELPHACID PLANTHOPPERS AND THE "MAL DE RIO CUARTO" IN MAIZE IN THE NORTH OF ARGENTINA (INSECTA - FULGOROMORPHA)	II	817	23/08/00	16:30	CC		17	PS	17
Virla, E. G.	3195	THE MORPHOLOGY OF THE POSTEMBRYONIC STAGES OF GONATOPUS CHILENSIS (HYMENOPTERA: DRYINIDAE), WITH CONSIDERATIONS ABOUT THE INMATURE LARVAE NUTRITION AND ITS RELATED STRUCTURES	II	806	25/08/00	16:30	CC		16	PS	16
Virla, E. G.	305	CICADELLIDAE (INSECTA-HOMOPTERA) SPECIES RICHNESS AND ABUNDANCE ON MAIZE IN ARGENTINA	I	77	24/08/00	16:30	CC		2	PS	2
Virtanen, T.	1204	CLIMATE DETERMINED PATTERNS IN THE OUTBREAKS OF THE AUTUMNAL MOTH (EPIRRITA AUTUMNATA, LEP.: GEOMETRIDAE)	I	303	25/08/00	16:30	CC		6	PS	6
Viscarret, M. M.	1689	BIOLOGICAL STUDIES ON ENCARSIA PORTERI (HYMENOPTERA: APHELINIDAE)	I	426	22/08/00	16:30	CC		8	PS	8
Viscarret, M. M.	2852	BIOLOGICAL STUDIES ON THE ARG1 BIOTYPE OF THE BEMISIA TABACI COMPLEX (HEMIPTERA: ALEYRODIDAE)	II	720	25/08/00	16:30	CC		14	PS	14
Visser, J. H.	738	NEW TOOLS TO CONTROL APHID PESTS: REPELLENT ODOURS	I	186	25/08/00	16:30	CC		4	PS	4
Vitek, C.	3025	VARIABLE TIMING OF EGG HATCH AND ITS RELATION TO ANNUAL PRECIPITATION IN POPULATIONS OF AEDES TRISERIATUS	II	763	25/08/00	16:30	CC		15	PS	15
Vittor, A. Y.	2878	THE IMPACT OF DEFORESTATION ON MALARIA: A CASE STUDY FROM THE PERUVIAN AMAZON	II	726	21/08/00	15:05	Bol	R	15	2	15
Vivan, L. M.	1690	ENVIRONMENTAL AND PREY INTERACTION ON THE DEVELOPMENT AND REPRODUCTION OF THE STINKBUG PREDATOR PODISUS NIGRISPINUS	I	426	25/08/00	16:30	CC		8	PS	8
Vivanco, E.	1996	USE OF PATHOGENIC NEMATODES AND THEIR SYMBIOTIC BACTERIA FOR THE CONTROL OF SLUG PEST	I	504	21/08/00	15:05	HM	P	11	2	11
Vizioli, J.	2354	THE ROLE OF INNATE IMMUNE PEPTIDES TO REDUCE PARASITE DEVELOPMENT IN AEDES AEGYPTI	II	595	23/08/00	11:05	HB	I	13	4	13
Vlimant, M.	2	COLD RECEPTORS ON THE BODY SURFACE OF THE TROPICAL BONT TICK AMBLYOMMA VARIEGATUM	I	1	24/08/00	14:05	HB	F	1	1	1
Vlimant, M.	583	SENSORY AND BEHAVIOURAL RESPONSES OF TRIATOMINE BUGS TO ODOURS OF VERTEBRATE HOSTS AND TO CONSPECIFIC SEMIOCHEMICALS	I	148	22/08/00	10:05	Bol	S	4	2	4
Vogler, A. P.	379	HABITAT CONSTRAINTS AND PATTERNS OF DIVERSITY	I	96	21/08/00	11:05	HB	C	3	1	3
Vogler, A. P.	546	HABITAT CONSTRAINTS AND PATTERNS OF DIVERSITY	I	138	24/08/00	16:30	CC		3	PS	3
Vogler, A. P.	3677	TOWARDS A MOLECULAR PHYLOGENY OF SCARABAEID DUNG BEETLES	II	928	24/08/00	16:05	HB	E	21	7	21
Vogler, A. P.	2330	A MOLECULAR PHYLOGENY OF COLEOPTERA FROM 18S rRNA SEQUENCES	I	588	25/08/00	16:30	CC		12	PS	12
Vogler, A. P.	3683	BASAL RELATIONSHIPS IN COLEOPTERA INFERRED FROM RIBISOMAL DATA	II	930	25/08/00	14:35	HB	E	21	8	21
Vogler, A. P.	1205	ASSESSING THE HISTORICAL AFFINITIES OF NEOTROPICAL BEETLE FAUNAS AT A JOINT UK BELIZEAN FIELD SITE	I	304	23/08/00	16:30	CC		6	PS	6
Vogler, A. P.	952	PHYLOGEOGRAPHY AND ECOLOGICAL DIVERSIFICATION OF CICINDELA LUSITANICA (CICINDELIDAE: COLEOPTERA)	I	240	22/08/00	16:30	CC		6	PS	6
Vogler, A. P.	3621	A PHYLOGENY OF THE WEEVIL MAJOR GROUPS: MORPHOLOGICAL AND MOLECULAR EVIDENCE	II	914	21/08/00	14:50	HB	E	21	2	21
Vogt, R. G.	578	DIVERSITY, PHYLOGENY, AND FUNCTIONS OF ODOR RECEPTION PROTEINS: OBP, ODE AND SNMP	I	146	21/08/00	13:30	Bol	S	4	1	4
Vogt, R. G.	604	HORMONAL REGULATION OF OLFACTORY DEVELOPMENT: DIAPAUSE ACCOMODATION?	I	153	23/08/00	13:35	Bol	S	4	5	4
Voicescu, I.	1847	A NEW VIRAL PRODUCT "Inf-Ld" USED IN THE CONTROL OF POPULATIONS DENSITY OF LYMANTRIA DISPAR L. AND EUPROCTIS CHRYSORRHOEA	I	466	23/08/00	15:35	HB	M	10	4	10
Völkl, W.	1758	INTERSPECIFIC AND INTRASPECIFIC VARIATIONS IN APHID HONEYDEW: IMPACT ON THE MUTUALISM WITH ANTS	I	443	21/08/00	16:30	CC		9	PS	9
Volkman, B.	2376	THE ROLE OF PLASMATOCYTE SPREADING PEPTIDE IN REGULATION OF ENCAPSULATION	II	600	24/08/00	16:05	HB	I	13	7	13

Sub-titles: (HB=Hotel Bourbon) - (HM=Hotel Mabu) - (CC=Convention Center) - (Bol=Foz Boulevard) - (PS=Poster Session) - (PL=Plenary Lecturer)

AUTHOR	Nº	TITLE	Book	Page	Date	Time	Local	Room	Session	Symp	New Session
Volkman, L.	2521	MELANIZATION AND ENCAPSULATION IN HELICOVERPA ZEA LARVAE INFECTED WITH AUTOGRAPHA CALIFORNICA M NUCLEOPOLYHEDROVIRUS	II	637	25/08/00	16:30	CC		13	PS	13
Volkmar, Ch.	3999	ECOLOGICAL STUDIES ACCOMPANYING THE CULTIVATION OF TRANSGENIC RAPE AND MAIZE IN THURINGIA (GERMANY)	II	1009	25/08/00	16:30	CC		22	PS	22
Volney, W. J. A.	1817	ARTHROPODS, THINNING AND INNOVATIVE HARVEST DESIGNS: ECOSYSTEM MANAGEMENT AND BOREAL BIODIVERSITY	I	458	21/08/00	13:35	HB	M	10	1	10
von Ellenrieder, N.	3813	REVISION AND CLADISTIC ANALYSIS OF THE NEOTROPICAL GENUS ANDINAGRION BULLA (ODONATA: COENAGRIONIDAE)	II	962	24/08/00	16:30	CC		21	PS	21
von Ellenrieder, N.	3814	REVISION OF THE NEOTROPICAL SUBGENUS AESHNA (MARMARAESCHNA) CALVERT (ODONATA: AESHNIDAE)	II	963	24/08/00	16:30	CC		21	PS	21
Von Zuben, C.J.	243	ENTROPY OF ADULT WASPS OF POLISTES LANIO AND MISCHOCYTTARUS CERBERUS (HYMENOPTERA, VESPIDAE) FROM COLONIES STUDIED IN FIELD CONDITIONS	I	62	22/08/00	16:30	CC		2	PS	2
Vontas J. G.	1311	CHARACTERISATION OF AMPLIFIED ALDEHYDE OXIDASES FROM INSECTICIDE RESISTANT CULEX QUINQUEFASCIATUS	I	331	21/08/00	16:30	CC		7	PS	7
Vontas, J. G.	351	MOLECULAR CHARACTERISATION AND QUANTITATION OF THE AMPLIFIED CARBOXYLESTERASE GENE ASSOCIATED WITH ORGANOPHOSPHORUS INSECTICIDE RESISTANCE IN THE BROWN PLANTHOPPER, NILAPARVATA LUGENS	I	89	25/08/00	16:30	CC		2	PS	2
Vorgetts, J.	3943	THE ROLE OF ENVIRONMENTAL POLICY AND PROCEDURES IN MITIGATING IMPACTS OF ACRIDID CONTROL IN SAHELIAN AFRICA	II	995	21/08/00	16:30	CC		22	PS	22
Vos, B. De	1903	FOREST SOIL CLASSIFICATION BASED ON COLLEMBOLA FAUNA	I	480	22/08/00	16:30	CC		10	PS	10
Vos, B. De	567	BEETLE DIVERSITY AND FOREST CHARACTERISTICS IN FLANDERS (BELGIUM)	I	143	25/08/00	16:30	CC		3	PS	3
Vos, B. De	1813	GROUND BEETLE DIVERSITY AND ASSEMBLAGES FROM FORESTS IN FLANDERS: A BASELINE STUDY	I	457	22/08/00	16:30	CC		10	PS	3
Vos, B. De	1813	GROUND BEETLE DIVERSITY AND ASSEMBLAGES FROM FORESTS IN FLANDERS: A BASELINE STUDY	I	457	22/08/00	16:30	CC		10	PS	3
Vos, B. De	1912	BEETLES, SPIDERS AND FLIES AS BIO-INDICATORS IN FORESTS: A LARGE SCALE RESEARCH PROJECT IN FLANDERS (BELGIUM)	I	482	21/08/00	16:30	CC		10	PS	10
Vosshall, L. B.	577	THE MOLECULAR BIOLOGY OF DROSOPHILA ODORANT RECEPTORS	I	146	21/08/00	10:45	Bol	S	4	1	4
W. Rassmann	3910	ASSOCIATION OF PHYSICAL CONTROL MEANS FOR THE CONTROL OF INSECTS IN CEREAL INDUSTRIES AND PRODUCTS	II	987	24/08/00	15:00	HB	H	22	6	22
Waage, J. K.	3917	AN INTERNATIONAL PERSPECTIVE ON RISK ASSESSMENT	II	989	25/08/00	14:30	HB	H	22	7	22
Waage, J.K.	444	ALIEN BUGS IN INTERNATIONAL CONVENTIONS	I	113	25/08/00	15:35	HB	C	3	8	3
Wackers, F. L.	1118	LINKING MULTITROPHIC INTERACTIONS ABOVE-BELOWGROUND	I	282	24/08/00	16:30	CC		6	PS	6
Wäckers, F. L.	1419	PLANTS KNOW HOW TO BE SWEET: PATTERNS OF EXTRAFLORAL NECTAR PRODUCTION OPTIMIZE INDIRECT DEFENSE	I	358	21/08/00	10:05	HM	O	8	1	8
Wäckers, F. L.	1453	ORIENTATION BY SELF-PRODUCED VIBRATIONS: HOW PUPAL PARASITOIDS HUNT FOR HIDING HOSTS	I	367	23/08/00	14:15	HM	O	8	6	8
Wäckers, F. L.	1792	GUSTATORY RESPONSE AND NUTRITIONAL SUITABILITY OF INDIVIDUAL NECTAR SUGARS FOR PIERIS BRASSICAE	I	451	24/08/00	16:30	CC		9	PS	9
Wackford, K. M.	1206	FACTORS LIMITING THE RED IMPORTED FIRE ANT (SOLENOPSIS WAGNERI) IN ITS NATIVE RANGE IN BRAZIL	I	304	25/08/00	16:30	CC		6	PS	6
Wada, A.	2530	TASTE ENHANCING EFFECT OF GLYCINE ON THE SWEETNESS OF GLUCOSE: A GUSTATORY TRICK FOR THE SYMBIOSIS BETWEEN THE ANT, CAMPONOTUS JAPONICUS AND THE LARVAE OF THE LYCAENID BUTTERFLY, NIPHANDA FUSCA	II	639	25/08/00	16:30	CC		13	PS	13
Wada, A.	4179	TASTE OF NOXIOUS LIPOPHILIC SUBSTANCES: AVERSIVE BEHAVIOR AND TASTE RESPONSE TO LIMONENE IN THE BLOWFLY, PHORMIA REGINA	II	1055	22/08/00	16:30	CC		Erratum	PS	13
Wada, H.	3571	LIFE HISTORY AND EGG DIAPAUSE OF A WATER STRIDER, METROCORIS HISTORIO B.WHITE	II	901	23/08/00	11:05	Bol	U	20	1	20
Wada, T.	588	A PHEROMONE COMPONENT OF THE BEAN BUG, RIPTORTUS CLAVATUS, ATTRACTS AN EGG PARASITOID, OOENCYRTUS NEZARAE	I	149	22/08/00	11:05	Bol	S	4	2	4
Wada, T.	371	MIGRATION-RELATED CHARACTERS OF THE BROWN PLANT-HOPPER, NILAPARVATA LUGENS, COLLECTED IN EAST AND SOUTHEAST ASIA	I	94	25/08/00	16:30	CC		2	PS	2
Wadiak, H.	2434	AN EST PROJECT ON AEDES AEGYPTI IDENTIFIES PROTEINS INVOLVED IN ION TRANSPORT IN THE MIDGUT AND MALPIGHIAN TUBULES	II	615	22/08/00	16:30	CC		13	PS	13
Wagner, M. R.	841	RESPONSE OF PHYTOLYMA LATA (HOMOPTERA: PSYLLIDAE) TO VARYING HOST DENSITY IN GHANA, WEST AFRICA	I	213	23/08/00	15:00	HB	D	6	5	6
Wagner, M. R.	948	ARTHROPOD COLONIZATION RATES OF EXOTIC WOODY SPECIES	I	239	22/08/00	16:30	CC		6	PS	6
Wagner, M. R.	1202	GROUND BEETLE COMMUNITY STRUCTURE AS A BIOINDICATOR OF FOREST HEALTH IN TWO PINE-BUNCHGRASS ECOSYSTEMS SUBJECTED TO DIFFERENT DISTURBANCE EVENTS	I	303	25/08/00	16:30	CC		6	PS	6
Wagner, M. R.	1864	USING RESISTANCE IN TROPICAL PLANTATIONS	I	470	24/08/00	15:35	HB	M	10	6	10
Wagner, M. R.	1959	SCOLYTIDAE AND ASSOCIATED INSECTS IN PONDEROSA PINE STANDS UNDER DIFFERENT STRUCTURAL CONDITIONS IN NORTHERN ARIZONA	I	494	25/08/00	16:30	CC		10	PS	10
Wagner, R. M.	3332	INGESTION AND DIGESTION OF GREEN FLUORESCENT PROTEIN BY THE WESTERN TARNISHED PLANT BUG, LYGUS HESPERUS	II	841	22/08/00	16:30	CC		18	PS	18
Wagner, R. M.	3250	TESTIS ECDYSIOTROPIN, AN INSECT GONADOTROPIN THAT INDUCES SYNTHESIS OF ECDYSTEROID	II	821	21/08/00	9:50	HB	K	18	1	18
Wagner, T.	452	BIOGEOGRAPHY OF AFROTROPICAL MONOLEPTA AND RELATED TAXA (CHRYSOMELIDAE: COLEOPTERA)	I	115	26/08/00	11:50	HB	C	3	9	3
Wagner, T.	3583	SEASONALITY OF CANOPY ARTHROPODS IN BUDONGO FOREST, UGANDA	II	904	24/08/00	14:30	Bol	U	20	2	20
Wagner, T.	3858	TAXONOMY AND PHYLOGENY OF AFROTROPICAL MONOLEPTA AND RELATED TAXA	II	974	25/08/00	11:40	HM	P	21	2	24
Wagner, T.	4126	BIOGEOGRAPHY OF AFROTROPICAL MONOLEPTA AND RELATED TAXA (CHRYSOMELIDAE: COLEOPTERA)	II	1042	21/08/00	16:30	CC		24	PS	24
Wahid, M. B.	84	MANAGEMENT OF RHINOCEROS BEETLES IN MALAYSIA	I	22	21/08/00	11:05	HB	A	2	1	2
Wahlberg, N.	2331	THE EVOLUTION OF HOST PLANT USE IN MELITAEINE BUTTERFLIES: A PHYLOGENETIC ANALYSIS	I	588	25/08/00	16:30	CC		12	PS	12
Wahlberg, N.	3859	PATTERN OF PHYLOGENETIC RELATIONSHIPS AMONG MEMBERS OF THE TRIBE MELITAEINI (LEPIDOPTERA: NYMPHALIDAE) INFERRED FROM MITOCHONDRIAL DNA SEQUENCES	II	974	25/08/00	16:30	CC		21	PS	21
Waiganjo, M.	2825	SURVEY OF PRACTICES AND PERCEPTIONS OF SMALL HOLDER FARMERS RELATING TO PEST MANAGEMENT ON VEGETABLE CROPS IN EASTERN AFRICA	II	713	23/08/00	16:30	CC		14	PS	14
Wainhouse, D.	1866	ENVIRONMENTAL EFFECTS ON RESISTANCE OF YOUNG SPRUCE TO INSECTS AND FUNGI	I	470	24/08/00	16:20	HB	M	10	6	10
Wainhouse, D.	3245	INSECT TRANSMISSION OF A VASCULAR WILT OF A TROPICAL HARDWOOD IN THE SEYCHELLES	II	819	25/08/00	16:30	CC		17	PS	17
Wainselboim, A. J.	3564	HONEYBEES ARE ABLE TO REPRESENT DURING TROPHALLAXIS INSTANTANEOUS CHANGES IN FLOW OF SOLUTION	II	899	25/08/00	16:30	CC		19	PS	19
Waite, G. K.	2853	OPTIONS FOR THE MANAGEMENT OF SPIDER MITES IN FIELD-GROWN STRAWBERRIES	II	720	25/08/00	16:30	CC		14	PS	14
Waite, G. K.	2854	MANAGEMENT OF FRUITSPOTTING BUGS IN TROPICAL AND SUBTROPICAL FRUIT CROPS	II	720	25/08/00	16:30	CC		14	PS	14
Walder, J. M.	4160	SEXUAL BEHAVIOR AND DAILY ACTIVITY OF CITRUS BORER MOTH ECDYTOLOPHA AURANTIANA (LEPIDOPTERA: TORTRICIDAE)	II	1051	21/08/00	16:30	CC		Erratum	PS	4

Sub-titles: (HB=Hotel Bourbon) - (HM=Hotel Mabu) - (CC=Convention Center) - (Bol=Foz Boulevard) - (PS=Poster Session) - (PL=Plenary Lecturer)

AUTHOR	Nº	TITLE	Book	Page	Date	Time	Local	Room	Session	Symp	New Session
Walder, J. M. M.	1617	PARASITISM EFFICIENCY OF THE BRACONIDAE WASPS, DIACHASMIMORPHA LONGICAUDATA, ON LARVAE OF MEDFLY IN GUAVAS	I	408	24/08/00	16:30	CC		8	PS	8
Walder, J. M. M.	1618	BIOLOGICAL CONTROL OF MEDFLY IN PEACH USING PARASITOID DIACHASMIMORPHA LONGICAUDATA (HYMENOPTERA: BRACONIDAE) INUNDATIVE RELEASINGS	I	408	24/08/00	16:30	CC		8	PS	8
Walder, J. M. M.	3324	REPRODUCTIVE CAPACITY OF DIACHASMIMORPHA LONGICAUDATA (HYMENOPTERA: BRACONIDAE) BY FACULTATIVE ARRHENOTOKY PARTHENOGESIS REARED ON PRE-PUPAE OF CERATITIS CAPITATA (DIPTERA: TEPHRITIDAE)	II	839	21/08/00	16:30	CC		18	PS	18
Walgraef, S.	1434	PRODUCTION OF PREDATORY BUGS ON ARTIFICIAL AND FACTITIOUS FOODS AND THEIR USE IN GREENHOUSE PEST MANAGEMENT	I	362	21/08/00	15:35	HM	O	8	2	8
Walker, J. T. S.	110	THE NEW ZEALAND APPLE INDUSTRY: THE AGROCHEMICAL AND PHYTOSANITARY CHALLENGES FOR GLOBAL EXPORTS	I	29	23/08/00	10:55	HB	A	2	5	2
Walker, J. T. S.	3877	LURE AND KILL FOR PEST MANAGEMENT IN ORCHARDS	II	979	21/08/00	15:30	HB	H	22	1	22
Walker, S.	511	SPATIAL MAPPING OF TWO PEST POPULATIONS IN NEW JERSEY SWEET CORN	I	129	23/08/00	16:30	CC		3	PS	3
Walker, T. J.	1738	THE EVOLUTION OF MATING SYSTEMS IN SHORT-TAILED CRICKETS (GRYLLIDAE: ANUROGRYLLUS SPP.)	I	438	23/08/00	10:15	HB	F	9	3	9
Walker, V. K.	3283	WHEN YOU CAN'T FLY TO BRAZIL: SURVIVING WINTER WITH ANTIFREEZE PROTEIN GENES	II	829	23/08/00	11:05	HB	K	18	4	18
Wall, R.	4102	THE SEASONAL ABUNDANCE AND CONTROL OF CHRYSOMYA MEGACEPHALA INFESTING DRYING FISH IN SOUTH-WEST INDIA	II	1036	24/08/00	16:30	CC		23	PS	23
Wall, R.	1113	MORTALITY RATE, REPRODUCTIVE OUTPUT, AND TRAP RESPONSE BIAS IN POPULATIONS OF THE BLOWFLY LUCILIA SERICATA	I	281	24/08/00	16:30	CC		6	PS	6
Wall, R. L.	2939	GENETIC RELATIONSHIPS BETWEEN CALLIPHORIDAE OF FORENSIC IMPORTANCE	II	742	26/08/00	9:35	Bol	R	15	11	15
Wallace, J. R	2947	THE ROLE OF AQUATIC INSECTS IN FORENSIC INVESTIGATIONS	II	744	26/08/00	11:35	Bol	R	15	11	15
Wallace, J. R.	4103	IMPACT OF URBANIZATION ON AN INSECT/PLANT INTERACTION: BRUCHID BEETLES ON BLUE PALO VERDE	II	1036	24/08/00	16:30	CC		23	PS	23
Waller, D. A.	569	BIODIVERSITY OF ANT SPECIES IN NATURAL AND CREATED WETLANDS	I	144	25/08/00	16:30	CC		3	PS	3
Wallis, G. W.	1818	EFFECTS OF A MULTI-YEAR GYPSY MOTH ERADICATION PROGRAM ON DIVERSITY OF NONTARGET FOREST CANOPY ARTHROPODS AND THEIR BIRD PREDATORS IN THE OZARK MOUNTAINS	I	458	21/08/00	14:20	HB	M	10	1	10
Wallman, J. F.	2942	IDENTIFICATION OF FORENSICALLY-IMPORTANT AUSTRALIAN BLOWFLIES	II	742	26/08/00	10:20	Bol	R	15	11	15
Walsh, S. B.	1228	MOLECULAR STUDIES OF INSECT ACETYLCHOLINESTERASE: IS THERE NEW LIFE IN AN OLD TARGET?	I	310	21/08/00	14:05	HM	N	7	2	7
Walter Leal	IV	Chemical communication in scarab beetles	I	XIV	21/08/00	8:00	HB			PL	
Walter, G. H.	821	LIFE HISTORY AND ITS ROLE IN INTERSPECIFIC INTERACTIONS	I	208	22/08/00	14:05	HB	D	6	4	6
Walter, M. F.	2927	STRUCTURE AND EXPRESSION OF THE LARVAL AND ADULT HEXAMERIN GENES, MDH1.1 AND MDH2.1, IN MUSCA DOMESTICA	II	739	25/08/00	11:20	Bol	R	15	9	15
Walters, K. F. A.	153	MODELLING THE SPATIAL DYNAMICS OF INSECT-TRANSMITTED PLANT VIRUSES	I	39	26/08/00	10:05	HB	A	2	10	2
Walters, K. F. A.	902	IMPACT OF THE GENOTYPE OF A SYMBIOTIC BACTERIA ON THE FITNESS OF A PHYTOPHAGOUS INSECT	I	228	21/08/00	16:30	CC		6	PS	6
Walters, M.	2541	REGIONAL MAMANGEMENT AND ERADICATION OF INSECT PESTS IN ANNUAL SYSTEMS	II	642	21/08/00	10:35	HB	B	14	1	14
Wang, C. L.	1691	FIELD AUGMENTATION OF ORIUS STRIGICOLLIS FOR THE CONTROL OF INSECT PESTS	I	426	22/08/00	16:30	CC		8	PS	8
Wang, F. G.	739	PRELIMINARY STUDY ON THE BEHAVIOR OF SELECTING HOST OF LONGHORNED BEETLES AND THE ROLE OF THEIR SENSE ORGANS IN THIS PROCESS	I	187	25/08/00	16:30	CC		4	PS	4
Wang, H.	3026	SUCCESSFUL INTERRUPTED FEEDING OF ADULT RHIPICEPHALUS APPENDICULATUS (IXODIDEA) AND INTRA-STADIAL TICK-BORNE THOGOTO VIRUS (ORTHOMYXOVIRIDAE) TRANSMISSION	II	763	25/08/00	16:30	CC		15	PS	15
Wang, H. K.	813	INSECT MIGRATION AND POPULATION PROCESSES IN INLAND AUSTRALIA OBSERVED WITH MONITORING RADARS	I	206	24/08/00	10:25	HB	F	6	3	6
Wang, H. K.	813	INSECT MIGRATION AND POPULATION PROCESSES IN INLAND AUSTRALIA OBSERVED WITH MONITORING RADARS	I	206	24/08/00	10:25	HB	F	6	3	6
Wang, H. K.	744	AUTOMATICALLY OPERATING RADARS FOR MONITORING INSECT PEST MIGRATIONS	I	188	21/08/00	9:55	Bol	T	5	1	5
Wang, H. K.	794	REPRESENTATION AND DISSEMINATION OF MIGRATION DATA FROM AUTOMATIC INSECT-MONITORING RADARS	I	200	21/08/00	16:30	CC		5	PS	5
Wang, J.	2822	A STUDY ON LIRIMYZA SATIVAE	II	712	25/08/00	16:30	CC		14	PS	14
Wang, J. X.	3384	CATHEPSIN B-LIKE CYSTEINE PROTEINASE FROM HELICOVERPA ARMIGERA	II	854	25/08/00	16:30	CC		18	PS	18
Wang, K.	1464	USING GREENHOUSE ENVIRONMENT TO AUGMENT BIOLOGICAL CONTROL	I	369	24/08/00	13:35	HM	O	8	7	8
Wang, L.-W.	1692	PRELIMINARY OBSERVATIONS ON DIETARY SELF-SELECTION BY MANDUCA SEXTA: DO PARASITIZED LARVAE CHOOSE NOT TO CHOOSE?	I	426	25/08/00	16:30	CC		8	PS	8
Wang, L.-W.	2366	INTERACTIONS OF DIETARY PROTEIN AND BLOOD SUGAR LEVEL: EFFECTS ON LARVAL FEEDING BEHAVIOUR IN MANDUCA SEXTA	II	598	24/08/00	10:20	HB	I	13	6	13
Wang, P.	2389	MOLECULAR STRUCTURE OF THE PERITROPHIC MEMBRANE AND ITS IMPLICATION FOR INSECT CONTROL	II	604	26/08/00	10:35	HB	I	13	10	13
Wang, Q.	1693	RESOURCE PARTITIONING BY TWO ICHNEUMOND PARASITOID SPECIES (HYMENOPTERA) OF A LONGICORN PEST, OEMONA HIRTA (COLEOPTERA: CERAMBYCIDAE), IN NEW ZEALAND	I	427	25/08/00	16:30	CC		8	PS	8
Wang, Q.	3335	REPRODUCTIVE POTENTIAL AND RHYTHMS OF THE BLACK-LYRE LEAFROLLER CNEPHASIA JACTATANA (LEPIDOPTERA: TORTRICIDAE), AN IMPORTANT PEST OF KIWIFRUIT IN NEW ZEALAND	II	842	22/08/00	16:30	CC		18	PS	18
Wang, S. F.	3301	ECDYSTEROID-TRIGGERED REGULATORY HIERARCHIES IN INSECT REPRODUCTION	II	834	25/08/00	14:05	HB	K	18	7	18
Wang, W.	2222	INSECT TRANSGENESIS: BACULOVIRUSES MEET TRANSPOSONS FOR BENEFICIAL INVASIONS	I	561	25/08/00	16:05	HB	L	12	10	12
Wang, X.	2915	MALARIA PARASITE ENCAPSULATION GENES IN ANOPHELES GAMBIAE	II	736	24/08/00	14:05	Bol	R	15	8	15
Wang, Y.	2360	ACTIVATION OF PROPHENOLOXIDASE IN MANDUCA SEXTA	II	596	23/08/00	15:20	HB	I	13	5	13
Wang, Y.	2380	NEUROPEPTIDE CONTROL OF INSECT HINDGUT REABSORPTION: RECENT MOLECULAR ADVANCES	II	601	25/08/00	11:05	HB	I	13	8	13
Wang, Y.	356	GENETIC VARIATION AND GENE FLOW AMONG POPULATIONS OF THE COTTON BOLLWORM HELICOVERPA ARMIGERA (LEPIDOPTERA: NOCTUIDAE) IN CHINA	I	90	24/08/00	16:30	CC		2	PS	2
Wanner, K.	1929	AZADIRACHTIN FROM THE NEEM TREE: AN EFFECTIVE NATURAL PRODUCT FOR FOREST INSECT PEST MANAGEMENT	I	486	22/08/00	16:30	CC		10	PS	10
Wappner, P.	2484	EVIDENCE FOR A CATECHOL-*-ALANYL LIGASE IN INSECTS	II	627	24/08/00	16:30	CC		13	PS	13
Wappner, P.	2386	B-ALANYL DERIVATIVES IN CUTICLE AND NEURAL TISSUE	II	603	25/08/00	15:50	HB	I	13	9	13
Waquil, J. M.	2673	EFFECTS OF SORGHUM GENOTYPES RESISTANCE TO SCHIZAPHIS GRAMINUM ON CHRYSOPERLA EXTERNA FECUNDITY	II	675	22/08/00	16:30	CC		14	PS	14
Waquil, J. M.	1412	THE EFFECT OF AQUEOUS EXTRACT OF AZADIRACHTA INDICA LEAVES ON THE CONTROL OF SPODOPTERA FRUGIPERDA FED WITH CORN LEAVES	I	356	25/08/00	16:30	CC		7	PS	7
Ward, A.	751	SPATIAL ANALYSIS OF HELIOTHIS DISTRIBUTION AND ABUNDANCE FOR MEASURING THE EFFECTS OF MOTH MOVEMENT AT THE REGIONAL SCALE	I	190	21/08/00	14:10	Bol	T	5	1	5

Sub-titles: (HB=Hotel Bourbon) - (HM=Hotel Mabu) - (CC=Convention Center) - (Bol=Foz Boulevard) - (PS=Poster Session) - (PL=Plenary Lecturer)

AUTHOR	Nº	TITLE	Book	Page	Date	Time	Local	Room	Session	Symp	New Session
Ward, B. R.	652	THE SOUTHERN PINE BEETLE INTERNET CONTROL CENTER: AN INTERACTIVE INTEGRATED PEST MANAGEMENT WEB-SITE	I	165	24/08/00	16:30	CC		4	PS	4
Ward, N.	1257	THE UPTAKE OF BOTANICAL INSECTICIDES BY FARMERS: A CASE STUDY OF TOBACCO BASED PRODUCTS IN NIGERIA	I	317	24/08/00	11:20	HM	N	7	7	7
Ware, A. B.	2589	NON-TARGET EFFECTS OF PESTICIDES ON BENEFICIAL INSECTS	II	654	24/08/00	14:50	HB	B	14	7	14
Ware, A. B.	1461	AUGMENTATION OF PARASITOIDS FOR CONTROL OF CITRUS PESTS IN SOUTHERNFRICA	I	369	22/08/00	10:35	HM	O	8	3	8
Warner, D. J.	372	SPATIAL RELATIONSHIPS BETWEEN A PREDATOR AND PEST INFESTATION IN WINTER RAPE AND RELEVANCE TO INTEGRATED PEST MANAGEMENT STRATEGIES	I	94	25/08/00	16:30	CC		2	PS	2
Warnes, M.L.	4102	THE SEASONAL ABUNDANCE AND CONTROL OF CHRYSOMYA MEGACEPHALA INFESTING DRYING FISH IN SOUTH-WEST INDIA	II	1036	24/08/00	16:30	CC		23	PS	23
Warren, A. M.	2243	THE IDENTIFICATION OF TRANSPOSABLE ELEMENTS IN THE GENOME OF THE MALARIA VECTOR, ANOPHELES GAMBIAE	I	566	21/08/00	16:30	CC		12	PS	12
Wasano, N.	2332	OCCURRENCE OF TWO DELTA-ENDOTOXIN GENES, THE CRY9DA AND A NOVEL ALLIED GENE, IN JAPANESE BACILLUS THURINGIENSIS ENVIRONMENTAL ISOLATES THAT PRODUCE SPHERICAL PARASPORAL INCLUSIONS WITH LEPIDOPTERA-SPECIFIC TOXICITY	I	588	25/08/00	16:30	CC		12	PS	12
Washburn, J.	2521	MELANIZATION AND ENCAPSULATION IN HELICOVERPA ZEA LARVAE INFECTED WITH AUTOGRAPHA CALIFORNICA M NUCLEOPOLYHEDROVIRUS	II	637	25/08/00	16:30	CC		13	PS	13
Washio, H.	2531	GLUTAMATE RECEPTORS ON THE SOMATA OF DORSAL UNPAIRED MEDIAN NEURONS IN COCKROACH, PERIPLANETA AMERICANA, THORACIC GANGLIA.	II	639	25/08/00	16:30	CC		13	PS	13
Wasserthal, L. T.	3088	COMPARATIVE MORPHOLOGY OF THE SPIRACLES OF THE PAPILIONIDAE, SPHINGIDAE, AND SATURNIIDAE (INSECTA: LEPIDOPTERA)	II	779	25/08/00	15:05	HB	G	16	8	16
Watanabe, H.	2712	INTEGRATED PEST MANAGEMENT PROGRAM USING MATING DISRUPTOR IN JAPANESE PEAR ORCHARDS	II	685	22/08/00	16:30	CC		14	PS	14
Watanabe, H.	2161	PROTOZOAN AND ENDOGENOUS CELLULASES FROM TERMITES OF THE GENUS COPTOTERMES	I	545	25/08/00	16:30	CC		11	PS	11
Watanabe, H.	2504	THE GENOME ORGANIZATION OF BUCHNERA, AN INTRACELLULAR BACTERIAL SYMBIONT OF APHIDS	II	632	24/08/00	16:30	CC		13	PS	13
Watanabe, K.	2145	WOLBACHIA ARE DISTRIBUTED THROUGHOUT SOMATIC AND GENITAL ORGANS OF A MULBERRY LEAFHOPPER, HISHIMONOIDES SELLATIFORMIS	I	541	25/08/00	16:30	CC		11	PS	11
Watanabe, M.	2532	HORMONAL CONTROL OF PHYSIOLOGICAL TRAITS ASSOCIATED WITH DIAPAUSE AND COLD HARDINESS IN A LEAF BEETLE, AULACOPHORA NIGRIPENNIS	II	640	25/08/00	16:30	CC		13	PS	13
Watanabe, M.	4183	HORMONAL CONTROL OF PHYSIOLOGICAL TRAITS ASSOCIATED WITH DIAPAUSE AND COLD HARDINESS IN A LEAF BEETLE, AULACOPHORA NIGRIPENNIS	II	1055	21/08/00	16:30	CC		13	PS	13
Watanabe, M. A.	1207	COMPETITION BETWEEN TWO ARMORED SCALES FOR CITRUS LEAVES COLONIZATION	I	304	23/08/00	16:30	CC		6	PS	6
Watanabe, M. A.	2162	NUCLEOPOLYHEDROVIRUS SPECIFIC TO FALL ARMYWORM SPODOPTERA FRUGIPERDA	I	545	22/08/00	16:30	CC		11	PS	11
Watanabe, M. A.	2855	ARMORED SCALES POPULATION DYNAMICS IN SÃO PAULO STATE CITRUS REGION	II	721	21/08/00	16:30	CC		14	PS	14
Watanabe, T.	2600	PLANT ARCHITECTURE AND IPM: PROGRESS IN DEVELOPING 'VIRTUAL RICE'	II	657	25/08/00	14:00	HB	B	14	8	14
Watanabe, T.	2726	MODE OF ACTION AND CHARACTARISTICS OF A NOVEL INSECT PEST CONTROL AGENT, CHROMAFENOZIDE	II	688	23/08/00	16:30	CC		14	PS	14
Watanabe, T.	3961	INSECTICIDAL ACTIVITY OF A NOVEL INSECT PEST CONTROL AGENT, CHROMAFENOZIDE	II	1000	22/08/00	16:30	CC		22	PS	22
Watari, Y.	1808	THE DIFFERENCE OF ADULT ECLOSION RHYTHM BETWEEN DIAPAUSE AND NON-DIAPAUSE PUPAE IN THE ONION FLY, DELIA ANTIQUA	I	455	25/08/00	16:30	CC		9	PS	9
Watari, Y.	3312	MOLECULAR BIOLOGY OF INSECT CLOCKS FOR PHOTOPERIODISM	II	836	25/08/00	14:00	HB	K	18	8	18
Watson, E.	3915	ECOLOGICAL APPROACHES TO DETERMINING THE RISK OF MICROBIAL CONTROL AGENTS	II	988	25/08/00	13:30	HB	H	22	7	22
Watt, A. D.	1811	INSECTS IN THE TROPICAL LAND-USE MOSAIC – THE IMPACT OF AGRICULTURAL AND FOREST DEVELOPMENT	I	457	21/08/00	9:50	HB	M	10	1	10
Watt, A. D.	1867	ECOLOGY AND MANAGEMENT OF DEFOLIATING PESTS OF CONIFERS IN NORTHERN BRITAIN	I	471	25/08/00	9:35	HB	M	10	7	10
Watts, D.	2903	SPATIAL AND TEMPORAL HETEROGENEITY IN DENGUE VIRUS TRANSMISSION AND AEDES AEGYPTI POPULATION DENSITIES IN IQUITOS, PERU	II	733	23/08/00	14:35	Bol	R	15	6	15
Watts, D. M.	3000	BITING PATTERNS AND DEVELOPMENTAL SUBSTRATES FOR CULICOIDES PARAENSIS (DIPTERA; CERATOPOGONIDAE), THE VECTOR OF OROPOUCHE VIRUS, IN IQUITOS, PERU	II	757	24/08/00	16:30	CC		15	PS	15
Way, M. O.	2601	INTEGRATED RICE PEST MANAGEMENT IN THE SOUTHERN UNITED STATES	II	657	25/08/00	14:30	HB	B	14	8	14
Wayne, R.	3590	SPECIATION PROCESSES IN TWO SYMPATRIC CAVE-DWELLING TRECHUS FROM PICO ISLAND, AZORES	II	906	25/08/00	13:30	Bol	U	20	3	20
Weisio, W. T.	3490	FORAGING SUCCESS AND INDIVIDUAL LEARNING OF ORIENTATION AND TIMING IN ECTATOMMA RUIDUM (FORMICIDAE: PONERINAE)	II	881	22/08/00	16:30	CC		19	PS	19
Weatherston, I.	618	REGULATORY ISSUES IN THE COMMERCIAL DEVELOPMENT OF PHEROMONES AND OTHER SEMIOCHEMICALS – GLOBAL ASPECTS	I	156	24/08/00	16:00	Bol	S	4	6	4
Weaver, D. K.	799	ASPECTS OF THE ECOLOGY OF THE WHEAT STEM SAWFLY (HYMENOPTERA: CEPHIDAE) IN NORTH AMERICA	I	202	21/08/00	10:05	HB	D	6	1	6
Weaver, D. K.	800	ACOUSTIC DETECTION AND MONITORING OF CEPHUS CINCTUS SAWFLY LARVAE IN WHEAT STEMS	I	202	21/08/00	10:20	HB	D	6	1	6
Weaver, D. K.	4016	ENHANCING THE BIOCONTROL OF BRUCHIDS INFESTING STORED LEGUMES THROUGH THE COMBINED APPLICATION OF A PREDATORY BUG AND LARVAL PARASITOIDS	II	1014	22/08/00	10:00	HB	J	23	3	23
Weaver, D. K.	801	IMPACT OF CULTURAL PRACTICES ON POPULATIONS OF THE WHEAT STEM SAWFLY (HYMENOPTERA: CEPHIDAE) AND ITS ASSOCIATED PARASITOIDS	I	203	21/08/00	10:35	HB	D	6	1	6
Webb, B. A.	2373	CHARACTERIZATION AND MODE OF ACTION OF A BIOLOGICALLY ACTIVE PROTEIN SECRETED BY TERATOCYTES	II	599	24/08/00	14:35	HB	I	13	7	13
Webber, J.	3245	INSECT TRANSMISSION OF A VASCULAR WILT OF A TROPICAL HARDWOOD IN THE SEYCHELLES	II	819	25/08/00	16:30	CC		17	PS	17
Weber, L. F.	1362	SELECTIVITY OF GROWTH REGULATORS, PHOSPHORATES AND PYRETROIDS UPON NATURAL ENEMIES OF PESTS ON SOYBEAN CROP	I	344	23/08/00	16:30	CC		7	PS	7
Weber, L. F.	170	AGRONOMIC EFFICIENCY OF INSECTICIDES AT DIFFERENT RATES TO THE CONTROL OF APHIS GOSSYPII IN COTTON CROP	I	44	21/08/00	16:30	CC		2	PS	2
Weber, L. F.	174	EFFICIENCY OF INSECTICIDES IN THE CONTROL OF THRIPS, FRANKLINIELLA SCHULZEI, IN COTTON CROP	I	45	22/08/00	16:30	CC		2	PS	2
Weber, T.	1741	EVOLUTION OF ULTRASONIC SIGNALING IN LEPIDOPTERA: DISCRIMINATION OF MATING CALLS FROM BAT ECHOLOCATION SIGNALS AND THE EXPLOITATION OF ANTI-PREDATOR RECEIVER BIAS BY SEXUAL ADVERTISEMENT	I	439	23/08/00	11:00	HB	F	9	3	9
Wechakit, D.	2650	INSECTICIDE SPRAYING TECHNIQUES FOR CONTROLLING THE DIAMOND BACK MOTH, PLUTELLA XYLOSTELLA ON CHINESE KALE	II	669	21/08/00	16:30	CC		14	PS	14
Wedell, N.	1716	MONANDRY AND POLYANDRY AS ALTERNATIVE LIFESTYLES IN A BUTTERFLY	I	432	21/08/00	14:50	HB	F	9	1	9
Wei, W.	2145	WOLBACHIA ARE DISTRIBUTED THROUGHOUT SOMATIC AND GENITAL ORGANS OF A MULBERRY LEAFHOPPER, HISHIMONOIDES SELLATIFORMIS	I	541	25/08/00	16:30	CC		11	PS	11
Wei, Y. S.	3382	COMPARATIVE STUDY OF PHASE RESPONSE CURVES BETWEEN TWO CLOSE-RELATED COCKROACHES	II	854	25/08/00	16:30	CC		18	PS	18

Sub-titles: (HB=Hotel Bourbon) - (HM=Hotel Mabu) - (CC=Convention Center) - (Bol=Foz Boulevard) - (PS=Poster Session) - (PL=Plenary Lecturer)

AUTHOR	Nº	TITLE	Book	Page	Date	Time	Local	Room	Session	Symp	New Session
Wei, Z.	3258	NEUROPEPTIDES IN LOCUSTS: PROGRESS IN THE SEARCH FOR FUNCTIONS	II	823	21/08/00	15:00	HB	K	18	1	18
Weiblen, G. D.	570	INSECT HERBIVORES AS PREDICTORS OF PLANT PHYLOGENY: EXAMPLES FROM NEW GUINEA FICUS	I	144	25/08/00	16:30	CC		3	PS	3
Weideman, H. J.	645	SIRENE® 6.0 GS: ATTRACT AND KILL, A NOVEL WAY TO CONTROL CODLING MOTH WITH AN AGE OLD VICE	I	163	21/08/00	16:30	CC		4	PS	4
Weinhold, C.	1208	INVESTIGATIONS INTO CARABIDES AT TYPICAL HABITATS OF THE NATURE RESERVE AND WINE GROWING REGION „SÜßER SEE", SACHSEN-ANHALT, GERMANY	I	304	25/08/00	16:30	CC		6	PS	6
Weinhold, C.	3597	INVESTIGATIONS OF THE BUTTERFLY FAUNA (LEPIDOPTERA, RHOPALOCERA, ZYGAENOIDAE) AROUND A DISUSED BROWN COAL MINE NEAR GRÄFENHAINICHEN (GERMANY, SACHSEN-ANHALT)	II	908	22/08/00	16:30	CC		20	PS	20
Weinlich, R.	2249	PHYLOGENETIC RELATIONSHIP AMONG STINGLESS BEE SPECIES INFERRED BY MITOCHONDRIAL DNA RESTRICTION FRAGMENT LENGTH POLYMORPHISM	I	568	21/08/00	16:30	CC		12	PS	12
Weintraub, P.	3904	PNEUMATIC CONTROL OF INSECTS IN PLANT PROTECTION	II	985	24/08/00	10:35	HB	H	22	6	22
Weintraub, P. G.	1277	PROGRESSIVE INSECTICIDE RESISTANCE MANAGEMENT PROGRAMS IN THE ISRAELI AGRICULTURAL ECOSYSTEM	I	322	25/08/00	14:20	HM	N	7	10	7
Weintraub, P.G	3230	HYTOPLASMA-BEARING LEAFHOPPERS/PLANTHOPPERS, SUSPECTED TO BE VECTORS, IN VINEYARDS IN THE GOLAN HEIGHTS, ISRAEL	II	815	23/08/00	16:30	CC		17	PS	17
Weir, K. M.	226	BIO-CONTROL FOR NEW PESTS INVASIONS IN CALIFORNIA VINEYARDS: OBSCURE MEALYBUG AS A CASE EXAMPLE	I	58	22/08/00	16:30	CC		2	PS	2
Weir, K. M.	2661	BIO-CONTROL FOR NEW PESTS INVASIONS IN CALIFORNIA VINEYARDS: OBSCURE MEALYBUG AS A CASE EXAMPLE	II	672	22/08/00	16:30	CC		14	PS	14
Weirauch, C.	3860	ON THE GROUNDPATTERN OF THE REDUVIIDAE (HEMIPTERA, HETEROPTERA)	II	974	25/08/00	16:30	CC		21	PS	21
Weiss, S.	1998	BACULOVIRUS PRODUCTION IN VITRO – RECENT DEVELOPMENTS	I	504	22/08/00	9:05	HM	P	11	3	11
Weißbecker, B.	2499	INSECT ANTENNAE AS BIOSENSORS	II	631	24/08/00	16:30	CC		13	PS	13
Weißbecker, B.	3054	INSECT ANTENNAE AS A BASIS OF EARLY WARNING SYSTEMS IN AGRICULTURE AND INDUSTRY	II	771	22/08/00	16:05	HB	G	16	3	16
Weller, S. J.	3643	THE INTERPLAY OF MORPHOLOGICAL AND MOLECULAR PHYLOGENETIC STUDIES IN THE NOCTUOIDEA	II	920	22/08/00	16:05	HB	E	21	4	21
Weller, S. J.	3696	PHYLOGENY OF ARCTIIDAE (LEPIDOPTERA: NOCTUOIDEA) BASED ON IMMATURE STAGES AND ADULT MORPHOLOGY	II	933	26/08/00	10:50	HB	E	21	9	21
Wells, J. D.	2949	DNA-BASED DIAGNOSTIC TESTS FOR FORENSIC ENTOMOLOGISTS	II	744	26/08/00	13:45	Bol	R	15	11	15
Wells, M. A.	2403	METABOLIC PATHWAYS FOR DIACYLGLYCEROL BIOSYNTHESIS AND RELEASE IN THE MIDGUT OF LARVAL MANDUCA SEXTAL	II	607	21/08/00	16:30	CC		13	PS	13
Wells, M. A.	2404	RELEASE OF DIACYLGLYCEROL FROM THE LARVAL MIDGUT OF MANDUCA SEXTA: IN VITRO ROLE OF THE LIPID TRANSFER PARTICLE	II	607	21/08/00	16:30	CC		13	PS	13
Wells, M. A.	2294	A MOLECULAR VIEW OF TRYPSIN SYNTHESIS IN AEDES AEGYPTI	I	579	24/08/00	16:30	CC		12	PS	12
Wells, M. A.	2497	TRIACYLGLYCEROL LIPASE FROM THE MIDGUT OF LARVAL MANDUCA SEXTA: PROPERTIES AND PARTIAL CHARACTERIZATION	II	631	24/08/00	16:30	CC		13	PS	13
Wells, M. A.	2972	VECTOR-TRYPANOSOMA CRUZI RELATIONSHIP: CHANGES IN THE HEMOLYMPHATIC PROTEIN COMPOSITION OF DIPETALOGASTER MAXIMUS AFTER EXPERIMENTAL INFECTION	II	750	21/08/00	16:30	CC		15	PS	15
Wells, M. A.	2477	REGULATION OF JH LEVELS IN MOSQUITOES	II	626	23/08/00	16:30	CC		13	PS	13
Welter, S. C.	2539	AREAWIDE MANAGEMENT OF LEPIDOPTEROUS PESTS IN PERENNIAL CROPPING SYSTEMS: OPPORTUNITIES AND CONSTRAINTS	II	642	21/08/00	9:35	HB	B	14	1	14
Welter, S. C.	1476	HOST ACCESSIBILITY IMPACTS ON BIOLOGICAL CONTROL OF LYGUS HESPERUS WITH ANAPHES IOLE: THE STRAWBERRY EXPERIENCE	I	372	26/08/00	11:35	HM	O	8	8	8
Welter, S. C.	2542	RESISTANCE MANAGEMENT ON AN AREAWIDE BASIS IN ANNUAL VERSUS PERENNIAL CROPPING SYSTEMS	II	642	21/08/00	11:05	HB	B	14	1	14
Wendt, J. G. N.	3383	BIOLOGY OF URBANUS ESMERALDUS (LEPIDOPTERA: HESPERIIDAE) IN CENTROSEMA PUBESCENS, CLITORIA FAIRCHILDIANA, GALACTIA STRIATA AND ALTERNATE FEEDING	II	854	25/08/00	16:30	CC		18	PS	18
Wendt, J. G. N.	1049	DETERMINATION OF THE INFLUENCE OF THE MATURITY OF THE LEAVES OF CLITORIA FAIRCHILDIANA IN THE DEVELOPMENT OF URBANUS ACAWOIOS (LEPIDOPTERA: HESPERIIDAE)	I	265	23/08/00	16:30	CC		6	PS	6
Wendt, J. G. N.	1907	OCCURRENCE AND DAMAGES CAUSED FOR ONCIDERES SAGA (COLEOPTERA: CERAMBYCIDAE) IN ARBORIZATION	I	481	21/08/00	16:30	CC		10	PS	10
Wendt, J. G. N.	2055	EVALUATION OF THE EFFICIENCY OF BACILLUS THURINGIENSIS IN THE CONTROL OF URBANUS ACAWOIOS (LEPIDOPTERA: HESPERIIDAE)	I	518	21/08/00	16:30	CC		11	PS	11
Wendt, J. G. N.	3359	BIOLOGY OF URBANUS ACAWOIOS (LEPIDOPTERA, HESPERIIDAE) IN LABORATORY	II	848	23/08/00	16:30	CC		18	PS	18
Wendt, J. G. N.	1964	OCCURRENCE OF WOOD BORING BEETLES IN THE NATIONAL FOREST MÁRIO XAVIER, RJ, BRASIL	I	495	21/08/00	16:30	CC		10	PS	10
Wendt, J. G. N.	1809	LEAF AREA CONSUMPTION OF URBANUS ESMERALDUS (LEPIDOPTERA: HESPERIIDAE) IN CENTROSEMA PUBESCENS, CLITORIA FAIRCHILDIANA AND ALTERNATE FEEDING	I	456	21/08/00	16:30	CC		9	PS	9
Wengorek, P.	1283	DEVELOPMENT OF A RESISTANCE MANAGEMENT STRATEGY FOR COLORADO BEETLE IN POLAND: A SUCCESSFUL IRAC-SPONSORED PROJECT	I	324	25/08/00	15:50	HM	N	7	10	7
Wenz, J. M.	614	PHEROMONE TECHNOLOGIES FOR MANAGING DOUGLAS-FIR TUSSOCK MOTH IN WESTERN NORTH AMERICA	I	155	24/08/00	14:00	Bol	S	4	6	4
Wepukhulu, S. B.	2825	SURVEY OF PRACTICES AND PERCEPTIONS OF SMALL HOLDER FARMERS RELATING TO PEST MANAGEMENT ON VEGETABLE CROPS IN EASTERN AFRICA	II	713	23/08/00	16:30	CC		14	PS	14
Wertheim, B.	1209	WHY DO DROSOPHILIDS PRODUCE AGGREGATION PHEROMONES WHEN IT GUIDES PARASITOIDS TO THEIR OFFSPRING?	I	305	25/08/00	16:30	CC		6	PS	6
Wesemael, W.	1403	SIGNIFICANCE OF UPTAKE AND BINDING IN LEPIDOPTERA AND COLEOPTERA ON TOXICITY OF DIBENZOYLHYDRAZINE ECDYSONE AGONISTS	I	354	25/08/00	16:30	CC		7	PS	7
Weslien, J.	2163	BIOLOGICAL CONTROL OF SPRUCE CONE INSECTS USING BACILLUS THURINGIENSIS	I	545	25/08/00	16:30	CC		11	PS	11
West, R.	1929	AZADIRACHTIN FROM THE NEEM TREE: AN EFFECTIVE NATURAL PRODUCT FOR FOREST INSECT PEST MANAGEMENT	I	486	22/08/00	16:30	CC		10	PS	10
West-Eberhard, M. J.	2186	HORMONAL LINKS BETWEEN GENES AND PHENOTYPES IN SOCIAL WASPS	I	552	22/08/00	15:15	HB	L	12	4	12
Westendorf, L.	3152	ANALYSIS OF HUNCHBACK IN NASONIA VITRIPENNIS	II	795	23/08/00	16:30	CC		16	PS	16
Wetcholowsky, I.	1414	THIACLOPRID - FIRST EXPERIENCES WITH THE NOVEL INSECTICIDE IN BRAZIL	I	357	25/08/00	16:30	CC		7	PS	7
Wettach, G. R.	1585	EFFECTS OF LARVAL DENSITY AND PREDATION BY TOXORHYNCHITES AMBOINENSIS (DIPTERA; CULICIDAE) UPON AEDES POLYNESIENSIS PRODUCTION	I	400	23/08/00	16:30	CC		8	PS	8
Wetzel, Th.	3999	ECOLOGICAL STUDIES ACCOMPANYING THE CULTIVATION OF TRANSGENIC RAPE AND MAIZE IN THURINGIA (GERMANY)	II	1009	25/08/00	16:30	CC		22	PS	22
Wharton, R.	1615	HYMENOPTERAN PARASITOIDS ON FRUIT - INFESTING TEPHRITIDAE (DIPTERA) IN LATIN AMERICA AND THE SOUTHERN UNITED STATES: DIVERSITY, DISTRIBUTION, TAXONOMIC STATUS AND THEIR USE IN FRUIT FLY BIOLOGICAL CONTROL	I	407	24/08/00	16:30	CC		8	PS	8
Wharton, R.	1661	FRUIT FLY BIOLOGICAL CONTROL IN LATIN AMERICA: MINIMIZING THE RISKS POSED BY TEPHRITIDAE IN MEXICO AND CENTRAL AMERICA	I	419	25/08/00	16:30	CC		8	PS	8
Wheeler, D. E.	2333	GENE EXPRESSION AND THE EVOLUTION OF INSECT POLYPHENISMS: INTRODUCTION	I	589	25/08/00	16:30	CC		12	PS	12
Wheeler, D. E.	2182	THE EVOLUTION OF ADAPTIVE POLYPHENISMS	I	551	22/08/00	13:35	HB	L	12	4	12

Sub-titles: (HB=Hotel Bourbon) - (HM=Hotel Mabu) - (CC=Convention Center) - (Bol=Foz Boulevard) - (PS=Poster Session) - (PL=Plenary Lecturer)

AUTHOR	Nº	TITLE	Book	Page	Date	Time	Local	Room	Session	Symp	New Session
Wheeler, T. A.	3861	RESOLVING HIGHER RELATIONSHIPS OF ACALYPTRATE DIPTERA: A STRATEGY FOR PROGRESS	II	974	25/08/00	16:30	CC		21	PS	21
Wheeler, W. C.	3630	FAMILY-GROUP RELATIONSHIPS WITHIN THE CIMICOMORPHA BASED ON DNA SEQUENCES AND MORPHOLOGY	II	917	22/08/00	10:20	HB	E	21	3	21
White, B.	1834	AN IPM APPROACH TO PREVENT THE ACCIDENTAL IMPORTATION OF SUBCORTICAL INSECTS FROM CHILE TO THE UNIDET STATES	I	462	22/08/00	14:35	HB	M	10	3	10
White, B. R.	2856	AN IPM APPROACH TO PREVENTION OF POTENTIAL PESTS THAT MIGHT BE IMPORTED TO THE UNITED STATES ON CHILEAN LOGS: PART I, EFFECTIVENESS OF METHYL BROMIDE ALTERNATIVES	II	721	24/08/00	16:30	CC		14	PS	14
White, B. R.	373	EFFECTIVENESS OF METHYL BROMIDE ALTERNATIVES AGAINST POTENTIAL PESTS TO BE IMPORTED TO THE UNITED STATES FROM CHILE	I	94	25/08/00	16:30	CC		2	PS	2
White, K. A. J.	2164	COPING WITH CROWDS: THE EVOLUTION OF DENSITY-DEPENDENT RESISTANCE TO PATHOGENS	I	546	25/08/00	16:30	CC		11	PS	11
White, N.	2876	VULNERABILITY OF LIVESTOCK TO ARTHROPOD PARASITES AND VECTOR-BORNE DISEASES UNDER GLOBAL CHANGE	II	726	21/08/00	14:05	Bol	R	15	2	15
White, N. D. G.	4041	CANADIAN GRAIN STORAGE CD-ROM	II	1020	23/08/00	15:30	HB	J	23	7	23
Whiting, M. F.	3680	PHYLOGENY OF THE HOLOMETABOLOUS INSECT ORDERS: STATE OF THE MOLECULES	II	929	25/08/00	13:50	HB	E	21	8	21
Whiting, M. F.	3850	DRUMMING, SKIMMING, AND EVOLUTION OF FLIGHT: A NEW PHYLOGENY OF PLECOPTERA	II	972	25/08/00	16:30	CC		21	PS	21
Whitman, D. W.	1694	MASSIVE PARASITISM OF GRASSHOPPERS BY TACHINID MAGGOTS	I	427	25/08/00	16:30	CC		8	PS	8
Whitman, D. W.	624	IDENTIFICATION OF CHEMICAL DEFENSE SECRETION OF A DUNG BEETLE	I	158	21/08/00	16:30	CC		4	PS	4
Whitman, D. W.	678	CHEMICAL DEFENSE IN THE PLANT BUG LOPIDEA ROBINIAE	I	171	23/08/00	16:30	CC		4	PS	4
Whitman, D. W.	1142	A SURVEY OF FECAL FIRING AND HOUSECLEANING IN LEPIDOPTERAN CATERPILLARS	I	288	24/08/00	16:30	CC		6	PS	6
Whittaker, J. B.	425	INSECTS AS INDICATORS OF SUBTLE, CLIMATE-INDUCED HABITAT FRAGMENTATION	I	108	24/08/00	11:20	HB	C	3	5	3
Whitworth, R. J.	374	CORN ROOTWORM AREAWIDE MANAGEMENT IN KANSAS	I	95	25/08/00	16:30	CC		2	PS	2
Wichterman, G.	2930	THE UNITED STATES FOOD QUALITY AND PROTECTION ACT; PUBLIC HEALTH PESTICIDE ACT	II	739	25/08/00	13:45	Bol	R	15	10	15
Wicky, S.	583	SENSORY AND BEHAVIOURAL RESPONSES OF TRIATOMINE BUGS TO ODOURS OF VERTEBRATE HOSTS AND TO CONSPECIFIC SEMIOCHEMICALS	I	148	22/08/00	10:05	Bol	S	4	2	4
Widenfalk, O.	1210	GALL MIDGE - PARASITOID DYNAMICS AT THE LANDSCAPE SCALE - EFFECTS OF DISTURBANCE AND PROLONGED DIAPAUSE	I	305	25/08/00	16:30	CC		6	PS	6
Widmer, A.	2	COLD RECEPTORS ON THE BODY SURFACE OF THE TROPICAL BONT TICK AMBLYOMMA VARIEGATUM	I	1	24/08/00	14:05	HB	F	1	1	1
Wiecheteck, H.	178	EFFICIENCY OF THE FORMULATIONS 50 CS AND 250 CS OF THE PYRETHROID LAMBDA-CYALOTHRIN IN THE CONTROL OF DIABROTICA SPECIOSA IN BEAN CROP	I	46	21/08/00	16:30	CC		2	PS	2
Wiedenmann, R. N.	1481	PHYSIOLOGICAL FACTORS DETERMINING SUITABILITY OF BRACONID ENDOPARASITOIDS (COTESIA FLAVIPES COMPLEX) FOR DEVELOPMENT IN NOVEL-ASSOCIATION LEPIDOPTERAN STEMBORERS (DIATRAEA SPECIES AND OSTRINIA NUBILALIS)	I	374	21/08/00	16:30	CC		8	PS	8
Wiegmann, B. M.	3687	MOLECULAR EVIDENCE FOR THE BASAL RADIATION OF THE LEPIDOPTERA	II	931	25/08/00	15:35	HB	E	21	8	21
Wiegmann, B. M.	3700	MOLECULAR PHYLOGENETIC ANALYSIS OF THE BRACHYCERA (DIPTERA)	II	934	25/08/00	16:50	HB	E	21	8	21
Wiesner, P.	1224	MODE OF ACTION OF THIAMETHOXAM, A NOVEL LIGAND OF NICOTINIC ACETYLCHOLINE RECEPTORS – A COMPARATIVE STUDY OF NEONICOTINOIDS AND INSECTS	I	309	21/08/00	10:35	HM	N	7	1	7
Wigand, B.	3076	PROXIMAL-DISTAL PATTERNING IN TRIBOLIUM CASTANEUM, AN INSECT WITH EMBRYONIC LIMB FORMATION	II	776	24/08/00	15:30	HB	G	16	6	16
Wiklund, C.	898	A FIVE YEAR STUDY OF MATING FREQUENCIES AND SIZE VARIATIONS IN WILD POPULATIONS OF THE GREEN-VEINED WHITE BUTTERFLY PIERIS NAPI	I	227	21/08/00	16:30	CC		6	PS	6
Wilcken, C. F.	1099	BIOLOGY OF THYRINTEINA ARNOBIA (LEPIDOPTERA: GEOMETRIDAE) ON THREE SPECIES OF EUCALYPTUS	I	277	24/08/00	16:30	CC		6	PS	6
Wilcken, C. F.	1949	CONSUMPTION AND UTILIZATION OF THREE SPECIES OF EUCALYPTUS BY THYRINTEINA ARNOBIA (LEPIDOPTERA: GEOMETRIDAE)	I	491	23/08/00	16:30	CC		10	PS	10
Wilcken, C. F.	1831	STRATEGIES TO MANAGE TERMITES IN EUCALYPTUS PLANTATIONS IN BRAZIL	I	462	22/08/00	11:50	HB	M	10	2	10
Wilcken, C. F.	1948	EFFICIENCY OF DIFFERENT INSECTICIDES IN CONTROL OF NURSERY FLY SCYTHROPOCHROA SP. (DIPTERA: SCIARIDAE) IN EUCALYPTUS SEEDLINGS	I	491	23/08/00	16:30	CC		10	PS	10
Wilcken, C. F.	1979	EVALUATION OF THIAMETHOXAM ON COSTALIMAITA FERRUGINEA (COLEOPTERA: CHRYSOMELIDAE) CONTROL IN EUCALYPTUS PLANTATIONS	I	499	25/08/00	16:30	CC		10	PS	10
Wilcken, C. F.	1980	EVALUATION OF TWO TRAP CARDS TO MONITORING OF SCYTHROPOCHROA SP. (DIPTERA: SCIARIDAE) IN EUCALYPTUS SEEDLINGS NURSERY	I	499	25/08/00	16:30	CC		10	PS	10
Wilcken, C. F.	3402	TERMITE PESTS IN EUCALYPTUS FORESTS OF BRAZIL	II	859	21/08/00	15:30	HM	Q	19	1	19
Wilcken, C. F.	2110	SUSCEPTIBILITY OF IMMATURE STAGES OF THYRINTEINA ARNOBIA (LEPIDOPTERA: GEOMETRIDAE) TO A POSSIBLE PICORNAVIRUS	I	532	23/08/00	16:30	CC		11	PS	11
Wilcox, W. F.	2581	INTERACTIONS BETWEEN MITES AND PLANT PATHOGENS AND IMPLICATIONS FOR BIOLOGICAL CONTROL IN GRAPES	II	652	24/08/00	10:35	HB	B	14	6	14
Wilde, G. E.	374	CORN ROOTWORM AREAWIDE MANAGEMENT IN KANSAS	I	95	25/08/00	16:30	CC		2	PS	2
Wildemann, B.	2348	NITRIC OXIDE: AN UNCONVENTIONAL TRANSMITTER IN INSECT NERVOUS SYSTEMS	II	593	22/08/00	10:20	HB	I	13	3	13
Wildey, K.	2912	ASSESSING RISKS ASSOCIATED WITH FOOD-CONTAMINATING INSECTS AND MITES	II	735	24/08/00	11:05	Bol	R	15	7	15
Wileyto, E. P.	4019	BIOLOGICAL CONTROL OF STORED GRAIN INSECTS DEMONSTRATED BY TIME-SERIES ANALYSIS	II	1015	22/08/00	10:45	HB	J	23	3	23
Wilhelm, E.	3541	DEFINING THE NATURE OF COOPERATION IN THE BARELY EUSOCIAL SWEAT BEE, HALICTUS SEXCINCTUS, IN SOUTHERN GREECE	II	893	24/08/00	16:30	CC		19	PS	19
Wilk, F. van der	3212	CHAPERONIN CAMOUFLAGE: AN INTRIGUING PHENOMENON IN THE TRANSMISSION OF LUTEOVIRUSES BY APHIDS	II	811	22/08/00	14:00	Bol	U	17	2	17
Wilkerson, R. C.	2977	EMERGENCE OF A NEW NEOTROPICAL MALARIA VECTOR FACILITATED BY HUMAN MIGRATION AND CHANGES IN LAND USE	II	751	22/08/00	16:30	CC		15	PS	15
Wilkinson, S.	1717	MEIOTIC DRIVE, SPERM COMPETITION AND THE EVOLUTION OF MULTIPLE MATING BY FEMALE STALK-EYED FLIES (DIOPSIDAE)	I	433	21/08/00	15:10	HB	F	9	1	9
Willat, G.	4088	INVASION OF AEDES AEGYPTI (DIPTERA: CULICIDAE) IN URUGUAY	II	1032	23/08/00	16:30	CC		23	PS	23
William Eberhard	IX	An updated review of evidence on sexual selection and the evolution of insect genitalia	I	XXX IX	23/08/00	8:00	HM			PL	
William H Settle	X	The role of small-scale farmers in strengthening the linkage between biodiversity and sustainable agriculture; One view on tropical rice and vegetable production in Asia	I	XLI	24/08/00	8:00	HB			PL	
Williams III, L. H.	1151	HOST RECOGNITION IN XIPHYDRIID WOODWASPS.	I	290	24/08/00	16:30	CC		6	PS	6
Williams III, L. H.	3862	A NEW SPECIES OF LEIOPHRON (HYMENOPTERA: BRACONIDAE) FROM ARGENTINA	II	975	25/08/00	16:30	CC		21	PS	21
Williams III, L. H.	903	A COMPARATIVE ANALYSIS OF THE FLIGHT BEHAVIOR OF LYGUS HESPERUS AND LYGUS LINEOLARIS (HEMIPTERA: MIRIDAE)	I	228	24/08/00	11:15	HB	F	6	3	6
Williams, C. J.	1270	INDOXACARB: ATTRIBUTES THAT IMPACT FIELD PERFORMANCE AND CONTRIBUTE TO CONSERVATION OF BENEFICIALS	I	321	25/08/00	10:20	HM	N	7	9	7
Williams, D. F.	2006	INTRODUCTION OF A PROTOZOAN FOR CONTROL OF IMPORTED FIRE ANTS IN THE USA	I	506	22/08/00	15:05	HM	P	11	4	11

Sub-titles: (HB=Hotel Bourbon) - (HM=Hotel Mabu) - (CC=Convention Center) - (Bol=Foz Boulevard) - (PS=Poster Session) - (PL=Plenary Lecturer)

AUTHOR	Nº	TITLE	Book	Page	Date	Time	Local	Room	Session	Symp	New Session
Williams, D. F.	3414	THE MICROSPORIDIUM VAIRIMORPHA INVICTAE (MICROSPORIDA: BURENELLIDAE), A POTENTIAL CANDIDATE FOR THE BIOLOGICAL CONTROL OF THE IMPORTED FIRE ANTS IN THE UNITED STATES	II	862	22/08/00	11:50	HM	Q	19	2	19
Williams, D. F.	3408	THE MANAGEMENT OF UNDESIRABLE ANTS IN THE URBAN ENVIRONMENT	II	860	22/08/00	10:35	HM	Q	19	2	19
Williams, G. T.	2990	MALARIA AND MOSQUITOES: PARASITE-INDUCED APOPTOSIS REDUCES VECTOR REPRODUCTIVE FITNESS AND MAY ENHANCE TRANSMISSION	II	754	23/08/00	16:30	CC		15	PS	15
Williams, H.	2345	MIMETIC INSECTATACHYKININ ANALOGS: INTERACTION WITH AN EXPRESSED STABLE FLY TACHYKININ-LIKE RECEPTOR AND ACTIVE CONFORMATION	II	592	21/08/00	15:05	HB	I	13	2	13
Williams, H. J.	1457	EGG PARASITOIDS ATTACKING HOMOLOGOUS HOSTS: EQUIVALENCES AND DIFFERENCES BETWEEN TWO ALLOPATRIC CABBAGE BUGS	I	368	23/08/00	15:35	HM	O	8	6	8
Williams, I. H.	372	SPATIAL RELATIONSHIPS BETWEEN A PREDATOR AND PEST INFESTATION IN WINTER RAPE AND RELEVANCE TO INTEGRATED PEST MANAGEMENT STRATEGIES	I	94	25/08/00	16:30	CC		2	PS	2
Williams, M.	840	PLANT QUALITY AND TROPHIC CASCADES: THE EFFECTS OF PLANT STRESS AND VIGOR ON INSECT ASSEMBLAGES	I	212	23/08/00	14:45	HB	D	6	5	6
Williams, M. A.	1211	PLANT QUALITY AND THE ORGANIZATION OF CYNIPID GALL WASP COMMUNITIES	I	305	25/08/00	16:30	CC		6	PS	6
Williams, M. A.	2766	POSTHARVEST CONTROL OF CODLING MOTH: CHALLENGES AND RECENT ADVANCES	II	698	24/08/00	16:30	CC		14	PS	14
Williams, M. A.	2554	POSTHARVEST CONTROL OF CODLING MOTH: CHALLENGES AND RECENT ADVANCES	II	645	21/08/00	16:20	HB	B	14	2	14
Williams, M. A.	3927	GENERIC TREATMENTS: RESEARCH PANACEA OR PIPE DREAM?	II	991	26/08/00	10:30	HB	H	22	8	22
Williams, M. L.	571	BIODIVERSITY IN THE SOFT SCALE INSECTS OF CENTRAL AMERICA	I	144	25/08/00	16:30	CC		3	PS	3
Williams, M. L.	3791	A PHYLOGENETIC ANALYSIS OF BRAZILIAN SOFT SCALE INSECTS	II	957	23/08/00	16:30	CC		21	PS	21
Williams, P.	381	MODELLING DISTRIBUTIONS AND MAKING COMPARISONS: CAN WE PREDICT RELATIVE GAPS IN OUR KNOWLEDGE OF INSECT BIODIVERSITY MORE ACCURATELY?	I	97	21/08/00	11:50	HB	C	3	1	3
Williams, R.	3914	RISK ASSESSMENT PROCEDURES FOR BIOCONTROL INTRODUCTIONS IN SOUTHERN SOUTH AMERICA AND A PROTOCOL FOR PREDICTING PARASITOID POST - INTRODUCTION HOST RANGE	II	988	25/08/00	11:00	HB	H	22	7	22
Williams, R. N.	2857	INTEGRATED PEST MANAGEMENT (IPM) OF GRAPES IN OHIO	II	721	25/08/00	16:30	CC		14	PS	14
Williamson, M. S.	1228	MOLECULAR STUDIES OF INSECT ACETYLCHOLINESTERASE: IS THERE NEW LIFE IN AN OLD TARGET?	I	310	21/08/00	14:05	HM	N	7	2	7
Willink, E.	368	FRUIT FLY (DIPTERA:TEPHRITIDAE) QUARANTINE PROCEDURES FOR EXPORT OF AVOCADOS FROM ARGENTINA TO CHILE	I	93	25/08/00	16:30	CC		2	PS	2
Willink, E.	1000	COMPARISON OF SENSITIVITY TO COLD IN SOUTH AMERICAN FRUIT FLY AND MEDFLY (DIPTERA: TEPHRITIDAE)	I	252	22/08/00	16:30	CC		6	PS	6
Willink, E.	1025	LIFE TABLE AND DEMOGRAPHIC PARAMETERS OF THE SOUTH AMERICAN FRUIT FLY (DIPTERA: TEPHRITIDAE)	I	259	23/08/00	16:30	CC		6	PS	6
Willink, E.	1700	BIOLOGICAL CONTROL OF THE CITRUS LEAFMINER (LEPIDOPTERA: GRACILLARIIDAE) IN NORTHWEST ARGENTINA	I	428	21/08/00	16:30	CC		8	PS	8
Willis, J. H.	3290	IS JUVENILE HORMONE THE METAMORPHIC HORMONE OF INSECTS?	II	831	23/08/00	16:05	HB	K	18	5	18
Wills, T. E.	1041	SOCIAL EVOLUTION IN THRIPS: LACK OF REPRODUCTIVE SKEW IN A GALL FORMING THRIPS WITH 'SOLDIERS'	I	263	23/08/00	16:30	CC		6	PS	6
Wilms, W.	398	HOW FAR NORTH AND SOUTH DOES THE APIFAUNA OF AMAZONIA REACH, ESPECIALLY THE BEE SPECIES VISITING MASS-FLOWERING TREES	I	101	22/08/00	15:05	HB	C	3	2	3
Wilson Fernandes, G.	1856	MECHANISMS OF RESISTANCE IN TREES TO GALL-FORMING INSECTS	I	468	24/08/00	11:35	HB	M	10	5	10
Wilson, A. D.	1151	HOST RECOGNITION IN XIPHYDRIID WOODWASPS.	I	290	24/08/00	16:30	CC		6	PS	6
Wilson, C. C.	2890	INTERACTIONS BETWEEN MALARIA PARASITES AND THE MOSQUITO VECTOR	II	729	22/08/00	14:35	Bol	R	15	4	15
Wilson, D. M.	3948	ASSESSMENT OF TRANSGENIC Bt RESISTANCE FOR CONTROL OF FALL ARMYWORM AND CORN EARWORM INFESTATIONS AND REDUCING AFLATOXIN CONTAMINATION OF CORN	II	996	21/08/00	16:30	CC		22	PS	22
Wilson, F. G.	853	ENDOPHYTES, TANNINS, AND HERBIVORES: THE INTERFACE IN A WOODY SHRUB	I	216	24/08/00	14:30	HB	D	6	6	6
Wilson, K.	817	RAPID EVOLUTION OF FLIGHT POTENTIAL IN LEPIDOPTERA	I	207	22/08/00	11:20	HB	D	6	3	6
Wilson, K.	2164	COPING WITH CROWDS: THE EVOLUTION OF DENSITY-DEPENDENT RESISTANCE TO PATHOGENS	I	546	25/08/00	16:30	CC		11	PS	11
Wilson, K.	2289	SEX-BIASED PARASITISM IN INSECTS	I	578	23/08/00	16:30	CC		12	PS	12
Wilson, K.	2414	HERITABILITY OF IMMUNE FUNCTION IN THE CATERPILLAR, SPODOPTERA LITTORALIS	II	610	21/08/00	16:30	CC		13	PS	13
Wilson, L. J.	1244	NON-TARGET EFFECTS OF BT-COTTON: A CASE STUDY FROM AUSTRALIA	I	314	23/08/00	10:35	HM	N	7	5	7
Wilson, L. J.	2858	IPM AND EARLY PEST DAMAGE IN COTTON: HOW TO SUCCEED BY DOING NOTHING	II	721	25/08/00	16:30	CC		14	PS	14
Wilson, L. T.	134	INTEGRATED MANAGEMENT OF SPIDER MITES IN CALIFORNIA VINEYARDS	I	35	24/08/00	15:10	HB	A	2	8	2
Wilson, L. T.	1562	SAMPLING PREDATORY INSECTS AND SPIDERS IN COTTON	I	394	22/08/00	16:30	CC		8	PS	8
Wilson, M.	2901	RANGE EXTENSION OF IXODES SCAPULARIS AND LYME DISEASE IN NORTH AMERICA	II	732	23/08/00	13:35	Bol	R	15	6	15
Wilson, M. R.	3206	THE TAXONOMY OF XYLEM FEEDING HOMOPTERA	II	809	21/08/00	15:05	Bol	U	17	1	17
Wilson, M. R.	3612	THE NEW WORLD ACHILIXIIDAE & RICANIIDAE (HEMIPTERA: FULGOROMORPHA)	II	912	21/08/00	10:20	HB	E	21	1	21
Wilson, M. R.	3246	THE TAXONOMY OF XYLEM FEEDING HOMOPTERA	II	819	21/08/00	16:30	CC		17	PS	17
Wilson, R.	2334	WEAK EXPRESSION OF EGFP IN TRANSGENIC AEDES AEGYPTI AND STOMOXYS CALCITRANS DESPITE THE PRESENCE OF MULTIPLE COPIES OF THE TRANSGENE	I	589	25/08/00	16:30	CC		12	PS	12
Wiltz, B. A.	118	POTENTIAL OF KAOLIN BASED PARTICLE BARRIERS FOR TERMITE CONTROL	I	31	23/08/00	15:15	HB	A	2	6	2
Wimmer, E. A.	3073	BICOID AS A PHYLOGENETIC ADDITION TO THE INSECT BODY PLAN	II	775	24/08/00	14:00	HB	G	16	6	16
Wimmer, E. A.	4000	UNIVERSAL TRANSFORMATION SYSTEM FOR TRANSGENIC ARTHROPODS	II	1009	25/08/00	16:30	CC		22	PS	22
Wimmer, Z.	4022	JUVENOGENS - INSECT HORMONOGENIC COMPOUNDS.	II	1016	22/08/00	13:45	HB	J	23	4	23
Wimmer, Z.	2709	POTENTIAL OF JUVENOIDS IN BAIT TECHNOLOGY FOR THE MANAGEMENT OF SUBTERRANEAN TERMITES (ISOPTERA) – LABORATORY AND FIELD STUDIES WITH A CARBAMATE DERIVATIVE (W-328)	II	684	22/08/00	16:30	CC		14	PS	14
Wimmerova, M.	4022	JUVENOGENS - INSECT HORMONOGENIC COMPOUNDS.	II	1016	22/08/00	13:45	HB	J	23	4	23
Windsor, D.	4130	CHEMICAL DEFENSE IN NEOTROPICAL LEAF BEETLES	II	1043	25/08/00	14:40	HM	P	24	2	24
Windsor, D.	4127	SYSTEMATIC POSITION OF TWO POLYMORPHIC SPECIES OF CHELYMORPHA BOH. (COLEOPTERA: CHRYSOMELIDAE: CASSIDINAE)	II	1042	25/08/00	13:40	HM	P	24	2	24
Windsor, D.	3856	SYSTEMATIC POSITION OF TWO POLYMORPHIC SPECIES OF CHELYMORPHA BOH. (COLEOPTERA: CHRYSOMELIDAE: CASSIDINAE)	II	973					21		21
Wing, K. D.	1222	MODE OF ACTION OF INDOXACARB IN PEST INSECTS AND IMPLICATIONS FOR CONTROL	I	309	21/08/00	9:35	HM	N	7	1	7
Wing, K. D.	1270	INDOXACARB: ATTRIBUTES THAT IMPACT FIELD PERFORMANCE AND CONTRIBUTE TO CONSERVATION OF BENEFICIALS	I	321	25/08/00	10:20	HM	N	7	9	7
Wingfield, B. D.	1987	OPHIOSTOMATOID FUNGI ASSOCIATED WITH THREE BARK BEETLES IN SOUTH AFRICA	I	501	25/08/00	16:30	CC		10	PS	10
Wingfield, B. D.	1972	UNDERSTANDING THE INTRODUCTION AND SPREAD OF SIREX NOCTILIO IN THE SOUTHERN HEMISPHERE	I	497	25/08/00	16:30	CC		10	PS	10

Sub-titles: (HB=Hotel Bourbon) - (HM=Hotel Mabu) - (CC=Convention Center) - (Bol=Foz Boulevard) - (PS=Poster Session) - (PL=Plenary Lecturer)

AUTHOR	Nº	TITLE	Book	Page	Date	Time	Local	Room	Session	Symp	New Session
Wingfield, B. D.	1894	ASSOCIATIONS OF INSECTS AND PATHOGENS RESULTING IN DISEASE AND DAMAGE TO PLANTATION GROWN EUCALYPTUS IN THE TROPICS AND SOUTHERN HEMISPHERE	I	477	26/08/00	15:35	HB	M	10	10	10
Wingfield, M.	1894	ASSOCIATIONS OF INSECTS AND PATHOGENS RESULTING IN DISEASE AND DAMAGE TO PLANTATION GROWN EUCALYPTUS IN THE TROPICS AND SOUTHERN HEMISPHERE	I	477	26/08/00	15:35	HB	M	10	10	10
Wingfield, M. J.	1972	UNDERSTANDING THE INTRODUCTION AND SPREAD OF SIREX NOCTILIO IN THE SOUTHERN HEMISPHERE	I	497	25/08/00	16:30	CC		10	PS	10
Wingfield, M. J.	3497	A NATIONAL PERSPECTIVE OF FOREST TREE PESTS IN SOUTH AFRICA	II	883	23/08/00	16:30	CC		19	PS	19
Wingfield, M. J.	1987	OPHIOSTOMATOID FUNGI ASSOCIATED WITH THREE BARK BEETLES IN SOUTH AFRICA	I	501	25/08/00	16:30	CC		10	PS	10
Winkler, P.	2786	USE AND IMPACT OF MATING DISRUPTION IN COMMERCIAL PEACH INTEGRATED CROP MANAGEMENT PROGRAMS IN NEW JERSEY, USA	II	703	24/08/00	16:30	CC		14	PS	14
Winstanley, D.	2026	PROGRESS IN THE GENETIC IMPROVEMENT OF GRANULOVIRUSES FOR THE CONTROL OF TWO IMPORTANT APPLE PESTS	I	511	24/08/00	15:30	HM	P	11	7	11
Wirtz, R. A.	4020	NEAR-INFRARED SPECTROSCOPY APPLIED TO DETECTING PARASITOIDS AND HIDDEN INSECT LARVAE, IDENTIFYING COLEOPTERA, AND CHRONOLOGICAL AGE-GRADING	II	1015	22/08/00	11:00	HB	J	23	3	23
Wirtz, R. A.	2977	EMERGENCE OF A NEW NEOTROPICAL MALARIA VECTOR FACILITATED BY HUMAN MIGRATION AND CHANGES IN LAND USE	II	751	22/08/00	16:30	CC		15	PS	15
Wisnivesky-Colli, M. C.	2962	TRIATOMINES INVOLVED IN DOMESTIC AND WILD TRYPANOSOMA CRUZI TRANSMISSION IN CONCEPCIÓN, CORRIENTES, ARGENTINA	II	747	21/08/00	16:30	CC		15	PS	15
Witten, J. L.	3048	DEVELOPMENTAL REGULATION AND FUNCTIONS FOR FLRFAMIDE PEPTIDES IN MANDUCA SEXTA	II	769	22/08/00	11:35	HB	G	16	2	16
Witzell, H.	3708	MOLECULAR PHYLOGENY OF THE SUBFAMILIES IN GEOMETRIDAE (GEOMETROIDEA: LEPIDOPTERA)	II	936	21/08/00	16:30	CC		21	PS	21
Witzgall, P.	654	SEX PHEROMONE OF THE BRAZILIAN APPLE LEAFROLLER, BONAGOTACRANAODES (LEPIDOPTERA: TORTRICIDAE): EFFECT OF GEOMETRICISOMERS ON MALE ATTRACTION TO (E,Z)-3,5-DODECADIENYL ACETATE	I	165	22/08/00	16:30	CC		4	PS	4
Witzgall, P.	3870	MATING DISRUPTION OF CODLING MOTH AND BEYOND	II	977	21/08/00	10:05	HB	H	22	1	22
Wnšk, A.	3188	STRUCTURE OF OVARIOLES IN ADELGES LARICIS (INSECTA, HEMIPTERA, APHIDINEA: ADELGIDAE)	II	804	25/08/00	16:30	CC		16	PS	16
Woitek, S. H.	3196	CHORIOGENESIS IN DACUS OLEAE WITH RESPECT TO PEROXIDASES	II	806	25/08/00	16:30	CC		16	PS	16
Woitek, S. H.	3150	MOLECULAR CHARACTERIZATION AND IN SITU LOCALIZATION OF A PEROXIDASE GENE WITH RESPECT TO CHORIOGENESIS IN DROSO-PHILA MELANOGASTER	II	795	23/08/00	16:30	CC		16	PS	16
Woiwod, I. P.	930	VERTICAL-LOOKING RADAR: A POWERFUL NEW TOOL FOR MONITORING INSECT FLIGHT AT ALTITUDE	I	235	21/08/00	16:30	CC		6	PS	6
Woiwod, I. P.	1212	SPATIO-TEMPORAL DYNAMICS OF AERIAL INSECT POPULATIONS EXAMINED WITH VERTICAL-LOOKING RADAR	I	305	25/08/00	16:30	CC		6	PS	6
Woiwod, I. P.	1245	UK FIELD-SCALE TRIALS OF GM HERBICIDE TOLERANT CROPS TO DETECT THE ENVIRONMENTAL EFFECTS ON INVERTEBRATE ABUNDANCE AND BIODIVERSITY	I	314	23/08/00	10:50	HM	N	7	5	7
Woiwood, I. P.	812	SPATIAL ANALYSIS OF PEST MOTH POPULATIONS IN THE UK AND EUROPE	I	205	24/08/00	10:05	HB	F	6	3	6
Woiwood, I. P.	812	SPATIAL ANALYSIS OF PEST MOTH POPULATIONS IN THE UK AND EUROPE	I	205	24/08/00	10:05	HB	F	6	3	6
Wojcicka, A.	1213	GRAIN APHID PERFORMANCE ON TRITICALE	I	306	25/08/00	16:30	CC		6	PS	6
Wojtusiak, J.	1952	VERTICAL DISTRIBUTION OF CLOUD FOREST PRONOPHILINAE BUTTERFLIES IN MONTE ZERPA, CORDILLERA DE MERIDA, VENEZUELA	I	492	24/08/00	16:30	CC		10	PS	10
Wolff, J. L.	1592	OCCURRENCE OF BACULOVIRUS AND HEXAMERMIS SP. (NEMATODA, MERMITHIDAE) IN LONOMIA OBLIQUA (LEPIDOPTERA, SATURNIIDAE)	I	401	23/08/00	16:30	CC		8	PS	8
Wolff, M.	1214	PRELIMINARY STUDIES ON FORENSIC ENTOMOLOGY IN MEDELLIN-COLOMBIA	I	306	25/08/00	16:30	CC		6	PS	6
Wolff, M.	1981	PRELIMINAR OBSERVATIONS OF CULICIDS (DIPTERA:CULICIDAE) ASSOCIATED TO PHYTOTELMATA IN A VERY HYMUD TROPICAL FOREST (bmh-T) IN CHOCO-COLOMBIA	I	499	21/08/00	16:30	CC		10	PS	10
Wolfner, M. F.	3300	CONTROL OF DROSOPHILA REPRODUCTION BY MALE-DERIVED PROTEINS IN THE SEMINAL FLUID	II	833	25/08/00	13:35	HB	K	18	7	18
Wood, B. C.	430	CONSERVATION OF GRASSLAND BUTTERFLIES IN AN URBAN LANDSCAPE IN THE UK	I	109	24/08/00	14:35	HB	C	3	6	3
Wood, S.	17	HOUSE DUST MITE (DERMATOPHAGOIDES PTERONYSSINUS) MORTALITY IN OCCUPIED BEDS AND HEATED AND UNHEATED CARPET	I	5	21/08/00	16:30	CC		1	PS	1
Woodrow, R. J.	3395	DISTRIBUTION AND MANAGEMENT OF TERMITES IN HAWAII	II	857	21/08/00	13:45	HM	Q	19	1	19
Woods, C. W.	3250	TESTIS ECDYSIOTROPIN, AN INSECT GONADOTROPIN THAT INDUCES SYNTHESIS OF ECDYSTEROID	II	821	21/08/00	9:50	HB	K	18	1	18
Woods, H. A.	2533	COMPARISON OF ACCLIMATORY AND EVOLUTIONARY CHANGES IN PHYSIOLOGY OF WATER-STRESSED LARVAL MANDUCA SEXTA	II	640	25/08/00	16:30	CC		13	PS	13
Woods, H. A.	3133	INTERACTION OF OXYGEN TENSION AND TEMPERATURE ON INSECT DEVELOPMENT	II	790	22/08/00	16:30	CC		16	PS	16
Woods, T. L.	1048	ARTHROPOD DIVERSITY IN AN AGROFORESTRY SYSTEM OF BLACK WALNUT AND FORAGE CROPS	I	264	23/08/00	16:30	CC		6	PS	6
Woodson, W. D.	118	POTENTIAL OF KAOLIN BASED PARTICLE BARRIERS FOR TERMITE CONTROL	I	31	23/08/00	15:15	HB	A	2	6	2
Woodson, W. D.	3542	A PILOT TEST FOR AREA WIDE MANAGEMENT OF THE FORMOSAN SUBTERRANEAN TERMITE IN THE FRENCH QUARTER, NEW ORLEANS, LOUISIANA	II	894	24/08/00	16:30	CC		19	PS	19
Wool, D.	831	GALLING APHIDS AS PHYSICAL ECOSYSTEM ENGINEERS : THE VASCULAR SYSTEM IN APHID GALLS AS A MASS-FEEDING APPARATUS	I	210	23/08/00	11:05	HB	D	6	5	6
Wootton, R. J.	3061	THE STRUCTURE AND MECHANICS OF INSECT WINGS	II	772	23/08/00	14:05	HB	G	16	5	16
Wootton, R. J.	3681	PALAEONTOLOGY, WING MECHANICS, AND THE EVOLUTION OF HOLOMETABOLA	II	929	25/08/00	14:05	HB	E	21	8	21
Wormleaton, S. L.	2026	PROGRESS IN THE GENETIC IMPROVEMENT OF GRANULOVIRUSES FOR THE CONTROL OF TWO IMPORTANT APPLE PESTS	I	511	24/08/00	15:30	HM	P	11	7	11
Wpoke van der Werf	156	CASE STUDY: GLASSHOUSE PESTS AND COCCINELLIDS.	I	40	26/08/00	11:35	HB	A	2	10	2
Wraight, S. P.	2015	MANIPULATION OF SPRAY PARAMETERS TO IMPROVE EFFICACY OF MYCOINSECTICIDES AGAINST INSECT PESTS OF FIELD CROPS	I	508	23/08/00	15:05	HM	P	11	6	11
Wraight, S. P.	2165	MANIPULATION OF SPRAY PARAMETERS TO IMPROVE EFFICACY OF MYCOINSECTICIDES AGAINST INSECT PESTS OF FIELD CROPS	I	546	25/08/00	16:30	CC		11	PS	11
Wraight, S. P.	3889	MYCOINSECTICIDES - OPPORTUNITIES AND CONSTRAINTS	II	982	23/08/00	10:15	HB	H	22	4	22
Wratten, S. D.	128	AGRICULTURAL AND NEIGHBORING SYSTEMS: LANDSCAPE EBB AND FLOW OF BIOTA	I	33	24/08/00	11:10	HB	A	2	7	2
Wratten, S. D.	154	INTERACTIONS BETWEEN PREDATOR SPECIES, THEIR PREY AND THE HOST PLANT	I	40	26/08/00	10:35	HB	A	2	10	2
Wratten, S. D.	1424	ADDING FLORAL RESOURCES TO AGRO-ECOSYSTEMS: MANAGING THE CONSEQUENCES FOR THIRD AND FOURTH TROPHIC LEVELS	I	359	21/08/00	11:20	HM	O	8	1	8
Wratten, S. D.	855	INTERACTIONS BETWEEN PREDATOR SPECIES, THEIR PREY AND THE HOST PLANT	I	216	25/08/00	10:05	HB	D	6	7	6
Wright, D. J.	1425	CASE STUDIES - TRITROPHIC ASPECTS OF INTEGRATED PEST MANAGEMENT FOR CRUCIFER PESTS IN THE FIELD	I	360	21/08/00	11:35	HM	O	8	1	8

Sub-titles: (HB=Hotel Bourbon) - (HM=Hotel Mabu) - (CC=Convention Center) - (Bol=Foz Boulevard) - (PS=Poster Session) - (PL=Plenary Lecturer)

AUTHOR	Nº	TITLE	Book	Page	Date	Time	Local	Room	Session	Symp	New Session
Wright, D. L.	3958	USE OF TROPICAL AND TRANSGENIC BACILLUS THURINGIENSIS CORN HYBRIDS IN SOUTHEASTERN UNITED STATES GRAIN AND SILAGE PRODUCTION SYSTEMS	II	999	22/08/00	16:30	CC		22	PS	22
Wright, E. J.	1669	SUITABILITY OF AUSTRALIAN TRICHOGRAMMA SPECIES (HYMENOPTERA: TRICHOGRAMMATIDAE) FOR BIOLOGICAL CONTROL OF STORED PRODUCT MOTHS	I	421	25/08/00	16:30	CC		8	PS	8
Wright, J.	4025	DETECTION OF STORED PRODUCT PEST INSECT	II	1016	22/08/00	15:00	HB	J	23	5	23
Wright, M. G.	2859	POTENTIAL OF MILLET AS A SWEET CORN COMPANION PLANT: EFFECT ON EUROPEAN CORN BORER AND BENEFICIAL INSECTS	II	722	25/08/00	16:30	CC		14	PS	14
Wright, M. G.	1550	INOCULATIVE RELEASES OF TRICHOGRAMMA OSTRINIAE FOR EUROPEAN CORN BORER CONTROL	I	391	22/08/00	16:30	CC		8	PS	8
Wright, M. S.	2100	RESPONSE OF COPTOTERMES FORMOSANUS SHIRAKI TO ISOLATES OF METARHIZIUM ANISOPLIAE IN THE UNITED STATES: VIRULENCE AND REPELLENCY	I	530	23/08/00	16:30	CC		11	PS	11
Wright, R. J.	160	INSECTICIDE RESISTANCE IN THE WESTERN CORN ROOTWORM: IMPLICATIONS TO CURRENT AND FUTURE MANAGEMENT STRATEGIES	I	41	26/08/00	14:35	HB	A	2	11	2
Wrigth, D.	1308	CAN THE RESISTANCE TO INSECTICIDAL TRANSGENIC PLANT PRODUCE NEW SPECIES OF INSECT PEST?: IMPLICATIONS OF DEVELOPMENT ASYNCHRONY OF RESISTENCE PEST TO BACILLUS THURINGIENSIS TRANSGENIC CROP	I	330	21/08/00	16:30	CC		7	PS	7
Wu, C. I.	2524	EXTREME HIGH-LEVEL OF AMINO ACID POLYMORPHISM IN A MALE REPRODUCTIVE PROTEIN GENE, ACP26AA, IN DROSOPHILA MAURITIANA	II	637	25/08/00	16:30	CC		13	PS	13
Wu, K.	150	MIGRATION AND DIAPAUSE OF HELICOVERPA ARMIGERA IN CHINA	I	39	25/08/00	15:15	HB	A	2	9	2
Wu, K.	1215	THE CAAS ENTOMOLOGICAL RADAR	I	306	25/08/00	16:30	CC		6	PS	6
Wu, W. J.	1766	EFFECTS OF MATING FREQUENCY ON FEMALE REPRODUCTIVE OUTPUT IN THE CAT FLEA, CTENOCEPHALIDES FELIS (SIPHONAPTERA: PULICIDAE)	I	445	22/08/00	16:30	CC		9	PS	9
Wu, Z. X.	1433	RECENT ADVANCES IN THE DEVELOPMENT OF ARTIFICIAL DIET BASED MASS REARING SYSTEMS FOR EGG PARASITOIDS	I	362	21/08/00	15:20	HM	O	8	2	8
Wuest, J.	3197	A SEM AND TEM COMPARATIVE STUDY OF TYPE I AND III SECRETORY GLANDS IN THE GENITAL APPARATUS OF THE COCKROACH NAUPHOETA CINEREA	II	806	25/08/00	16:30	CC		16	PS	16
Wulbeck, C.	3077	THE DEVELOPMENT AND EVOLUTION OF BRISTLE PATTERNS IN DIPTERA	II	776	24/08/00	16:00	HB	G	16	6	16
Wyman, J. A.	3282	USING ICE NUCLEATING BACTERIA TO REDUCE WINTER SURVIVAL OF COLORADO POTATO BEETLES: DEVELOPING A NOVEL STRATEGY FOR BIOLOGICAL CONTROL	II	829	23/08/00	10:50	HB	K	18	4	18
Wyman, L. M.	3541	DEFINING THE NATURE OF COOPERATION IN THE BARELY EUSOCIAL SWEAT BEE, HALICTUS SEXCINCTUS, IN SOUTHERN GREECE	II	893	24/08/00	16:30	CC		19	PS	19
Wysiecki, M. L. de	476	GRASSHOPPER (ORTHOPTERA: ACRIDOIDEA) SPECIES DIVERSITY IN THE PAMPAS, ARGENTINA	I	121	21/08/00	16:30	CC		3	PS	3
Wysoki, M.	1415	INFLUENCE OF SPINOSAD ON SOME HYMENOPTEROUS NATURAL ENEMIES OF AVOCADO, CITRUS AND OTHER ORCHARD PESTS	I	357	25/08/00	16:30	CC		7	PS	7
Wysoki, M.	1439	INFLUENCE OF SPINOSAD ON SOME PARASITOIDS OF CITRUS AND OTHER ORCHARD PESTS	I	363	22/08/00	11:35	HM	O	8	3	8
Wyss, P.	1269	THIAMETHOXAM: NEW INNOVATIVE APPLICATION OPPORTUNITIES FOR A SYSTEMIC PRODUCT	I	320	25/08/00	10:05	HM	N	7	9	7
Wyss, P.	1279	PRO-ACTIVE RESISTANCE MANAGEMENT OF THIAMETHOXAM	I	323	25/08/00	14:50	HM	N	7	10	7
Xia, Y. L.	783	INSECT INFORMATICS: TO MEET THE CHALLENGE OF MODERN INFORMATION DISSEMINATION	I	198	25/08/00	10:35	Bol	T	5	6	5
Xia, Y. L.	795	THE DEVELOPMENT OF WEB-BASED INTELLIGENT INSECT MANAGEMENT INFORMATION SYSTEM FOR BETTER DECISION-MAKING SUPPORT	I	201	24/08/00	16:30	CC		5	PS	5
Xia, Y. L.	2860	WEB-BASED AFRICA IPM FORUM FOR BETTER INFORMATION DISSEMINATION	II	722	25/08/00	16:30	CC		14	PS	14
Xie, C.	2921	STUDIES ON THE POSSIBILITY OF TRANSMISSION OF DENGUE VIRUS BY CULEX PIPIENS QUINQUEFASCIATUS IN LABORATORY	II	737	25/08/00	9:50	Bol	R	15	9	15
Xie, J. J.	1416	COMPARISON OF ROTENONE CONTENT AND INSECT BIOACTIVITY BETWEEN ROOTS AND CALLUS CULTURES OF DERRIS ELLIPTICA	I	357	25/08/00	16:30	CC		7	PS	7
Xing, J. M.	1267	INSECTICIDE RESISTANCE GENES IN CULEX PIPIENS COMPLEX MOSQUITOES FROM CHINA	I	320	24/08/00	15:50	HM	N	7	8	7
Xu, G.	150	MIGRATION AND DIAPAUSE OF HELICOVERPA ARMIGERA IN CHINA	I	39	25/08/00	15:15	HB	A	2	9	2
Xu, H-l.	792	SPECIES INFORMATION DATABASE KONCHU ON JAPANESE, EAST ASIAN AND PACIFIC INSECTS, SPIDERS AND MITES ON INTERNET	I	200	23/08/00	16:30	CC		5	PS	5
Xu, J. L.	310	LITCHI INSECT PESTS RESEARCH AND CONTROL	I	79	24/08/00	16:30	CC		2	PS	2
Xu, R.	2385	OXIDATIVE CONJUGATION OF CATECHOLS FOR INSECT CUTICLE SCLEROTIZATION	II	603	25/08/00	15:20	HB	I	13	9	13
Xu, R.	2454	OXIDATIVE CONJUGATION OF CATECHOLS FOR INSECT CUTICLE SCLEROTIZATION	II	620	23/08/00	16:30	CC		13	PS	13
Xu, X. L.	3384	CATHEPSIN B-LIKE CYSTEINE PROTEINASE FROM HELICOVERPA ARMIGERA	II	854	25/08/00	16:30	CC		18	PS	18
Xu, Z. H.	1505	THE OCCURRENCE OF LEAFMINERS AND THEIR PARASITOIDS ON VEGETABLE CROPS AND WEEDS IN SOUTHEAST CHINA	I	380	21/08/00	16:30	CC		8	PS	8
Yaga, S.	3552	TERMITICIDAL SUBSTANCES FROM THE HEARTWOOD OF CRYPTOMERIA JAPONICA D. DON	II	896	25/08/00	16:30	CC		19	PS	19
Yagi, T.	3820	MOLECULAR SYSTEMATICS AND EVOLUTION OF BUTTERFLIES OF THE GENUS PARNASSIUS, PAPILIONIDAE, BASED ON MITOCHONDRIAL DNA SEQUENCE DATA	II	964	24/08/00	16:30	CC		21	PS	21
Yaginuma, D.	2166	THE SPECIFICITY ANALYZE OF ENTOMOPATHOGENIC FUNGUS BEAUVERIA BRONGNIARTII	I	546	25/08/00	16:30	CC		11	PS	11
Yaginuma, K.	2167	MICROBIAL CONTROL OF APPLE INSECT PESTS WITH ENTOMOGENOUS FUNGI	I	546	25/08/00	16:30	CC		11	PS	11
Yago, M.	3565	ADHESIVE STRENGTH OF THE GLUE SUBSTANCES IN THE COLLETERIAL GLANDS OF THE JAPANESE WILD SILKMOTHS	II	899	22/08/00	16:30	CC		19	PS	19
Yago, M.	3863	A SYSTEMATIC STUDY OF THE SUBFAMILY LYCAENINAE (LEPIDOPTERA, LYCAENIDAE)	II	975	25/08/00	16:30	CC		21	PS	21
Yaide, N.	3648	MORPHOLOGY AND BIOGEOGRAPHY OF FEMALE MYRMECOLACIDAE PARASITIC IN ORTHOPTERA IN PAPUA NEW GUINEA	II	921	23/08/00	14:20	HB	E	21	5	21
Yamada, Y. Y.	1695	INDUCTION OF FEMALE-EGG OVIPOSITION BY HIGH ILLUMINATION IN A PARASITOID, HAPLOGONATOPUS ATRATUS (HYMENOPTERA: DRYINIDAE)	I	427	25/08/00	16:30	CC		8	PS	8
Yamaguchi, D.	839	HOST ALTERNATION BY MULTIVOLTINE GALL MIDGES OF THE GENUS ASPHONDYLIA	I	212	23/08/00	14:30	HB	D	6	5	6
Yamakawa, M.	2356	REGULATION OF TISSUE-SPECIFIC AND LIPOPOLYSACCHARIDE-INDUCIBLE GENE EXPRESSION OF AN ANTIBACTERIAL PROTEIN FROM THE SILKWORM, BOMBYX MORI	II	595	23/08/00	11:45	HB	I	13	4	13
Yamakawa, M.	2446	ISOLATION, cDNA CLONING AND MODIFICATION OF DEFENSIN FROM THE COCONUT RHINOCEROS BEETLE, ORYCTES RHINOCEROS	II	618	22/08/00	16:30	CC		13	PS	13
Yamakawa, M.	2516	CDNA CLONING AND EXPRESSION ANALYSIS OF REL PROTEINS FROM BOMBYX MORI	II	635	25/08/00	16:30	CC		13	PS	13
Yamakawa, W.	3143	MORPHOLOGY OF THE LARVA AND OBSERVATIONS ON BIOLOGY OF PLATYPUS MUTATUS (COLEOPTERA, CURCULIONIDAE, PLATYPODINAE)	II	793	24/08/00	16:30	CC		16	PS	16
Yamamoto, P. T.	2861	EFFICIENCY OF THIAMETHOXAM TO CONTROL ONCOMETOPIA FACIALIS (HEMIPTERA: CICADELLIDAE) IN CITRUS	II	722	25/08/00	16:30	CC		14	PS	14
Yamamoto, P. T.	1502	AGENIASPIS CITRICOLA: INTRODUCTION, LABORATORY REARING AND ADAPTATION IN BRAZIL	I	379	21/08/00	16:30	CC		8	PS	8
Yamamoto, P. T.	3209	VECTOR AND EPIDEMIOLOGICAL ASPECTS OF CITRUS VARIEGATED CHLOROSIS	II	810	21/08/00	15:50	Bol	U	17	1	17

Sub-titles: (HB=Hotel Bourbon) - (HM=Hotel Mabu) - (CC=Convention Center) - (Bol=Foz Boulevard) - (PS=Poster Session) - (PL=Plenary Lecturer)

AUTHOR	N°	TITLE	Book	Page	Date	Time	Local	Room	Session	Symp	New Session
Yamanaka, A.	3566	PHOTOPERIODIC AND NEUROENDOCRINE REGULATION OF THE SEASONAL MORPH DEVELOPMENT IN A BIVOLTINE RACE (DAIZO) OF THE SILKMOTH, BOMBYX MORI	II	900	25/08/00	16:30	CC		19	PS	19
Yamao, M.	2221	BACULOVIRUS-MEDIATED GENE TARGETING IN THE SILKWORM	I	561	25/08/00	15:35	HB	L	12	10	12
Yamaoka, R.	4179	TASTE OF NOXIOUS LIPOPHILIC SUBSTANCES: AVERSIVE BEHAVIOR AND TASTE RESPONSE TO LIMONENE IN THE BLOWFLY, PHORMIA REGINA	II	1055	22/08/00	16:30	CC		Erratum	PS	13
Yamaoka, R.	2530	TASTE ENHANCING EFFECT OF GLYCINE ON THE SWEETNESS OF GLUCOSE: A GUSTATORY TRICK FOR THE SYMBIOSIS BETWEEN THE ANT, CAMPONOTUS JAPONICUS AND THE LARVAE OF THE LYCAENID BUTTERFLY, NIPHANDA FUSCA	II	639	25/08/00	16:30	CC		13	PS	13
Yamashita, O.	2291	DIAPAUSE HORMONE AND PHEROMONE BIOSYNTHESIS ACTIVATING NEUROPEPTIDE (DH-PBAN) GENE EXPRESSION IN THE EMBRYO OF THE SILKWORM, BOMBYX MORI	I	578	23/08/00	16:30	CC		12	PS	12
Yamashita, O.	3277	A NEW CHALLENGE FOR THE FUTURE MOLECULAR STUDY ON EMBRYONIC DIAPAUSE OF THE SILKWORM, BOMBYX MORI	II	828	23/08/00	9:35	HB	K	18	4	18
Yamauchi, T.	3865	PHYLOGENY AND EVOLUTION OF THE SUBFAMILY COLIADINAE (LEPIDOPTERA: PIERIDAE)	II	975	25/08/00	16:30	CC		21	PS	21
Yamauchi, T.	3552	TERMITICIDAL SUBSTANCES FROM THE HEARTWOOD OF CRYPTOMERIA JAPONICA D. DON	II	896	25/08/00	16:30	CC		19	PS	19
Yamazaki, T.	3556	AN INVITATION: MORE FRESH COCOONS FOR A COMPLETELY NEW USE OF SERICIN AND FIBROIN AND SILKWORM PUPAE, AN URGENT NEED FOR A NEW INDUSTRIAL SYSTEM OF SERICULTURE IN THE 21ST CENTURY	II	897	25/08/00	16:30	CC		19	PS	19
Yanagi, M.	2726	MODE OF ACTION AND CHARACTARISTICS OF A NOVEL INSECT PEST CONTROL AGENT, CHROMAFENOZIDE	II	688	23/08/00	16:30	CC		14	PS	14
Yanagi, M.	3961	INSECTICIDAL ACTIVITY OF A NOVEL INSECT PEST CONTROL AGENT, CHROMAFENOZIDE	II	1000	22/08/00	16:30	CC		22	PS	22
Yanai, T.	3961	INSECTICIDAL ACTIVITY OF A NOVEL INSECT PEST CONTROL AGENT, CHROMAFENOZIDE	II	1000	22/08/00	16:30	CC		22	PS	22
Yanega, D. A.	498	COMPOSITION AND RELATIVE ABUNDANCE OF HYMENOPTERA FAMILIES IN TWO URBAN AREAS OF BELO HORIZONTE, MINAS GERAIS, BRAZIL	I	126	22/08/00	16:30	CC		3	PS	3
Yang, C. Y.	641	TRIALS OF CONTROLLING LEPIDOPTERAN PESTS WITH SEX PHEROMONES IN KOREAN APPLE AND PEAR ORCHARDS	I	162	21/08/00	16:30	CC		4	PS	4
Yang, C. Y.	3872	TRIALS OF CONTROLLING LEPIDOPTERAN PESTS WITH SEX PHEROMONES IN KOREAN APPLE AND PEAR ORCHARDS	II	977	21/08/00	11:05	HB	H	22	1	22
Yang, C.-M.	828	CIRCADIAN TEMPERATURE PATTERNS IN TWO CECIDOMYIID GALLS OF MACHILUS THUNBERGII (LAURACEAE)	I	209	23/08/00	10:20	HB	D	6	5	6
Yang, C.-M.	1810	CIRCADIAN TEMPERATURE PATTERNS IN TWO CECIDOMYIID GALLS OF MACHILUS THUNBERGII (LAURACEAE)	I	456	25/08/00	16:30	CC		9	PS	9
Yang, E. C.	3198	ANTENNATION AND SEXUALLY DIMORPHIC ANTENNAE OF THE BLISTER BEETLE, EPICAUTA HIRTICONIS	II	807	25/08/00	16:30	CC		16	PS	16
Yang, F.	2921	STUDIES ON THE POSSIBILITY OF TRANSMISSION OF DENGUE VIRUS BY CULEX PIPIENS QUINQUEFASCIATUS IN LABORATORY	II	737	25/08/00	9:50	Bol	R	15	9	15
Yang, H. M.	1678	SPATIO-TEMPORAL DISTRIBUTION OF CITRUS LEAFMINER AND ITS NATURAL ENEMIES IN SÃO PAULO STATE, BRAZIL	I	423	25/08/00	16:30	CC		8	PS	8
Yang, J.	2446	ISOLATION, cDNA CLONING AND MODIFICATION OF DEFENSIN FROM THE COCONUT RHINOCEROS BEETLE, ORYCTES RHINOCEROS	II	618	22/08/00	16:30	CC		13	PS	13
Yang, J. T.	1216	THE APPLICATION OF CECIDOMYIIDS GALLS ON THE SYSTEMATICS OF THE GENUS MACHILUS (LAURACEAE) IN TAIWAN	I	306	25/08/00	16:30	CC		6	PS	6
Yang, J. T.	3864	MOGOPLISTIDAE (ORTHOPTERA: GRYLLOIDEA) OF TAIWAN WITH LECTOTYPE DESIGNATION OF SHIRAKI'S SPECIES	II	975	25/08/00	16:30	CC		21	PS	21
Yang, M. M.	1810	CIRCADIAN TEMPERATURE PATTERNS IN TWO CECIDOMYIID GALLS OF MACHILUS THUNBERGII (LAURACEAE)	I	456	25/08/00	16:30	CC		9	PS	9
Yang, M. M.	828	CIRCADIAN TEMPERATURE PATTERNS IN TWO CECIDOMYIID GALLS OF MACHILUS THUNBERGII (LAURACEAE)	I	209	23/08/00	10:20	HB	D	6	5	6
Yang, S. Y.	1216	THE APPLICATION OF CECIDOMYIIDS GALLS ON THE SYSTEMATICS OF THE GENUS MACHILUS (LAURACEAE) IN TAIWAN	I	306	25/08/00	16:30	CC		6	PS	6
Yang, X. Y.	739	PRELIMINARY STUDY ON THE BEHAVIOR OF SELECTING HOST OF LONGHORNED BEETLES AND THE ROLE OF THEIR SENSE ORGANS IN THIS PROCESS	I	187	25/08/00	16:30	CC		4	PS	4
Yaninek, J. S.	38	EFFECTS OF CASSAVA CULTIVAR ON ABUNDANCE OF EXOTIC PHYTOSEIID MITES IN AFRICA	I	10	22/08/00	16:30	CC		1	PS	1
Yaninek, J. S.	8	DISPERSAL AND SPREAD OF EXOTIC PHYTOSEIIDS IN AFRICA	I	2	22/08/00	9:55	Bol	U	1	2	1
Yannopoulos, G.	2251	CYTOGENETIC STUDIES OF POLYTENE CHROMOSOMES IN THE TSETSE FLIES GLOSSINA AUSTENI AND GLOSSINA PALLIDIPES	I	568	23/08/00	16:30	CC		12	PS	12
Yasui, H.	685	AMINO ACID SECRETION IN DIGESTIVE JUICE: COUNTERADAPTATION OF HERBIVOROUS INSECTS AGAINST PROTEIN-DENATURING ACTIVITY OF PLANT IRIDOID GLYCOSIDES ACTIVATED BY PLANT BETA-GLUCOSIDASE	I	173	23/08/00	16:30	CC		4	PS	4
Yasukochi, Y.	3262	RECENT PROGRESS IN GENOMIC MAPPING IN BOMBYX MORI: WHERE SHOULD WE GO FROM HERE?	II	824	22/08/00	9:35	HB	K	18	2	18
Yasunaga, D.	3556	AN INVITATION: MORE FRESH COCOONS FOR A COMPLETELY NEW USE OF SERICIN AND FIBROIN AND SILKWORM PUPAE, AN URGENT NEED FOR A NEW INDUSTRIAL SYSTEM OF SERICULTURE IN THE 21ST CENTURY	II	897	25/08/00	16:30	CC		19	PS	19
Yata, O.	3865	PHYLOGENY AND EVOLUTION OF THE SUBFAMILY COLIADINAE (LEPIDOPTERA: PIERIDAE)	II	975	25/08/00	16:30	CC		21	PS	21
Yates III J. R.	3567	INSTALLATION GUIDELINES FOR THE BASALTIC TERMITE BARRIER: A PARTICLE BARRIER FOR FORMOSAN SUBTERRANEAN TERMITES (ISOPTERA: RHINOTERMITIDAE)	II	900	25/08/00	16:30	CC		19	PS	19
Yates, J. R.	3395	DISTRIBUTION AND MANAGEMENT OF TERMITES IN HAWAII	II	857	21/08/00	13:45	HM	Q	19	1	19
Yates, T.	380	NATIONAL SCIENCE FOUNDATION	I	97	21/08/00	11:35	HB	C	3	1	3
Yazlovetsky, I. G.	2534	ONCE AGAIN ABOUT INVESTIGATION IMPORTANCE ON PECULIARITIES OF NUTRITION OF PREIMAGINAL STAGES OF ENTOMOPHAGES DEVELOPMENT	II	640	25/08/00	16:30	CC		13	PS	13
Yeates, D. K.	766	HYBRID KEYS AND SYNTHETIC DATASETS: NEW DEVELOPMENTS IN INTERACTIVE KEYS WITH LUCID VERSION 2.0	I	193	23/08/00	14:00	Bol	T	5	4	5
Yeates, D. K.	3691	THE PHYLOGENY OF BRACHYCERAN DIPTERA: A SYNTHESIS OF MORPHOLOGICAL EVIDENCE	II	932	25/08/00	16:35	HB	E	21	8	21
Yeates, D. K.	3726	SYSTEMATICS OF WET TROPICS COELOMETOPINI (COLEOPTERA: TENEBRIONIDAE: COELOMETOPINAE) FROM AUSTRALIA: RADIATION IN HIGH ELEVATION RAINFORESTS	II	941	22/08/00	16:30	CC		21	PS	21
Yeh, H.-H.	3213	BIOLOGY OF CRINIVIRUSES AND WHITEFLY-TRANSMISSION	II	811	22/08/00	14:30	Bol	U	17	2	17
Yeh, F. S.	3864	MOGOPLISTIDAE (ORTHOPTERA: GRYLLOIDEA) OF TAIWAN WITH LECTOTYPE DESIGNATION OF SHIRAKI'S SPECIES	II	975	25/08/00	16:30	CC		21	PS	21
Yen, S. H.	2335	EVOLUTIONARY TRENDS ON MALE GENITAL STRUCTURES OF CHALCOSIINAE (LEPIDOPTERA: ZYGAENIDAE)	I	589	25/08/00	16:30	CC		12	PS	12
Yiem, M. S.	2723	TEMPERATURE-DEPENDENT DEVELOPMENTS OF CARPOSINA SASAKII (LEPIDOPTERA: CARPOSINIDAE) AND ITS STAGE EMERGENCE MODELS	II	688	24/08/00	16:30	CC		14	PS	14
Yilmaz, T.	1696	FECUNDITY OF EURYGASTER INTEGRICEPS AND EURYGASTER AUSTRIACA IN LABORATORY CONDITION AND NATURE	I	427	25/08/00	16:30	CC		8	PS	8
Yin, C. M.	3821	TWO NEW SPECIES OF THE GENUS THOMISUS FROM CHINA (ARANEAE : THOMISIDAE)	II	964	24/08/00	16:30	CC		21	PS	21

Sub-titles: (HB=Hotel Bourbon) - (HM=Hotel Mabu) - (CC=Convention Center) - (Bol=Foz Boulevard) - (PS=Poster Session) - (PL=Plenary Lecturer)

AUTHOR	Nº	TITLE	Book	Page	Date	Time	Local	Room	Session	Symp	New Session
Yin, C. M.	3822	ONE NEW SPECIES OF THE GENUS XYSTICUS FROM CHINA (ARANEAE: THOMISIDAE)	II	965	24/08/00	16:30	CC		21	PS	21
Ylioja, T.	1217	HOST UTILIZATION, OVIPOSITION PATTERNS AND POPULATION DYNAMICS OF A DIPTERAN MINER OF BIRCH STEMS	I	307	25/08/00	16:30	CC		6	PS	6
Ylioja, T.	1982	SPECIES MIXTURE OF BIRCH AND CONIFERS DECREASES DAMAGE BY A DIPTERAN MINER OF BIRCH STEMS	I	499	25/08/00	16:30	CC		10	PS	10
Ylioja, T.	1983	STEM BORING AND PUPATION OF A DIPTERAN MINER OF BIRCH STEMS	I	500	25/08/00	16:30	CC		10	PS	10
Yocum, G. D.	3278	DIAPAUSE-SPECIFIC GENE EXPRESSION	II	828	23/08/00	9:50	HB	K	18	4	18
Yokohari, F.	2474	MODALITY-SPECIFIC PROJECTIONS OF ANTENNAL SENSORY AFFERENTS IN THE COCKROACH BRAIN	II	625	23/08/00	16:30	CC		13	PS	13
Yokoi, S.	3961	INSECTICIDAL ACTIVITY OF A NOVEL INSECT PEST CONTROL AGENT, CHROMAFENOZIDE	II	1000	22/08/00	16:30	CC		22	PS	22
Yokoi, S.	2726	MODE OF ACTION AND CHARACTARISTICS OF A NOVEL INSECT PEST CONTROL AGENT, CHROMAFENOZIDE	II	688	23/08/00	16:30	CC		14	PS	14
Yokoo, S.	2517	INVOLVEMENT OF BOTH GRANULAR CELLS AND PLASMATOCYTES IN PHAGOCYTIC REACTION IN THE GREATER WAX MOTH, GALLERIA MELLONELLA	II	636	25/08/00	16:30	CC		13	PS	13
Yokoyama, M.	3247	DETERMINING THE PROTECTION PERIOD OF DRY BEAN (PHASEOLUS VULGARIS) AGAINST WHITEFLY (BEMISIA ARGENTIFOLII), IN FUNCTION OF YIELD LOSS DUE TO BEAN GOLDEN MOSAIC VIRUS INFECTION	II	820	25/08/00	16:30	CC		17	PS	17
Yokoyama, M.	1380	RESISTANCE OF COMMON BEAN GENOTYPES TO DIABROTICA SPECIOSA (COLEOPTERA: CHRYSOMELIDAE) ADULTS	I	348	24/08/00	16:30	CC		7	PS	7
Yokoyama, N.	597	MOLECULAR MECHANISM OF SEX PHEROMONE PRODUCTION IN THE SILKWORM, BOMBYX MORI	I	151	23/08/00	10:00	Bol	S	4	4	4
Yokoyama, V. Y.	3909	PHYSICAL METHODS TO CONTROL REGULATORY PESTS IN EXPORTED HAY AND DECIDUOUS FRUITS	II	987	24/08/00	14:30	HB	H	22	6	22
Yokoyama, V. Y.	3928	PEST RESPONSE TO QUARANTINE TREATMENTS ON DIFFERENT VARIETIES OF A COMMODITY	II	991	26/08/00	10:45	HB	H	22	8	22
Yoshida, T.	3568	CONTROL OF THE MATING FLIGHT TIME OF HONEYBEES BY PHOTOPERIODIC TREATMENT WITHIN THE HIVE	II	900	25/08/00	16:30	CC		19	PS	19
Yoshiga, T.	597	MOLECULAR MECHANISM OF SEX PHEROMONE PRODUCTION IN THE SILKWORM, BOMBYX MORI	I	151	23/08/00	10:00	Bol	S	4	4	4
Yoshikawa, K.	1804	DAILY PERIODICITY OF MATING- AND OVIPOSITING- BEHAVIOR IN DIAMONDBACK MOTH	I	454	25/08/00	16:30	CC		9	PS	9
Yoshimura, T.	3388	RECENT DEVELOPMENT IN THE CONTROL OF JAPANESE SUBTERRANEAN TERMITES	II	855	21/08/00	10:20	HM	Q	19	1	19
Yoshinari, N. H.	3248	SEROLOGY FOR BABESIA BOVIS IN HUMAN PATIENTS WITH LYME-LYKE DISEASE SYNDROME, SYPHILIS, SEPTICEMIA AND AUTOIMMUNE DISEASES	II	820	25/08/00	16:30	CC		17	PS	17
Yoshinari, N. H.	1902	RELATIONSHIP BETWEEN TICKS AND SMALL WILD MAMMALS IN A DISTURBED ATLANTIC FOREST FRAGMENT IN ITAPEVI COUNTY, STATE OF SÃO PAULO, BRAZIL	I	479	21/08/00	16:30	CC		10	PS	10
Yoshino, D.	2336	IDENTIFICATION AND CHARACTERIZATION OF THE KS-1 GENE, WHICH IS EXPRESSED PREFERENTIALLY IN THE SMALL TYPE-KENYON CELLS OF THE HONEYBEE BRAIN	I	589	25/08/00	16:30	CC		12	PS	12
Youn, Y. N.	1652	EFFECTIVE PRESERVATION METHODS OF THE ASIAN LADYBIRD, HARMONIA AXYRIDIS (COLEOPTERA: COCCINELLIDAE), AS APPLICATION STRATEGY FOR BIOLOGICAL CONTROL OF APHIDS	I	416	21/08/00	16:30	CC		8	PS	8
Youn, Y. N.	2862	TOXICAL RESPONSES OF THE ASIAN LADYBIRDS, HARMONIA AXYRIDIS (COLEOPTERA: COCCINELLIDAE), AGAINST SEVERAL INSECTICIDES, ACARICIDES AND FUNGICIDES FOR INTEGRATED PEST MANAGEMENT OF APHIDS IN THE GREENHOUSES	II	722	23/08/00	16:30	CC		14	PS	14
Young, M. W.	2318	RESTORATION OF CIRCADIAN BEHAVIORAL RHYTHM OF DROSOPHILA DOUBLE-TIME MUTANTS BY GENE TRANFE.	I	585	25/08/00	16:30	CC		12	PS	12
Youssef, G. S.	2665	WHEAT CROP PROTECTION BASED ON PLANT RESISTANCE AND BIOLOGICAL CONTROL IN EGYPT	II	673	22/08/00	16:30	CC		14	PS	14
Yseng, C. T.	1691	FIELD AUGMENTATION OF ORIUS STRIGICOLLIS FOR THE CONTROL OF INSECT PESTS	I	426	22/08/00	16:30	CC		8	PS	8
Yu, X. P.	145	MOVEMENTS OF PLANTHOPPERS AND THEIR NATURAL ENEMIES BETWEEN HABITATS IN RICE ECOSYSTEM	I	37	25/08/00	13:45	HB	A	2	9	2
Yu, H.	2337	TRACKING AUSTRALIAN FRUIT FLIES USING MICROSATELLITES	I	590	25/08/00	16:30	CC		12	PS	12
Yu, H. B.	1508	CURRENT STATUS OF THE BIOLOGICAL CONTROL PROGRAM FOR THE MEALYBUG, ORACELLA ACUTA, IN THE PEOPLE'S REPUBLIC OF CHINA	I	380	21/08/00	16:30	CC		8	PS	8
Yu, M.-J.	2535	LEUCOKININ INCREASES SHUNT CONDUCTANCE AND ANION SELECTIVITY IN MALPIGHIAN TUBULES OF THE YELLOW FEVER MOSQUITO AEDES AEGYPTI	II	640	25/08/00	16:30	CC		13	PS	13
Yu, M.-J.	2536	THE MECHANISM OF ACTION OF LEUCOKININ IN MALPIGHIAN TUBULES OF THE YELLOW FEVER MOSQUITO AEDES AEGYPTI: REQUIREMENT OF INTRA- AND EXTRACELLULAR CALCIUM	II	641	25/08/00	16:30	CC		13	PS	13
Yu, Y. M.	2862	TOXICAL RESPONSES OF THE ASIAN LADYBIRDS, HARMONIA AXYRIDIS (COLEOPTERA: COCCINELLIDAE), AGAINST SEVERAL INSECTICIDES, ACARICIDES AND FUNGICIDES FOR INTEGRATED PEST MANAGEMENT OF APHIDS IN THE GREENHOUSES	II	722	23/08/00	16:30	CC		14	PS	14
Yuan, Z	3027	REVIEW OF THE RESEARCH AND APPLICATION OF THE MOSQUITO LARVICIDE BACILLUS SPHAERICUS IN CHINA	II	764	25/08/00	16:30	CC		15	PS	15
Yuan, Z. M.	2935	MICROBIAL PESTICIDES FOR MOSQUITO CONTROL IN CHINA: CURRENT AND FUTURE CONSIDERATIONS	II	741	25/08/00	15:00	Bol	R	15	10	15
Yudin, L. S.	3393	TERMITES OF MARIANA ISLANDS AND PHILIPPINES, THEIR DAMAGE AND CONTROL.	II	857	21/08/00	11:35	HM	Q	19	1	19
Yukawa, J.	844	LONG-TERM POPULATION DYNAMICS OF GALL MIDGES IN EVERGREEN FORESTS	I	213	23/08/00	15:45	HB	D	6	5	6
Yukawa, J.	835	SYNCHRONIZATION OF GALLER'S APPEARANCE WITH HOST PLANT PHENOLOGY	I	211	23/08/00	13:30	HB	D	6	5	6
Yukawa, J.	839	HOST ALTERNATION BY MULTIVOLTINE GALL MIDGES OF THE GENUS ASPHONDYLIA	I	212	23/08/00	14:30	HB	D	6	5	6
Yukawa, J.	1150	BIODIVERSITY OF FAGUS GALL MIDGES: COEXITENCE AND LIFE HISTORY STRATEGY	I	290	24/08/00	16:30	CC		6	PS	6
Yukuhiro, F.	3560	ECDYSONE BUT NOT 20-HYDROXYECDYSONE INDUCES THE REGENERATION OF MIDGUT EPITHELIAL CELLS IN THE SILKWORM, BOMBYX MORI	II	898	25/08/00	16:30	CC		19	PS	18
Yukuhiro, F.	685	AMINO ACID SECRETION IN DIGESTIVE JUICE: COUNTERADAPTATION OF HERBIVOROUS INSECTS AGAINST PROTEIN-DENATURING ACTIVITY OF PLANT IRIDOID GLYCOSIDES ACTIVATED BY PLANT BETA-GLUCOSIDASE	I	173	23/08/00	16:30	CC		4	PS	4
Yukuhiro, K.	3265	RECENT PROGRESS IN THE TRANSGENESIS OF SILKWORM, BOMBYX MORI AND APPLICATION TO THE GENOME PROJECT	II	825	22/08/00	10:35	HB	K	18	2	18
Yukuhiro, K.	2305	CHARACTERIZATION OF GENOMIC GENE ENCODING KYNURENINE 3-MONOOXYGENASE IN THE SILKWORM BOMBYX MORI	I	582	24/08/00	16:30	CC		12	PS	12
Yun, C. Y.	2491	OOCYTE RECEPTORS FOR THE SPECIFIC ACCUMULATION OF YOLK PROTEINS	II	629	24/08/00	16:30	CC		13	PS	13
Yun, C. Y.	3305	OOCYTE RECEPTORS FOR THE SPECIFIC ACCUMULATION OF YOLK PROTEINS	II	835	25/08/00	16:05	HB	K	18	7	18
Yun, J.-C.	2863	ARTHROPOD COMMUNITY STRUCTURE AND ITS CHANGING PATTERNS IN RICE ECOSYSTEMS IN KOREA	II	723	25/08/00	16:30	CC		14	PS	14
Yuval, B.	2656	MASS TRAPPING STRATEGY TO REDUCE MEDITERRANEAN FRUIT FLY (DIPTERA: TEPHRITIDAE) DAMAGE ON APPLES IN ISRAEL	II	671	21/08/00	16:30	CC		14	PS	14

Sub-titles: (HB=Hotel Bourbon) - (HM=Hotel Mabu) - (CC=Convention Center) - (Bol=Foz Boulevard) - (PS=Poster Session) - (PL=Plenary Lecturer)

AUTHOR	Nº	TITLE	Book	Page	Date	Time	Local	Room	Session	Symp	New Session
Zabala, N.	572	SOCIEDAD ENTOMOLOGICA ECUATORIANA	I	145	25/08/00	16:30	CC		3	PS	3
Zabini, A. V.	171	AGRONOMIC EFFICIENCY OF INSECTICIDES AT DIFFERENT RATES TO THE CONTROL OF STERNECHUS SUBSIGNATUS IN SOYBEAN	I	44	21/08/00	16:30	CC		2	PS	2
Zacarin, G. G.	1697	EVALUATION OF THE INTERACTIONS BETWEEN GALLERIA MELLONELLA (LEPIDOPTERA: PYRALIDAE), ACHROIA GRISELLA (LEPIDOPTERA: PYRALIDAE) AND THE PARASITOID APANTELES GALLERIAE (HYMENOPTERA: BRACONIDAE)	I	428	25/08/00	16:30	CC		8	PS	8
Zacaro, A. A.	2537	CALYX CELLS AND POLYDNAVIRUS (PDV) PRODUCTION IN THE OVARY OF COTESIA FLAVIPES (HYMENOPTERA, BRACONIDAE)	II	641	25/08/00	16:30	CC		13	PS	13
Zacaro, A. A.	3199	NURSE CELLS DEGENERATION DURING OOGENESIS OF APIS MELLIFERA (HYMENOPTERA, APIDAE)	II	807	24/08/00	16:30	CC		16	PS	16
Zacaro, A. A.	2046	INFECTION OF DIATRAEA SACCHARALIS (LEP.; PYRALIDAE) WITH THE MICROSOPORIDIA NOSEMA SP	I	516	21/08/00	16:30	CC		11	PS	11
Zacharioudakis, S. S.	3200	MORPHOLOGICAL CHARACTERISTICS OF COMMUNICATION ORGANS OF ADULT BACTROCERA (DACUS) OLEAE (DIPTERA: TEPHRITIDAE)	II	807	25/08/00	16:30	CC		16	PS	16
Zacharopoulou, A.	787	MICROSATELLITE MARKERS OF TWO AGRICULTURAL PESTS, THE MEDFLY, CERATITIS CAPITATA AND THE OLIVE FLY, BACTROCERA OLEAE	I	199	22/08/00	16:30	CC		5	PS	5
Zacharopoulou, A.	2251	CYTOGENETIC STUDIES OF POLYTENE CHROMOSOMES IN THE TSETSE FLIES GLOSSINA AUSTENI AND GLOSSINA PALLIDIPES	I	568	23/08/00	16:30	CC		12	PS	12
Zacharopoulou, A.	3976	A CENTROMERE-SPECIFIC CLONE IN THE MEDFLY, CERATITIS CAPITATA	II	1003	24/08/00	16:30	CC		22	PS	22
Zacharopoulou, A.	2262	HEAT SHOCK RESPONSE IN THE MEDITERRANEAN FRUIT FLY: GENES, PROMOTERS AND THERMOTOLERANCE	I	571	22/08/00	16:30	CC		12	PS	12
Zachrisson, B. A.	1698	DETERMINATION OF THE THERMAL LIMITS OF TRICHOGRAMMA PRETIOSUM (PIRASSUNUNGA STRAIN), ON THE EGGS OF ANTICARSIA GEMMATALIS	I	428	25/08/00	16:30	CC		8	PS	8
Zago, H. B.	1627	COLLECTS AND IDENTIFICATION OF RACES OF TRICHOGRAMMA IN COMMERCIAL FIELDS OF TOMATO, IN DIFFERENT ALTITUDE	I	410	24/08/00	16:30	CC		8	PS	8
Zagoya, A.	573	BIONOMICS OF PEPPERTREE PSYLLID CALOPHYA RUBRA (HOMOPTERA: PSYLLIDAE) IN MEXICOR	I	145	25/08/00	16:30	CC		3	PS	3
Zahavi, T.	3230	HYTOPLASMA-BEARING LEAFHOPPERS/PLANTHOPPERS, SUSPECTED TO BE VECTORS, IN VINEYARDS IN THE GOLAN HEIGHTS, ISRAEL	II	815	23/08/00	16:30	CC		17	PS	17
Zaia, G.	1700	BIOLOGICAL CONTROL OF THE CITRUS LEAFMINER (LEPIDOPTERA: GRACILLARIIDAE) IN NORTHWEST ARGENTINA	I	428	21/08/00	16:30	CC		8	PS	8
Zakharov, E. V.	1218	NATURAL HYBRIDIZATION AND EVOLUTION IN PARNASSIUS (LEPIDOPTERA: PAPILIONIDAE) IN SIBERIA AND RUSSIAN FAR EAST	I	307	25/08/00	16:30	CC		6	PS	6
Zaki, F. N.	1699	RATES OF PARASITISM BY METEORUS RUBENS AND M. GYRATOR ON THEIR INSECT HOSTS	I	428	25/08/00	16:30	CC		8	PS	8
Zaki, F. N.	2136	THE USE OF BACILLUS THURINGIENSIS TO CONTROL LEPIDOPTEROUS INSECTS ON POTATO CULTIVATIONS IN EGYPT	I	539	24/08/00	16:30	CC		11	PS	11
Zakynthinos, E.	2237	MOLECULAR STUDIES OF SEX-SPECIFIC GENES IN THE INSECTS C. CAPITATA AND BACTROCERA OLEAE	I	565	21/08/00	16:30	CC		12	PS	12
Zaldivar, M. E.	3006	THE IMPORTANCE OF DEVELOPING NOVEL STRATEGIES FOR PESTICIDE USE IN CONTROLLING VECTOR-BORNE DISEASES	II	758	24/08/00	16:30	CC		15	PS	15
Zalom, F. G.	134	INTEGRATED MANAGEMENT OF SPIDER MITES IN CALIFORNIA VINEYARDS	I	35	24/08/00	15:10	HB	A	2	8	2
Zalucki, M. P.	129	LANDSCAPE LEVEL CULTURAL CONTROL: FUTURE PROSPECTS AND LIMITATIONS	I	33	24/08/00	11:30	HB	A	2	7	2
Zalucki, M. P.	141	HELICOVERPA FORECASTING IN AUSTRALIA: STATISTICAL MODELS INCORPORATING LOCAL AND NON-LOCAL FACTORS	I	36	25/08/00	11:15	HB	A	2	9	2
Zalucki, M. P.	751	SPATIAL ANALYSIS OF HELIOTHIS DISTRIBUTION AND ABUNDANCE FOR MEASURING THE EFFECTS OF MOTH MOVEMENT AT THE REGIONAL SCALE	I	190	21/08/00	14:10	Bol	T	5	1	5
Zalucki, M. P.	750	SIMULATION OF INSECT MOVEMENT WITH RESPECT TO PLANT ARCHITECTURE AND MORPHOGENESIS	I	189	21/08/00	13:50	Bol	T	5	1	5
Zama, U. S.	3201	CHARACTERISTICS OF SPERMATOZOA OF A STINGLESS BEE MELIPONA MARGINATA (HYMENOPTERA: APIDAE: MELLIPONINI)	II	807	25/08/00	16:30	CC		16	PS	16
Zamudio, M. P.	1700	BIOLOGICAL CONTROL OF THE CITRUS LEAFMINER (LEPIDOPTERA: GRACILLARIIDAE) IN NORTHWEST ARGENTINA	I	428	21/08/00	16:30	CC		8	PS	8
Zanela, C.	2091	GROWTH OF FUNGI CULTIVATED BY CUTTING ANTS ON MURASHIGE & SKOOG NUTRIENT SOLUTION IN DIFFERENT pH	I	527	24/08/00	16:30	CC		11	PS	11
Zanela, C.	2092	EFFICIENCY OF DIFFERENT CULTURE MEDIA IN THE IN VITRO GROWTH OF FUNGI CULTIVATED BY DIFFERENT LEAF CUTTING ANT SPECIES	I	528	24/08/00	16:30	CC		11	PS	11
Zanette, L. R. S.	1162	BIOLOGY OF ISODONTIA FUSCIPENNIS COMPLEX IN TRAP-NESTS (HYMENOPTERA: SPHECIDAE)	I	293	25/08/00	16:30	CC		6	PS	6
Zanette, L. R. S.	498	COMPOSITION AND RELATIVE ABUNDANCE OF HYMENOPTERA FAMILIES IN TWO URBAN AREAS OF BELO HORIZONTE, MINAS GERAIS, BRAZIL	I	126	22/08/00	16:30	CC		3	PS	3
Zanetti, R.	1895	MANAGEMENT PROGRAMS FOR LEAF CUTTING ANTS IN BRAZIL	I	478	26/08/00	15:50	HB	M	10	10	10
Zanetti, R.	2865	EFFICIENCY OF MIREX-S MAX (SULFLURAMID 0.3%) BAIT AGAINST ATTA SEXDENS RUBROPILOSA AND ACROMYRMEX OCTOSPINOSUS (HYMENOPTERA: FORMICIDAE)	II	723	24/08/00	16:30	CC		14	PS	14
Zanetti, R.	2614	EFFECT OF NITROGEN FERTILIZATION ON THE RESISTANCE OF CORN PLANTS TO THE ATTACK OF FALL ARMYWORM (LEPIDOPTERA: NOCTUIDAE)	II	660	21/08/00	16:30	CC		14	PS	14
Zanetti, R.	218	DETERMINATION OF INJURY AND DAMAGE OF THE MEALYBUG DYSMICOCCUS BREVIPES (HEMIPTERA: PSEUDOCOCCIDAE) IN PINEAPPLE	I	56	22/08/00	16:30	CC		2	PS	2
Zang, L.	341	THIAMETHOXAM USED AS SEED TREATMENT (CRUISER/ADAGE®), OR AS SOIL APPLICATION (ACTARA/PLATINUM®)	I	86	25/08/00	16:30	CC		2	PS	2
Zanic, K.	2864	CITRUS WHITEFLY, DIALEURODES CITRI (HOMOPTERA: ALEYRODIDAE) IN ADRIATIC REGION OF CROATIA	II	723	25/08/00	16:30	CC		14	PS	14
Zanic, K.	258	GIANT BLACK BARK PEACH APHID PTEROCHLOROIDES PERSICAE (HOMOPTERA: LACNIDAE)	I	66	23/08/00	16:30	CC		2	PS	2
Zaniou, A.	2265	CLONING OF THE ACIDIC RIBOSOMAL P-PROTEINS IN THE SILKMOTH BOMBYX MORI	I	572	22/08/00	16:30	CC		12	PS	12
Zannat, A.	468	BIODIVERSITY OF THE PARASITIC HYMENOPTERA IN A COASTAL MANGROVE FOREST OF BANGLADESH	I	119	21/08/00	16:30	CC		3	PS	3
Zanol, K. M. R.	3866	SCAPHYTOPIUS (CICADELLIDAE, SCAPHYTOPIINI): DESCRIPTION OF TWELVE NEW SPECIES FROM SOUTH AMERICA	II	976	25/08/00	16:30	CC		21	PS	21
Zanuncio, J. C.	587	EFFECTS OF PHEROMONES IN ARTIFICIAL DIETS FOR PREDATORY BUGS	I	149	22/08/00	9:50	Bol	S	4	2	4
Zanuncio, J. C.	1887	USE OF STRIPS OF NATIVE VEGETATION WITHIN EUCALYPTUS PLANTATIONS AS A STRATEGY TO REDUCE LEPIDOTERA PEST POPULATIONS	I	476	26/08/00	13:35	HB	M	10	10	10
Zanuncio, J. C.	1950	MONITORING OF LEPIDOPTERA DEFOLIATORS OF EUCALYPTUS IN NIQUELÂNDIA, STATE OF GOIÁS, BRAZIL	I	491	23/08/00	16:30	CC		10	PS	10
Zanuncio, J. C.	1816	ENVIRONMENTAL DIVERSITY IN A EUCALYPTUS PLANTATION AFFECTS NUMBERS OF SARSINA VIOLASCENS (LEPIDOPTERA: LYMANTRIIDAE) ADULTS?	I	458	21/08/00	11:50	HB	M	10	1	10
Zanuncio, J. C.	1701	HYMENOPTERAN NATURAL ENEMIES IN A EUCALYPTUS PLANTATION IN IPABA, STATE OF MINAS GERAIS, BRAZIL	I	429	21/08/00	16:30	CC		8	PS	8
Zanuncio, J. C.	1829	POTENTIAL USE OF ASOPINAE STINKBUG BUG PREDATORS IN BRAZIL	I	461	22/08/00	11:20	HB	M	10	2	10
Zanuncio, J. C.	1895	MANAGEMENT PROGRAMS FOR LEAF CUTTING ANTS IN BRAZIL	I	478	26/08/00	15:50	HB	M	10	10	10
Zanuncio, J. C.	1910	FAUNA OF LEPIDOPTERA IN A TRANSECT OF NATIVE VEGETATION- EUCALYPTUS PLANTATION IN IPABA, MINAS GERAIS, BRAZIL	I	481	23/08/00	16:30	CC		10	PS	10

Sub-titles: (HB=Hotel Bourbon) - (HM=Hotel Mabu) - (CC=Convention Center) - (Bol=Foz Boulevard) - (PS=Poster Session) - (PL=Plenary Lecturer)

AUTHOR	Nº	TITLE	Book	Page	Date	Time	Local	Room	Session	Symp	New Session
Zanuncio, J. C.	1938	SPATIAL DISTRIBUTION OF NESTS OF THE LEAF CUTTING ANT ATTA SEXDENS RUBROPILOSA (HYMENOPTERA: FORMICIDAE) IN PLANTATIONS OF EUCALYPTUS UROPHYLLA IN BRAZIL	I	488	23/08/00	16:30	CC		10	PS	10
Zanuncio, J. C.	1953	DEVELOPMENT OF PSILOPTERA SP. (COLEOPTERA: BUPRESTIDAE) IN STUMPS OF PINUS CARIBAEA, IN THE NORTHEAST REGION OF THE STATE OF BAHIA, BRAZIL	I	492	24/08/00	16:30	CC		10	PS	10
Zanuncio, J. C.	1954	OCCURRENCE OF PSILOPTERA SP. (COLEOPTERA: BUPRESTIDAE) DAMAGING PLANTS OF EUCALYPTUS SPP., IN THE NORTHEAST REGION OF BAHIA, BRAZIL	I	492	24/08/00	16:30	CC		10	PS	10
Zanuncio, J. C.	1984	EFFECT OF FEEDING ON THREE EUCALYPTUS SPECIES ON THE DEVELOPMENT OF BRONTOCORIS TABIDUS (HET.: PENTATOMIDAE) FED WITH TENEBRIO MOLITOR (COL.: TENEBRIONIDAE)	I	500	25/08/00	16:30	CC		10	PS	10
Zanuncio, J. C.	1985	LEPIDOPTERAN COLLECTED IN AN EUCALYPTUS PLANTATION IN GOIÁS, BRAZIL, FROM MAY 1995 TO APRIL 1996 - EFFECT OF TEMPERATURE AND RAINFALL ON POPULATION DYNAMICS	I	500	25/08/00	16:30	CC		10	PS	10
Zanuncio, J. C.	2865	EFFICIENCY OF MIREX-S MAX (SULFLURAMID 0.3%) BAIT AGAINST ATTA SEXDENS RUBROPILOSA AND ACROMYRMEX OCTOSPINOSUS (HYMENOPTERA: FORMICIDAE)	II	723	24/08/00	16:30	CC		14	PS	14
Zanuncio, J. C.	1474	PARASITISM RATE AND VIABILITY OF TRICHOGRAMMA MAXACALII (HYM.: TRICHOGRAMMATIDAE) ON EGGS OF THE EUCALYPTUS DEFOLIATOR EUSELASIA APISAON (LEP.: RIODINIDAE)	I	372	26/08/00	11:05	HM	O	8	8	8
Zanuncio, J. C.	1849	OCCURRENCE OF HYMENOPTERA PARASITOIDS IN LARVAE OF PHORACANTHA SEMIPUNCTATA (COLEOPTERA: CERAMBYCIDAE)	I	466	23/08/00	16:05	HB	M	10	4	10
Zanuncio, J. C.	1926	PATTERNS OF SPECIES RICHNESS AND ABUNDANCE OF DEFOLIATOR LEPIDOPTERA ASSOCIATED WITH EUCALYPTUS GRANDIS IN BRAZIL AND HOW THEY RELATE TO PLANT AGE	I	485	22/08/00	16:30	CC		10	PS	10
Zanuncio, J. C.	375	STRESS BY SUBLETHAL DOSES OF PYRETHROIDS ON THE DEVELOPMENT, SURVIVAL AND WEIGHT OF SUPPUTIUS CINCTICEPS (HETEROPTERA: PENTATOMIDAE)	I	95	22/08/00	16:30	CC		2	PS	2
Zanuncio, J. C.	1681	QUANTITATIVE MASS PRODUCTION OF THE STINKBUG PREDATOR PODISUS NIGRISPINUS (HETEROPTERA: PENTATOMIDAE)	I	424	25/08/00	16:30	CC		8	PS	8
Zanuncio, J. C.	1962	INFLUENCE OF STRIPS OF NATIVE VEGETATION IN PLANTATIONS OF EUCALYPTUS CLOËZIANA ON POPULATION OF OXYDIA VESULIA.	I	494	24/08/00	16:30	CC		10	PS	10
Zanuncio, J. C.	1690	ENVIRONMENTAL AND PREY INTERACTION ON THE DEVELOPMENT AND REPRODUCTION OF THE STINKBUG PREDATOR PODISUS NIGRISPINUS	I	426	25/08/00	16:30	CC		8	PS	8
Zanuncio, T. V.	375	STRESS BY SUBLETHAL DOSES OF PYRETHROIDS ON THE DEVELOPMENT, SURVIVAL AND WEIGHT OF SUPPUTIUS CINCTICEPS (HETEROPTERA: PENTATOMIDAE)	I	95	22/08/00	16:30	CC		2	PS	2
Zanuncio, T. V.	1701	HYMENOPTERAN NATURAL ENEMIES IN A EUCALYPTUS PLANTATION IN IPABA, STATE OF MINAS GERAIS, BRAZIL	I	429	21/08/00	16:30	CC		8	PS	8
Zanuncio, T. V.	1816	ENVIRONMENTAL DIVERSITY IN A EUCALYPTUS PLANTATION AFFECTS NUMBERS OF SARSINA VIOLASCENS (LEPIDOPTERA: LYMANTRIIDAE) ADULTS?	I	458	21/08/00	11:50	HB	M	10	1	10
Zanuncio, T. V.	1887	USE OF STRIPS OF NATIVE VEGETATION WITHIN EUCALYPTUS PLANTATIONS AS A STRATEGY TO REDUCE LEPIDOTERA PEST POPULATIONS	I	476	26/08/00	13:35	HB	M	10	10	10
Zanuncio, T. V.	1962	INFLUENCE OF STRIPS OF NATIVE VEGETATION IN PLANTATIONS OF EUCALYPTUS CLOËZIANA ON POPULATION OF OXYDIA VESULIA.	I	494	24/08/00	16:30	CC		10	PS	10
Zanuncio, T. V.	1984	EFFECT OF FEEDING ON THREE EUCALYPTUS SPECIES ON THE DEVELOPMENT OF BRONTOCORIS TABIDUS (HET.: PENTATOMIDAE) FED WITH TENEBRIO MOLITOR (COL.: TENEBRIONIDAE)	I	500	25/08/00	16:30	CC		10	PS	10
Zanuncio, T. V.	1926	PATTERNS OF SPECIES RICHNESS AND ABUNDANCE OF DEFOLIATOR LEPIDOPTERA ASSOCIATED WITH EUCALYPTUS GRANDIS IN BRAZIL AND HOW THEY RELATE TO PLANT AGE	I	485	22/08/00	16:30	CC		10	PS	10
Zanuncio, T. V.	1950	MONITORING OF LEPIDOPTERA DEFOLIATORS OF EUCALYPTUS IN NIQUELÂNDIA, STATE OF GOIÁS, BRAZIL	I	491	23/08/00	16:30	CC		10	PS	10
Zanuncio, T. V.	1985	LEPIDOPTERAN COLLECTED IN AN EUCALYPTUS PLANTATION IN GOIÁS, BRAZIL, FROM MAY 1995 TO APRIL 1996 - EFFECT OF TEMPERATURE AND RAINFALL ON POPULATION DYNAMICS	I	500	25/08/00	16:30	CC		10	PS	10
Zapater, M. C.	1702	EXPLORATION IN ARGENTINA FOR POTENTIAL BIOLOGICAL CONTROL AGENTS OF HELIOTROPIUM AMPLEXICAULE, AN INVASIVE WEED IN EASTERN AUSTRALIA	I	429	25/08/00	16:30	CC		8	PS	8
Zappalà, L.	1487	STATUS OF BIOLOGICAL CONTROL OF THE CITRUS LEAFMINER (PHYLLOCNISTIS CITRELLA) IN ITALY	I	375	21/08/00	16:30	CC		8	PS	8
Zara, F. J.	3202	THE SALIVARY GLANDS OF PACHYCONDYLA (= NEOPONERA) VILLOSA (HYMENOPTERA: FORMICIDAE) LARVA: FUNCTIONAL CHANGES IN LAST INSTAR	II	808	25/08/00	16:30	CC		16	PS	16
Zartaloudis, Z. D.	2083	COMBINED APPLICATION OF MATING DISRUPTION AND BACILLUS THURINGIENSIS FOR CONTROL OF THE BERRY MOTH IN GREEK ISLANDS, LIMNOS AND SAMOS	I	525	22/08/00	16:30	CC		11	PS	11
Zartaloudis, Z. D.	2111	EFFICACY OF SPINOSAD NATURALYTE INSECT CONTROL AGAINST LOBESIA BOTRANA (LEPIDOPTERA: TORTRICIDAE) ON GREEK VINEYARDS	I	532	23/08/00	16:30	CC		11	PS	11
Zatwarnicki, T.	3663	A PHYLOGENETIC STUDY OF THE TRIBE DRYXINI (DIPTERA: EPHYDRIDAE)	II	925	24/08/00	11:05	HB	E	21	6	21
Zaviezo, T.	407	CONSERVATION OF THE BIODIVERSITY OF INSECTS IN CHILE	I	103	23/08/00	10:50	HB	C	3	3	3
Zaviezo, T.	541	THE SOCIEDAD CHILENA DE ENTOMOLOGIA	I	137	24/08/00	16:30	CC		3	PS	3
Zawadneak, M. A. C.	2762	FIRST RECORD OF NEOHYDATOTHRIPS SAMAYUNKUR (THYSANOPTERA:THRIPIDAE) IN BRAZIL	II	697	23/08/00	16:30	CC		14	PS	14
Zborowski, P.	1811	INSECTS IN THE TROPICAL LAND-USE MOSAIC – THE IMPACT OF AGRICULTURAL AND FOREST DEVELOPMENT	I	457	21/08/00	9:50	HB	M	10	1	10
Zdarek, J.	2538	THE ROLE OF MOULTING HORMONE IN DETERMINATION OF PUPARIATION BEHAVIOUR IN FLIES	II	641	25/08/00	16:30	CC		13	PS	13
Zdarkova, E.	4097	MITES OF STORED HAZELNUTS IN TURKEY	II	1034	24/08/00	16:30	CC		23	PS	23
ďárková, E.	41	THE CARBOHYDRAZES OF THREE ACAROID MITES (ACARI: ACARIDIDA) – PRELIMINARY RESULTS	I	11	23/08/00	16:30	CC		1	PS	1
ďárková, E.	42	THE FOOD INTERACTIONS BETWEEN THREE ACAROID MITES (ACARI: ACARIDIDA) AND SOME MICROMYCETES	I	11	23/08/00	16:30	CC		1	PS	1
Zdárková, E.	74	NUMBER OF PREY NECESSARY FOR COMPLETING DEVELOPMENT OF CHEYLETUS ERUDITUS (ACARINA: CHEYLETIDAE)	I	19	25/08/00	16:30	CC		1	PS	1
Zebitz, C. P. W.	1544	SURVEY FOR NATIVE TRICHOGRAMMATID SPECIES IN KENYA	I	389	22/08/00	16:30	CC		8	PS	8
Zefa, E.	3867	BEHAVIOUR, BIOACUSTIC, PHALLIC SCLERITES AND CYTOGENETIC IN SOME SPECIES OF THE GENUS ENDECOUS (ORTHOPTERA, PHALANGOPSIDAE)	II	976	22/08/00	16:30	CC		21	PS	21
Zelazowska, M.	3146	DIFFERENT MECHANISMS ENSURE THE FLOW OF CYTOPLASMIC CONSTITUENTS IN NURSE CELL-OOCYTE SYNCYTIA	II	794	23/08/00	16:30	CC		16	PS	16
Zelenay, S.	4086	ANALYSIS OF VARIATION OF SPECIFIC CHARACTERS OF CULEX (CULEX) IN TWO ENVIROMENTS AND DETECTION OF NEW SPECIES IN THE CITY OF BUENOS AIRES	II	1032	23/08/00	16:30	CC		23	PS	23
Zeng, B.	1432	IN VITRO REARING OF TRICHOGRAMMA OSTRINIAE PANG ET CHENS	I	361	21/08/00	15:05	HM	O	8	2	8
Zeng, L.	3996	INTEGRATED MEASURES FOR CONTROLLING THE DIAMONDBACK MOTH (DBM) IN SOUTHERN CHINA	II	1008	25/08/00	16:30	CC		22	PS	22
Zeng, L.	4001	EFFECTS OF INTEGRATED MEASURES FOR CONTROLLING THE DIAMONBACK MOTH (DBM) ON ARTHROPOD DIVERSITIES IN VEGETABLE PLANTATIONS	II	1010	25/08/00	16:30	CC		22	PS	22

Sub-titles: (HB=Hotel Bourbon) - (HM=Hotel Mabu) - (CC=Convention Center) - (Bol=Foz Boulevard) - (PS=Poster Session) - (PL=Plenary Lecturer)

AUTHOR	Nº	TITLE	Book	Page	Date	Time	Local	Room	Session	Symp	New Session
Zeng, P.	3262	RECENT PROGRESS IN GENOMIC MAPPING IN BOMBYX MORI: WHERE SHOULD WE GO FROM HERE?	II	824	22/08/00	9:35	HB	K	18	2	18
Zeng, X. N.	1416	COMPARISON OF ROTENONE CONTENT AND INSECT BIOACTIVITY BETWEEN ROOTS AND CALLUS CULTURES OF DERRIS ELLIPTICA	I	357	25/08/00	16:30	CC		7	PS	7
Zeng, Z.	1094	DYNAMIC STATE VARIABLE MODEL OF OPTIMAL CLUTCH SIZE IN UROPHORA AFFINIS (DIPTERA: TEPHRITIDAE) ON SPOTTED KNAPWEED, CENTAUREA MACULOSA	I	276	24/08/00	16:30	CC		6	PS	6
Zenz, N.	273	LIFE-TIME ACTIVITY BUDGET OF MANGO (MARULA) FRUIT FLY, CERATITIS COSYRA, AND ITS RESPONSE TO ATTRACTANTS	I	69	23/08/00	16:30	CC		2	PS	2
Zeppelini, D. F.	3868	"COECUS GROUP", A PHYLOGENETIC ANALYSIS TO REVIEW THE STACH'S STATEMENTS. (COLLEMBOLA : ARRHOPALITIDAE)	II	976	25/08/00	16:30	CC		21	PS	21
Zequi, J. A. C.	4115	CULEX SALTANENSIS EGG AND IMMATURE MORPHOMETRICS OBTAINED IN LABORATORY AND FIELD	II	1039	25/08/00	16:30	CC		23	PS	23
Zerba, E.	1385	DETECTION AND MONITORING OF INSECTICIDE RESISTANCE IN TRIATOMA INFESTANS AND RHODNIUS PROLIXUS	I	349	24/08/00	16:30	CC		7	PS	7
Zerba, E.	4092	OVICIDAL EFFECT AND EMBRYO RESISTANCE TO INSECTICIDES IN PEDICULUS CAPITIS (PHTHIRAPTERA, PEDICULIDAE)	II	1033	23/08/00	16:30	CC		23	PS	23
Zerba, E.	668	NITROGENOUS COMPOUNDS AS ATTRACTANTS OF TRIATOMA INFESTANS	I	169	22/08/00	16:30	CC		4	PS	4
Zerba, E.	2622	INSECT DEVELOPMENT DELAY PRODUCED BY WITHANOLIDES FROM SOLANACEAE	II	662	22/08/00	16:30	CC		14	PS	14
Zerba, E.	4099	SYNERGIZED PYRETHROIDS FOR THE CONTROL OF PERMETHRIN RESISTANT HEAD LICE PEDICULUS CAPITIS (PHTHIRAPETRA, PEDICULIDAE)	II	1035	21/08/00	16:30	CC		23	PS	23
Zerba, E.	667	COPULATION PHEROMONE OF THE VECTOR OF CHAGAS DISEASE, TRIATOMA infestans: IDENTIFICATION AND BIOASSAY	I	169	22/08/00	16:30	CC		4	PS	4
Zerba, E.	4100	REVERSION OF PERMETHRIN RESISTANCE BY INSECTICIDE SYNERGISTS IN THE HEADLICE PEDICULUS CAPITIS (PHTHIRAPTERA, PEDICULIDAE).	II	1035	21/08/00	16:30	CC		23	PS	23
Zerm, M.	390	DIVERSITY AND LIFE HISTORY TRAITS OF TIGER BEETLES (COLEOPTERA: CICINDELIDAE) FROM CENTRAL AMAZONIA (BRAZIL)	I	99	22/08/00	11:20	HB	C	3	2	3
Zhang, Y. M.	2935	MICROBIAL PESTICIDES FOR MOSQUITO CONTROL IN CHINA: CURRENT AND FUTURE CONSIDERATIONS	II	741	25/08/00	15:00	Bol	R	15	10	15
Zhang, A.	740	LOOKING AT PESTS THROUGH THE ANTENNAE OF THEIR PARASITES: HOST PHEROMONES AND BIOCONTROL	I	187	25/08/00	16:30	CC		4	PS	4
Zhang, A.	589	SEMIOCHEMICAL COEVOLUTION BETWEEN HETEROPTERA AND THEIR TACHINID FLY PARASITOIDS: GAS CHROMATOGRAPHY-ELECTROANTENNOGRAM DETECTION AND BEHAVIOR	I	149	22/08/00	11:20	Bol	S	4	2	4
Zhang, A. B.	691	MONITORING MASSON PINE CATERPILLAR (DENDROLIMUS PUNCTATUS (WALKER)) WITH SYNTHETIC SEX PHEROMONE IN CHINA	I	175	23/08/00	16:30	CC		4	PS	4
Zhang, F.	742	INFLUENCES OF PLANT-DERIVED SEMIOCHEMICALS ON BEHAVIOR OF APHIDS	I	187	22/08/00	16:30	CC		4	PS	4
Zhang, H.	3028	THE DISCOVERY OF NATURAL FOCI OF TSUTSUGAMUSHI DISEASE IN SOUTHERN SHANXI PROVINCE, NORTH CHINA, AND ITS ZOO-EPIDEMIOLOGIC FEATURES	II	764	25/08/00	16:30	CC		15	PS	15
Zhang, H.	3029	THE PROGRESS AND TENDENCY OF THE CHEMICAL MEASURES ON CONTROLLING THE HYGIENIC PESTS IN CHINA	II	764	25/08/00	16:30	CC		15	PS	15
Zhang, H.-j.	75	NOTE ON A NEW LAELAPTID MITE FROM SHANXI PROVINCE, CHINA (ACARINA: LAELAPTIDAE)	I	19	24/08/00	16:30	CC		1	PS	1
Zhang, J.	3028	THE DISCOVERY OF NATURAL FOCI OF TSUTSUGAMUSHI DISEASE IN SOUTHERN SHANXI PROVINCE, NORTH CHINA, AND ITS ZOO-EPIDEMIOLOGIC FEATURES	II	764	25/08/00	16:30	CC		15	PS	15
Zhang, J.	3029	THE PROGRESS AND TENDENCY OF THE CHEMICAL MEASURES ON CONTROLLING THE HYGIENIC PESTS IN CHINA	II	764	25/08/00	16:30	CC		15	PS	15
Zhang, J.	4048	THE INFORMATION OF URBAN MEDICAL INSECTS MANAGEMENT SYSTEM	II	1022	24/08/00	11:00	HB	J	23	8	23
Zhang, J. R.	3047	ALLATOSTATINS AND THE REGULATION OF THE CORPORA ALLATA IN A COCKROACH	II	769	22/08/00	11:05	HB	G	16	2	16
Zhang, J.-L.	75	NOTE ON A NEW LAELAPTID MITE FROM SHANXI PROVINCE, CHINA (ACARINA: LAELAPTIDAE)	I	19	24/08/00	16:30	CC		1	PS	1
Zhang, K.	1267	INSECTICIDE RESISTANCE GENES IN CULEX PIPIENS COMPLEX MOSQUITOES FROM CHINA	I	320	24/08/00	15:50	HM	N	7	8	7
Zhang, M.	943	INFERRING ACTIVITIES AND POPULATION DENSITY FROM INCIDENTAL SOILBORNE SOUNDS OF WHITE GRUBS	I	238	21/08/00	16:30	CC		6	PS	6
Zhang, Q. H.	741	ANTENNAL AND BEHAVIORAL RESPONSES TO NONHOST ANGIOSPERM LEAF AND BARK VOLATILES BY CONIFER INSECT	I	187	25/08/00	16:30	CC		4	PS	4
Zhang, R.	4175	EFFECTS OF LITCHI ORCHARD GROUNDCOVER ON ARTHROPOD COMMUNITIES	II	1054	21/08/00	16:30	CC		Erratum	PS	6
Zhang, R. Z.	3241	APHID PROBING EVENTS IN AN ANOMALOUS VIRUS TRANSMISSION	II	818	24/08/00	16:30	CC		17	PS	17
Zhang, X.	1704	APPLIED TECHNOLOGY OF PEST CONTROLLING BY TRICHOGRAMMA FROM ARTIFICIAL HOST EGG IN SHANXI, CHINA	I	429	25/08/00	16:30	CC		8	PS	8
Zhang, Y.	1464	USING GREENHOUSE ENVIRONMENT TO AUGMENT BIOLOGICAL CONTROL	I	369	24/08/00	13:35	HM	O	8	7	8
Zhang, Y. X.	76	CAUSES OF MITE PEST OUTBREAKS IN BAMBOO FORESTS IN FUJIAN, CHINA: ANALYSES OF MITE DAMAGE IN MONOCULTURE VERSUS POLYCULTURE STANDS	I	19	25/08/00	16:30	CC		1	PS	1
Zhang, Y. X.	77	POTENTIAL OF AMBLYSEIUS CUCUMERIS (ACARI: PHYTOSEIIDAE) AS A BIOCONTROL AGENT AGAINST SCHIZOTETRANYCHUS NANJINGENSIS (ACARI: TETRANYCHIDAE) IN CHINA	I	20	25/08/00	16:30	CC		1	PS	1
Zhang, Y. X.	1986	KEY FACTORS AFFECTING POPULATIONS OF SCHIZOTETRANYCHUS NANJINGENSIS, APONYCHUS CORPUZAE AND ACULUS BAMBUSAE IN FUJIAN BAMBOO FORESTS DURING DIFFERENT SEASONS: AN ANALYSIS USING METHODS OF GREY SEQUENCE	I	500	21/08/00	16:30	CC		10	PS	10
Zhang, Y. X.	2866	AN OVERVIEW OF OCCURRENCE, DEVELOPMENT AND DAMAGE OF BAMBOO MITES AND THEIR INTEGRATED MANAGEMENT IN FUJIAN, CHINA	II	723	22/08/00	16:30	CC		14	PS	14
Zhang, Y. X.	49	CHECKLIST OF MITES FROM MOSO BAMBOO IN FUJIAN, CHINA	I	13	23/08/00	16:30	CC		1	PS	1
Zhang, Z.	1574	STUDIES ON THE KAIROMONE INFLUENCING PARASITE OF TRICHOGRAMMA OSTRINIAE ON ARTIFICIAL EGGS	I	397	23/08/00	16:30	CC		8	PS	8
Zhang, Z.	2822	A STUDY ON LIRIMYZA SATIVAE	II	712	25/08/00	16:30	CC		14	PS	14
Zhang, Z. H.	3384	CATHEPSIN B-LIKE CYSTEINE PROTEINASE FROM HELICOVERPA ARMIGERA	II	854	25/08/00	16:30	CC		18	PS	18
Zhang, Z. N.	742	INFLUENCES OF PLANT-DERIVED SEMIOCHEMICALS ON BEHAVIOR OF APHIDS	I	187	22/08/00	16:30	CC		4	PS	4
Zhang, Z. Q.	49	CHECKLIST OF MITES FROM MOSO BAMBOO IN FUJIAN, CHINA	I	13	23/08/00	16:30	CC		1	PS	1
Zhang, Z. Q.	76	CAUSES OF MITE PEST OUTBREAKS IN BAMBOO FORESTS IN FUJIAN, CHINA: ANALYSES OF MITE DAMAGE IN MONOCULTURE VERSUS POLYCULTURE STANDS	I	19	25/08/00	16:30	CC		1	PS	1
Zhang, Z. Q.	77	POTENTIAL OF AMBLYSEIUS CUCUMERIS (ACARI: PHYTOSEIIDAE) AS A BIOCONTROL AGENT AGAINST SCHIZOTETRANYCHUS NANJINGENSIS (ACARI: TETRANYCHIDAE) IN CHINA	I	20	25/08/00	16:30	CC		1	PS	1
Zhang, Z. Q.	2866	AN OVERVIEW OF OCCURRENCE, DEVELOPMENT AND DAMAGE OF BAMBOO MITES AND THEIR INTEGRATED MANAGEMENT IN FUJIAN, CHINA	II	723	22/08/00	16:30	CC		14	PS	14
Zhang, Z. Q.	1986	KEY FACTORS AFFECTING POPULATIONS OF SCHIZOTETRANYCHUS NANJINGENSIS, APONYCHUS CORPUZAE AND ACULUS BAMBUSAE IN FUJIAN BAMBOO FORESTS DURING DIFFERENT SEASONS: AN ANALYSIS USING METHODS OF GREY SEQUENCE	I	500	21/08/00	16:30	CC		10	PS	10
Zhantiev, R.D.	1734	VIBRATIONAL COMMUNICATION IN ORTHOPTERA	I	437	22/08/00	16:15	HB	F	9	3	9

Sub-titles: (HB=Hotel Bourbon) - (HM=Hotel Mabu) - (CC=Convention Center) - (Bol=Foz Boulevard) - (PS=Poster Session) - (PL=Plenary Lecturer)

AUTHOR	Nº	TITLE	Book	Page	Date	Time	Local	Room	Session	Symp	New Session
Zhao, D.	3319	OOGENESIS IN DROSOPHILA	II	838	22/08/00	16:30	CC		18	PS	18
Zhao, H.	4048	THE INFORMATION OF URBAN MEDICAL INSECTS MANAGEMENT SYSTEM	II	1022	24/08/00	11:00	HB	J	23	8	23
Zhao, J.	3895	BT AND THE TRANSGENICS' FUTURE IN IPM PROGRAMS-INTEGRATION AND RESISTANCE	II	983	24/08/00	14:30	HB	J	22	4	22
Zhao, T.	2920	STUDIES OF WOLBACHIA IN CULEX PIPIENS COMPLEX IN CHINA	II	737	25/08/00	9:35	Bol	R	15	9	15
Zhao, T.	2921	STUDIES ON THE POSSIBILITY OF TRANSMISSION OF DENGUE VIRUS BY CULEX PIPIENS QUINQUEFASCIATUS IN LABORATORY	II	737	25/08/00	9:50	Bol	R	15	9	15
Zhao, T.	4048	THE INFORMATION OF URBAN MEDICAL INSECTS MANAGEMENT SYSTEM	II	1022	24/08/00	11:00	HB	J	23	8	23
Zhao, X. F.	3384	CATHEPSIN B-LIKE CYSTEINE PROTEINASE FROM HELICOVERPA ARMIGERA	II	854	25/08/00	16:30	CC		18	PS	18
Zhao, Y.	2380	NEUROPEPTIDE CONTROL OF INSECT HINDGUT REABSORPTION: RECENT MOLECULAR ADVANCES	II	601	25/08/00	11:05	HB	I	13	8	13
Zheng, L.	2230	POLYMORPHIC MICROSATELLITE MARKERS TO ASSESS THE GENETIC VARIABILITY IN THE MEDITERRANEAN FRUIT FLY, CERATITIS CAPITATA, SPECIES RANGE	I	563	21/08/00	16:30	CC		12	PS	12
Zheng, S.-C.	1320	AN RNA HELICASE OF THE "DEAD BOX" FAMILY CLONED FROM A LEPIDOPTERAN SPECIES, THE SPRUCE BUDWORM (CHORISTONEURA FUMIFERANA)	I	333	22/08/00	16:30	CC		7	PS	7
Zheng, S.-C.	3325	GLUTATHIONE S-TRANSFERASE FROM THE SPRUCE BUDWORM, CHORISTONEURA FUMIFERANA: IDENTIFICATION, CHARACTER-IZATION, LOCALIZATION, CDNA CLONING, DEVELOPMENTAL EXPRESSION AND INDUCTION BY VARIOUS FACTORS	II	840	21/08/00	16:30	CC		18	PS	18
Zhioua, E.	2168	MICROBIAL CONTROL OF IXODES SCAPULARIS	I	547	25/08/00	16:30	CC		11	PS	11
Zhong, J. H.	3389	TERMITE FAUNA IN CHINA, AND THEIR ECONOMIC IMPORTANCE	II	856	21/08/00	10:35	HM	Q	19	1	19
Zhong, P. S.	3996	INTEGRATED MEASURES FOR CONTROLLING THE DIAMONDBACK MOTH (DBM) IN SOUTHERN CHINA	II	1008	25/08/00	16:30	CC		22	PS	22
Zhong, P. S.	4001	EFFECTS OF INTEGRATED MEASURES FOR CONTROLLING THE DIAMONBACK MOTH (DBM) ON ARTHROPOD DIVERSITIES IN VEGETABLE PLANTATIONS	II	1010	25/08/00	16:30	CC		22	PS	22
Zhong-qi, Y.	1870	MASS REARING OF THE NATIVE ENDOPARASITOID CHOUIOIA CUNEA (HYMENOPTERA: EULOPHIDAE) AND ITS SUCCESSFUL USE FOR CONTROL OF THE INTRODUCED FALL WEBWORM IN CHINA	I	471	25/08/00	11:05	HB	M	10	7	10
Zhou, B.	3288	CROSS TALK BETWEEN ECDYSTEROIDS AND JUVENILE HORMONE AT THE CELLULAR LEVEL	II	830	23/08/00	15:05	HB	K	18	5	18
Zhou, G.	1703	THE RELATIONSHIP OF STEM BORER COMPOSITION IN MAIZE TO PARASITOID DIVERSITY	I	429	25/08/00	16:30	CC		8	PS	8
Zhou, J. X.	739	PRELIMINARY STUDY ON THE BEHAVIOR OF SELECTING HOST OF LONGHORNED BEETLES AND THE ROLE OF THEIR SENSE ORGANS IN THIS PROCESS	I	187	25/08/00	16:30	CC		4	PS	4
Zhou, X. D.	1987	OPHIOSTOMATOID FUNGI ASSOCIATED WITH THREE BARK BEETLES IN SOUTH AFRICA	I	501	25/08/00	16:30	CC		10	PS	10
Zhou, Y.	1704	APPLIED TECHNOLOGY OF PEST CONTROLLING BY TRICHOGRAMMA FROM ARTIFICIAL HOST EGG IN SHANXI, CHINA	I	429	25/08/00	16:30	CC		8	PS	8
Zhu, J.	3301	ECDYSTEROID-TRIGGERED REGULATORY HIERARCHIES IN INSECT REPRODUCTION	II	834	25/08/00	14:05	HB	K	18	7	18
Zhu, W.	3261	ANGIOTENSIN CONVERTING ENZYME-LIKE ACTIVITY IN THE FLESHFLY NEOBELLIERIA BULLATA	II	824	21/08/00	16:15	HB	K	18	1	18
Zhuzhikov, D. P.	2420	PROTEINASE INHIBITORS IN THE MIDGUT OF THE COCKROACH	II	611	21/08/00	16:30	CC		13	PS	13
Ziemnicka, J.	2099	GENETIC CHARACTERIZATION OF BACULOVIRUS SsMNPV, A PATHOGEN OF STILPNOTIA SALICIS (LYMANTRIIDAE) ISOLATED IN POLAND	I	529	23/08/00	16:30	CC		11	PS	11
Zillikens, A.	398	HOW FAR NORTH AND SOUTH DOES THE APIFAUNA OF AMAZONIA REACH, ESPECIALLY THE BEE SPECIES VISITING MASS-FLOWERING TREES	I	101	22/08/00	15:05	HB	C	3	2	3
Zillikens, A.	1219	UNUSUAL NEST SUBSTRATE OF AN AUGOCHLORINE BEE WITH DESCRIPTION OF NEST STRUCTURE AND POLLEN RESOURCES	I	307	25/08/00	16:30	CC		6	PS	6
Zimmermann, M.	3859	PATTERN OF PHYLOGENETIC RELATIONSHIPS AMONG MEMBERS OF THE TRIBE MELITAEINI (LEPIDOPTERA: NYMPHALIDAE) INFERRED FROM MITOCHONDRIAL DNA SEQUENCES	II	974	25/08/00	16:30	CC		21	PS	21
Ziobro, G.C.	2913	ALLERGENIC MITES: AN EMERGING FOOD SAFETY ISSUE	II	735	24/08/00	11:35	Bol	R	15	7	15
Zitoudi, K.	2327	LIFE CYCLE, MORPHOLOGICAL AND GENETIC VARIATION IN CLONES OF MYZUS PERSICAE (HOMOPTERA: APHIDIDAE)	I	587	25/08/00	16:30	CC		12	PS	12
Zografou, E. N.	1577	COMPOSITION AND EFFICIENCY OF A YEAST FREE LARVAL DIET FOR THE MEDITERRANEAN FRUIT FLY	I	398	23/08/00	16:30	CC		8	PS	8
Zorzenon, F. J.	3535	USE OF ABOVE GROUND 0,5% HEXAFLUMURON BAITS (RECRUIT* AG) IN THE CONTROL OF COPTOTERMES HAVILANDI (ISOPTERA: RHINOTERMITIDAE) IN CONSTRUCTIONS LOCATED IN SÃO PAULO, SP, BRAZIL	II	892	24/08/00	16:30	CC		19	PS	19
Zorzenon, F. J.	3506	FORAGING POPULATION AND TERRITORY OF THE SUBTERRANEAN TERMITE COPTOTERMES HAVILANDI (ISOPTERA : RHINOTERMITIDAE) BY THE TRIPLE MARKED RECAPTURE METHOD IN AN URBAN AREA	II	885	23/08/00	16:30	CC		19	PS	19
Zorzenon, F. J.	3507	FORAGING POPULATION AND TERRITORY OF THE SUBTERRANEAN TERMITE HETEROTERMES TENUIS (ISOPTERA : RHINOTERMITIDAE) BY THE TRIPLE MARKED RECAPTURE METHOD IN AN URBAN AREA	II	885	23/08/00	16:30	CC		19	PS	19
Zorzenon, F.J.	3449	FIELD EVALUATION OF A 0,5% HEXAFLUMURON BAIT (RECRUIT* II) FOR COLONY ELIMINATION OF THE SUBTERRANEAN TERMITE COPTOTERMES HAVILANDI (ISOPTERA : RHINOTERMITIDAE)	II	871	21/08/00	16:30	CC		19	PS	19
Zorzenon, F.J.	4165	FIELD EVALUATION OF A 0,5% HEXAFLUMURON BAIT (RECRUIT* II) FOR COLONY ELIMINATION OF SUBTERRANEAN TERMITE HETEROTERMES TENUIS (ISOPTERA : RHINOTERMITIDAE).	II	1052	21/08/00	16:30	CC		Erratum	PS	19
Zuben, C. J. Von	897	DISCRETE TIME MODEL OF POST-FEEDING LARVAL DISPERSAL IN BLOWFLIES	I	227	21/08/00	16:30	CC		6	PS	6
Zuben, C. J. Von C. J. Von	1220	PROPOSAL OF MODIFICATION IN LIFE TABLES TO STUDY THE EFFECT OF PROPORTIONAL MORTALITY DIFFERENCES ON LIFE EXPECTANCIES	I	307	25/08/00	16:30	CC		6	PS	6
Zucchi, R.	2475	ON THE EVOLUTION OF CASTE DIMORPHISM IN THE EPIPONINE WASPS: A PHYLOGENETIC PERSPECTIVE	II	625	23/08/00	16:30	CC		13	PS	13
Zucchi, R.	3456	THE CELL PROVISIONING AND OVIPOSITION PROCESS (POP) IN SOME SPECIES OF PARTAMONA (HYMENOPTERA, APIDAE, MELIPONINAE)	II	872	21/08/00	16:30	CC		19	PS	19
Zucchi, R. A.	1507	MOLECULAR KEY TO SOME BRAZILIAN SPECIES OF TRICHOGRAMMA USING ITS2 SEQUENCES AND RESTRICTION ANALYSIS	I	380	21/08/00	16:30	CC		8	PS	8
Zucchi, R. A.	1628	THE USE OF SUCTION TRAP TO COLLECT TRICHOGRAMMA SPECIES	I	410	22/08/00	16:30	CC		8	PS	8
Zucchi, R. A.	1629	CHARACTERIZATION OF THREE SPECIES OF THE GENUS TRICHOGRAMMA	I	411	22/08/00	16:30	CC		8	PS	8
Zucchi, R. A.	1764	DOES THE FRUIT SIZE INFLUENCE THE PARASITISM OF FRUGIVOROUS LARVAE BY EUCOILINAE SPECIES?	I	444	22/08/00	16:30	CC		9	PS	8
Zucchi, R. A.	2238	IDENTIFICATION OF TRICHOGRAMMA BASED ON THE SEQUENCE OF THE ITS2 REGION OF THE rDNA, WITH A NEW RECORD FROM BRAZIL	I	565	22/08/00	16:30	CC		12	PS	12
Zucchi, R. A.	181	FRUIT FLIES OF THE GENUS ANASTREPHA IN THE FRUIT PRODUCING REGION OF MOSSORO/ASSU, RIO GRANDE DO NORTE, BRAZIL	I	46	21/08/00	16:30	CC		2	PS	2
Zucchi, R. A.	796	TOWARDS A DATABASE FOR THE TRICHOGRAMMA SPECIES, THEIR HOSTS AND PLANT ASSOCIATIONS IN THE SOUTH AMERICA	I	201	24/08/00	16:30	CC		5	PS	5
Zucchi, T. D.	1375	BASES FOR AN INSECTICIDE RESISTANCE MANAGEMENT OF SPODOPTERA FRUGIPERDA IN CORN IN BRAZIL	I	347	24/08/00	16:30	CC		7	PS	7

Sub-titles: (HB=Hotel Bourbon) - (HM=Hotel Mabu) - (CC=Convention Center) - (Bol=Foz Boulevard) - (PS=Poster Session) - (PL=Plenary Lecturer)

AUTHOR	Nº	TITLE	Book	Page	Date	Time	Local	Room	Session	Symp	New Session
Zucoloto, F. S.	896	EFFECT OF FOOD DEPRIVATION ON IMMATURE PHASE OF ASCIA MONUSTE	I	226	21/08/00	16:30	CC		6	PS	6
Zucoloto, F. S.	1185	ECOLOGICAL AND EVOLUTINARY CORRELATIONS AMONG ACCEPTABILITY, OVIPOSITION PREFERENCE AND PERFORMANCE IN ZABROTES SUBFASCIATUS (COLEOPTERA, BRUCHIDAE)	I	299	25/08/00	16:30	CC		6	PS	6
Zucoloto, F. S.	2415	DIETARY SELF-SELECTION IN ANASTREPHA OBLIQUA WILD FEMALES (DIPTERA, TEPHRITIDAE)	II	610	21/08/00	16:30	CC		13	PS	13
Zucoloto, F. S.	2427	DIET SELECTION WITH DIFFERENT SUCROSE CONCENTRATIONS BY ANASTREPHA OBLIQUA (DIPTERA, TEPHRITIDAE)	II	613	22/08/00	16:30	CC		13	PS	13
Zucoloto, F. S.	4164	WHAT HAPPENS WITH THE OVIPOSITION WHEN THE FEMALES OF ZABROTES SUBFASCIATUS STAY A DETERMINED PERIOD WITHOUT HOST?	II	1052	21/08/00	16:30	CC		Erratum	PS	6
Zufei, M.	660	APHIS GROOSYPII MODEL WITH COMPLEX LIFE HISTORY	I	167	22/08/00	16:30	CC		4	PS	4
Zuk, M.	1708	SINGING AND SCALES: VARIATION IN SEXUAL SIGNALS OF CRICKETS SUBJECT TO PHONOTACTIC PARASITOIDS	I	430	21/08/00	10:35	HB	F	9	1	9
Zuk, M.	1740	SINGING UNDER PRESSURE: CALLING BEHAVIOR AND MATE ATTRACTION IN CRICKETS SUBJECT TO PHONOTACTIC PARASITOIDS	I	438	23/08/00	10:45	HB	F	9	3	9
Zupan, E.	1939	APPLICATION OF A GEOGRAPHICAL INFORMATION SYSTEM TO THE STUDY OF SIREX NOCTILIO (HYMENOPTERA-SIRICIDAE) IN CALAMUCHITA VALLEY, CÓRDOBA, ARGENTINA	I	489	23/08/00	16:30	CC		10	PS	10
Zurcher, E. J.	774	INTERACTIVE IDENTIFICATION USING THE INTERNET	I	195	24/08/00	11:35	Bol	T	5	5	5
Zurovec, M.	3422	SILK COMPOSITION IN LEPIDOPTERA	II	864	22/08/00	15:30	HM	Q	19	3	19
Zvereva, E. L.	1221	ROLE OF HOST PLANT QUALITY IN HERBIVORE POPULATION DYNAMICS IN HABITATS DISTURBED BY POLLUTION	I	308	25/08/00	16:30	CC		6	PS	6
Zyzak, M.	2903	SPATIAL AND TEMPORAL HETEROGENEITY IN DENGUE VIRUS TRANSMISSION AND AEDES AEGYPTI POPULATION DENSITIES IN IQUITOS, PERU	II	733	23/08/00	14:35	Bol	R	15	6	15



www.bayer.com.br

TeleBayer
Discagem Direta Gratuita
0800-115560

Bayer
Proteção das Plantas

ATENÇÃO

Este produto é perigoso à saúde humana, animal e ao meio ambiente. Leia atentamente e siga rigorosamente as instruções contidas no rótulo, na bula e na receita. Utilize sempre os equipamentos de proteção individual. Nunca permita a utilização do produto por menores de idade.

Consulte sempre um Engenheiro Agrônomo

Venda sob receituário agronômico

ANDEF

Tracer*

UM NOVO PRODUTO.
UM NOVO MODO DE AÇÃO.

ATENÇÃO

Este produto é perigoso à saúde humana, animal e ao meio ambiente. Leia atentamente e siga rigorosamente as instruções contidas no rótulo na bula e receita. Utilize sempre os equipamentos de proteção individual. Nunca permita a utilização do produto por menores de idade.

Consulte sempre um engenheiro agrônomo.

Venda sob receituário agronômico.

ANDEF

USE EPI
EQUIPAMENTOS DE PROTEÇÃO INDIVIDUAL
SEMPRE QUE MANUSEAR PRODUTOS AGROTÓXICOS

ECONOMIA SEGURANÇA AMBIENTE
TRÍPLICE LAVAGEM x3

Consulte um Distribuidor Autorizado Dow AgroSciences.



CONTROLA SOZINHO A LAGARTA DO CARTUCHO EM QUALQUER FASE.

Mais vantagens para a sua lucratividade

- Tracer* tem atividade residual igual ou superior aos demais inseticidas (7 a 10 dias).
- Tracer* pode ser aplicado via Pivô Central ou equipamento tratorizado.
- Tracer* apresenta alta seletividade aos inimigos naturais da lagarta - excelente ferramenta nos programas de Manejo Integrado de Pragas.
- Tracer* não apresenta, até o momento, incompatibilidade com os produtos utilizados na cultura do milho.
- Tracer* possibilita um adequado Manejo de Resistência, graças a seu novo modo de ação.
- Tracer* é apresentado em embalagens de 1 litro, facilitando o manuseio e a aplicação.
- Tracer* minimiza os problemas de descarte de embalagens, graças às suas baixas doses.

CONTROLE DE INSETOS NATURALYTE Dow AgroSciences

DowAgroSciences
Melhorando a qualidade de vida

* Marcas registradas de Dow AgroSciences

Chegou Tracer*. Adeus Lagarta do Cartucho!

Promotion

Embrapa Soja:
25 anos plantando tecnologia

Empresa Brasileira de Pesquisa Agropecuária
Centro Nacional de Pesquisa de Soja
Minstério da Agricultura e do Abastecimento
e-mail: sac@snpso.embrapa.br
http://www.cnpso.embrapa.br

Organizing Committee

XXI INTERNATIONAL CONGRESS OF ENTOMOLOGY
Foz do Iguaçu - Brazil 2000 - August 20 to 26
Home Page: http://www.embrapa.br/ice

P.O. Box 231 - ZIP 86001-970
Londrina - PR - Brazil
Phone: +55 43 371-6213
Fax: +55 43 371-6100
e-mail: ice@sercomtel.com.br
http://www.embrapa.br/ice

Travel Agency

Oliveira Viagens & Turismo

Oliveira Travel
Rua José Risseto, 1023 - ZIP 82015-010
Curitiba - PR - Brazil
Phone/Fax: +55 41 372-4222
e-mail: oliveiratravel@pjeventos.com.br

Official Carrier

VARIG Brasil

Secretariat

PJ EVENTOS
FEIRAS & CONGRESSOS

PJ Eventos Feiras & Congressos
Rua José Risseto, 1023 - Sta. Felicidade
Curitiba-Paraná-Brasil - CEP(ZIP) 82 015-010
Phone/Fax 55 41 372 1177
e:mail: *pjeventos@pjeventos.com.br*

Embrapa

Brazilian Agricultural Research Corporation
National Soybean Research Center
Ministry of Agriculture and Food Supply
P.O.Box, 231 - CEP: 86001-970 - Londrina, PR - Brazil
Phone: 00-55-43-371 6000 - Fax: 00-55-43-371 6100
http://www.cnpso.embrapa.br - E-mail: sac@cnpso.embrapa.br

BRAZILIAN GOVERNMENT