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BIOLOGICAL CONTROL IN BRASIL

(Proposta apresentada)

Autores: LUIZ ALEXANDRE NOGUEIRA DE SÁ
RAQUEL GHINI
ITAMAR SOARES DE MELO

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APRESENTAÇÃO

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I - BIOLOGICAL CONTROL IN BRAZIL

EMBRAPA/CNPDA (Brazilian Agricultural Research Corporation/ National Research Center for Agriculture Defense)

II - Introduction

Crop protection against pests and pathogens corresponds to a critical aspect in agriculture.

Such protection can be artificially achieved through different means, as the use of pesticides or other less disruptive methods, especially BIOLOGICAL CONTROL.

Under an applied point of view, biological control refers to the use of natural enemies (parasites, predators and pathogens) to reduce pest populations below their economic damage levels or to reduce vectors of pathogens to less harmful levels.

Although not easily attainable for all sorts of pest problems, successful projects have resulted in considerable savings to growers worldwide. In addition, recently growing public concern about environmental quality and the possibility of environmental pollution with extensive use of chemical pesticides have turned the attention of the scientific community towards a renewed interest in biological control.

II.1 - The Importance of Biological Control

The method that was developed scientifically over a hundred years ago presents considerable chances of success in relation to different groups of pest organisms (here understood in the broad sense, including arthropods, pathogens and weeds).

All over the world, more than one hundred and twenty species of insects and mites have been partially or totally controlled after the introduction of natural controlling agents.

In spite of the benefits of biocontrol programs developed in Brazil, few have been submitted to an adequate quantification of the resulting economic benefits.

A recent review by Flores et al (in press) has presented the important accomplishments of different EMBRAPA's projects on biological pest control. Quite a few other projects conducted by Brazilian especialists working for different institutions could also be mentioned, the first of which were conducted in the begining of this century.

II.2 - The Potencial to the Country

Some of the most important advantages of biological control over other methods is the fact that once acchieved it is permanent in most cases and once established it may spread over wide ecologically comparable areas, which makes it particularly atractive to developing countries, where financial circumstances and educational status of growers limit the viability of other methods.

II.3 - Infrastructure Available and Constraints

Although the number of specialists in biological control is relatively small compared with specialists working in other aspects of agricultural research, many of the Brazilian biological control specialists are worldwide recognized as very prominent in their area of work. The field of biological control is well established in the country, with a solid experience acquired through the years.

One of the major constraints which persisted for a long time was finally overcome by the establishment of a National Quarantine facility, which is now under operation, and which should facilitate the process of introduction of new promising natural enemy candidates. Introductions should now be safer, by preliminarily considering potencial risks involved in the introductions and by processing the introduction properly.

Some research institutions all over the country are reasonably equiped to conduct biological control activities, although in many other cases they are not updated in terms of laboratory equipments, computer façilities, etc.

Nevertheless, there is a major constraint in biological control work, which is not a particularity of the country but a common reality almost everywhere. Biological control activities in most cases are not of interest to private initiatives, and thus biological control specialists generally face considerable dificulties in raising funds for their work. In most cases they have to rely on progresively more scarce funds from public sources, or from international organizations related to environmental protection.

III - RESULTS: Major Results in Biological Control

III.1 - Agriculture

Regardless of the dificulties, there is a series of considerable results which have been obtained in Brazil. We now mention some of the most outstanding results nationwide, giving special consideration to the most recent projects.

One of the most classical and worldwide known examples of biological control of a pest by the use of a pathogen was conducted in northeastern Brazil. That involved the use of the fungus *Metarrhizium anisopliae* for the control of the sugarcane spitttlebug *Mahanarva posticata*, which is now routinely conducted by private growers or growers' associations, providing the protection of hundreds of thousand hectares against what is one of the most important pest of sugarcane in the northeast.

Another outstanding example on sugarcane refers to the control of the sugarcane borer, *Diatraea saccharalis*, which was accomplished with the introduction of the parasite *Apanteles flavipes* in 1974. Up to the end of 1989, over 7.1 billion *A. flavipes* had been released in northeastern and southern Brazil for the control of the pest. As a result of the release of this and other less promising parasites, the level of parasitism has jumped from 13.77 to 25.58%, keeping damage at acceptable levels.

Another important example of successful biological control refers to the wheat aphids *Schizaphis graminum*, *Metopolophium dirhodum* and *Sitobion avenae*, which are now controlled using the parasites *Aphelinus* and *Aphidius* as well as the predators *Hippodamia quinquesignata* and *Coccinella septempuctata*. This program eliminated the use of one million liters of insecticide in the State of Rio Grande do Sul in 1977 and 1.6 million liters in the State of Paraná in 1989. This translates into a savings of more than fifteen million dollars in chemical pesticide aplications.

In Northeastern Brazil, the control of the tomato pin worm (*Scropipalpula absoluta*) was made possible by introducing the of Pernambuco. Prior to the introduction of the parasitoid, the pin worm caused losses of aproximately 140 thousand tons of tomatoes, equivalent to 8 millon dollars, over the last 10 years. The level of parasitism by *T. pretiosum* has been maintained at 19.5% to 42.90%, after less than less one year of the introduction of the parasitoid. The result of this successful experience is now being spread over the whole region, as a result of the considerable interest of most of the tomato growers in the region, which produces most of the processing tomatoes in the country.

In most of the soybean growing regions in Brazil, a major example of applied biological control is related to the application of the entomopathogen *Baculovirus anticarsia* to control the velvetbean caterpillar *Anticarsia gemmatalis*. In the 1989/90 growing season, one million hectares were treated with this virus. After beginning the use of this system in 1983, some five million hectares of soybeans were treated with this pathogen resulting in a fifty million dollars savings. This tecnology has recently been passed to four private companies, which are now producing the pathogen for commercial purpose. Aside from the savings of funds to the country, because of the reduced importation of chemical pesticides, the danger of contamination and growers intoxication has certainly reduced significantly, considering the considerable area over which soybean is grown in Brazil.

Since 1985, the granulosis virus (GV) *Baculovirus erinnyis* has been used for the control of *Erinnyis ello*, an important pest of cassava, a staple fod in many areas of Brasil, grown and especially by small growers in northeastern Brazil. This virus GV was used in 800 hectares of cassava in the State of Bahia from 1985 to 1986. In the southern part of Brazil, where the pest is also important, this virus has been consistently used over the year, and is now being formulated to facilitate its conservation from one year to the next, and its field aplication.

Strains of the fungus *Colletotrichum gloesporioides* have also been isolated from the mealybug *Orthezia praelonga* on citrus, and used experimentally for the control of this pest at a concentration of 10^8 conidia/ml causing 80 to 100% mortality.

Biological control of other important pests of soybean, the stink bugs *Nezara viridula*, *Piezodorus guildinii* and *Euchistus heros* has also been investigated using the egg parasitoid wasp, *Trissolcus basalis*. After determining the technical viability of the approach, the project is now implementing the use of the parasite by growers.

Another pest of great concern, the wood borer *Sirex noctilio*, which was recently introduced into southern Brazil is now being investigated in terms of the viability of its control by a parasitic nematode. In 1989, this insect caused the loss of more than one million trees or 425 cubic meters of pinewood. A technique which involves the use of the nematode *Deladenus siricidicola* is now being developed. Just after the first releases into fields in 1990, the level of parasitism averaged 30% Reaching a maximum of up to 75%. Mass breeding of this nematode is being developed for release in fields of the States of Santa Catarina and Rio Grande do Sul in 1992.

Other promising research projects in the field of biological control using entomopathogens include the use of a virus for the biological control of the fall armyworm *Spodoptera frugiperda* in corn, by the use of a virus and the rice bug *Tibraca limbativentris* using the fungus *Metarhizium anisophiae*.

Joint projects involving different Brazilian and international organizations have been commonly undertaken, promoting the use of biological control in Brazil and other countries. Some examples include works in colaboration with several of the international centers, as CIAT and IITA, and several North American and European Universities. Those activities also involve exchange of experiences, information, natural enemies and personnel.

The use of biological control for minimizing plant diseases is extensive and some examples are listed below. To control apple root rot caused by the fungus *Phytophthora* spp. the antagonic fungus *Trichoderma viride* has been used successfully in Rio Grande do Sul. New genetically improved biotypes of *T. harzianum* were developed to allow joint use of this fungus with reduced dosages of chemicals applied to control such root fungi as *Sclerotinia minor* and *S.sclerotiorum* in lettuce. Results are promising when used by small farmers.

Induced systemic resistance (plant immunization) offers promise of providing alternative means of control the "tristeza dos citros" effectively and economically. Immunization of citris plants with a weak virus strain provides protection against severe strain that causes the disease. Immunization of citrus plants represents a production increase of seven to eight times when compared with non immunized plants.

But one of the main examples of applied biocontrol in field conditions occours in Northest. The antagonic fungi *Acremoniuns alternatum* and *A. persicinum* have been used to control the coconut disease called "lixa". The cost of control when using those antagonic organisms is about five fold lower than the control with chemical pesticide.

Other programs of plant disease biocontrol have been developed in Brazil with promised results, including: induced resistance to control coffee rust, wheat root rot caused by *Gaeumannomyces graminis*, cocoa witch broom, caused by the fungus *Crinipella perniciosa*, ruber tree leaf blight, caused by the fungus *Microcyclus ulei*.

The biological control of the plant pathogenic nematode *Meloidogyne javanica* was obtained by selected strains of the fungi *Paecilomyces lilaninus* and *P. fumosoroseus*. Some of the *Paecilomyces* strains may be marketed already in 1992.

Biological weed control has also been pursued in Brazil. The fungus *Helminthosporium* sp. was discovered and a formulated product has been developed to control the leafy spurge, *Euphorbia heterophylla*. This product provides control equal to or even superior to chemical herbicides.

III.2-Veterinary Science

One of the most promissing programs refers to the biological control of the horn fly, *Hematobia irritans* using the brown dung beetle *Ontophagus gazella*. The natural enemy was introduced in the State of Mato Grosso do Sul from specimens received from the United States. Eating dung, this insect inhibits the multiplication of the horn fly and several other worms and parasites that irritate cattle. This technology has been passed on to cattle breeders by the National Beef Cattle Research Center (EMBRAPA/CNPGC) and by the São Paulo State Research Center (UEPAE/São Carlos/SP).

The biological control of the gastrointestinal nematode *Heamonchus contortus* which affects bovines and other ruminants by means of the toxins produced by the *Bacillus thuringiensis* and other natural products in test. This project is coordinated by the National Dairy Cattle Research Center (EMBRAPA/CNPGL) and also counts on researchers from the National Research Center for the Defense of Agriculture (EMBRAPA/CNPDA).

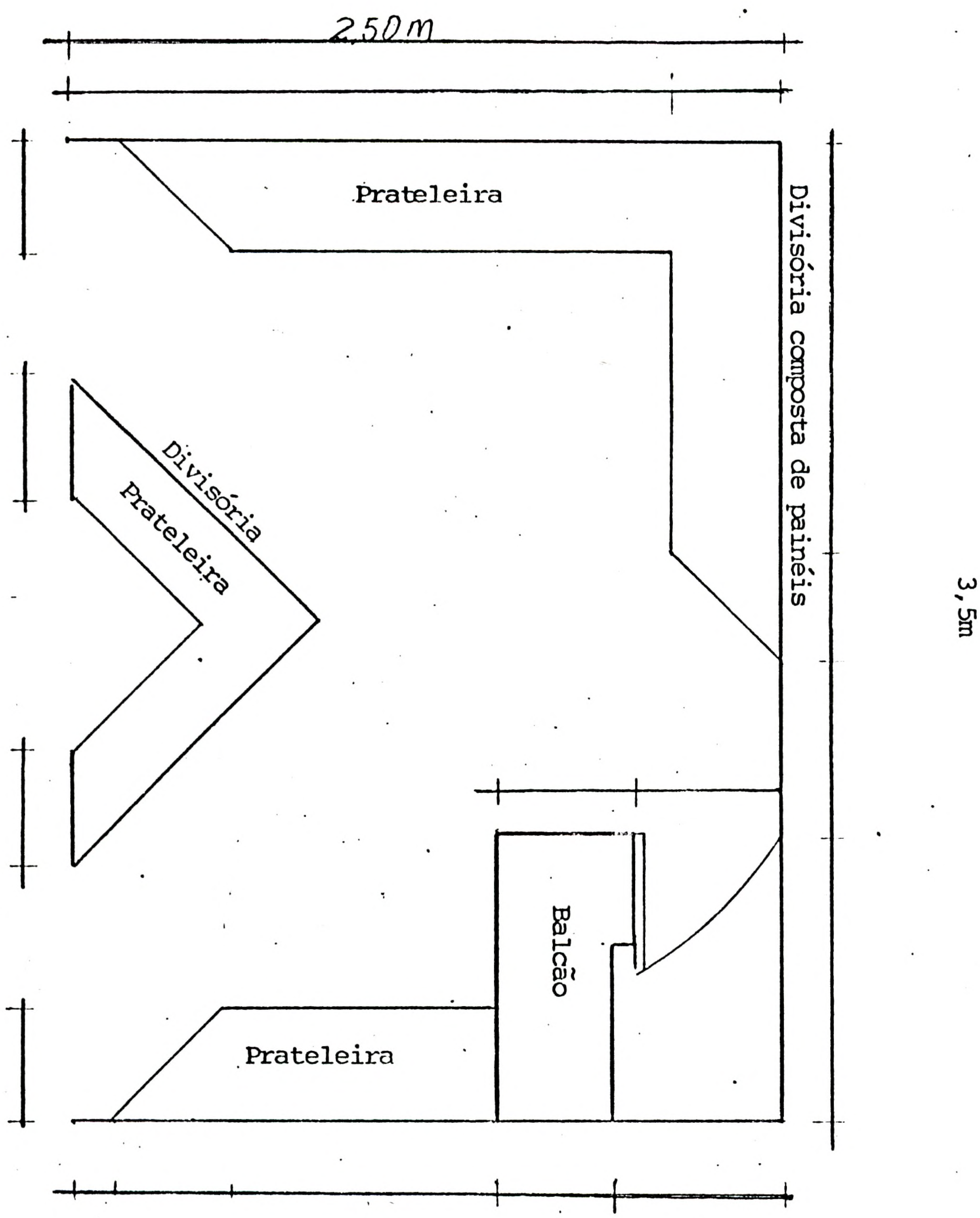
III.3 - Public Health

The Production and use of the commercial bioinsecticide *Bacillus thuringiensis* variety *israelensis* for the biological control of mosquitos *Aedes* and black flies is widely employed around the world. Researchers at the National Center for Genetic Resources and Biotechnology (EMBRAPA / CENARGEN / BIOTECHNOLOGY) research products on the base of *Bacillus sphaericus* which have proved efficient in the control of the southern house mosquito *Culex quinquebasciatus* and *Anopheles*. *Culex* control by *B. sphaericus* has proven thar it is possible to substitute totally, chemicals for bioinsecticides, maintaining control and reducing costs. Studies on the use of various by-products and agroindustrial residues for *B. sphaericus* production are in the final stages. Contacts are being made with interested industries with a view to producing a new bioinsecticide on a commercial scale.

<u>RESOURCES</u> <u>NECESSARY</u> TO PRESENT EMBRAPA'S BIOLOGICAL CONTROL PROGRAM:

* Video
* Illustrative panels
* books, publications, folders
* living material (plants, insects, fungi, virus, bacteria, nematodes, mites)
* maquette of a solar colector
* optic microscopic
* estereoscopic microscopic
* researchers from biological control area (minimum of three persons).

PROPOSTA PARA O LAY-OUT DO STAND SOBRE CONTROLE BIOLÓGICO



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